LINOTYPE
INSTRUCTION BOOK

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LINOTYPE INSTRUCTION BOOK

A Detailed Description of the
Mechanism and Operation of the Linotype
with Instructions for Its Erection,
Maintenance, and Care

By
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TRADE LINOTYPE MARK

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Composed entirely on the Linotype in
Old Style No. 7 and Caslon Old Face

This Book Is Full of Troubles So That Troubles May Never Occur

AN ANCIENT philosopher said: "My life has been full of troubles, most of which never happened." So that the troubles enumerated in this book may never happen under careful operation and maintenance, every possible source of trouble has been explained. Cause, effect and remedy are given in full detail. To the casual reader this may create the impression that the operation of the Linotype is attended by many difficulties. We mention, therefore, at this point that in all parts of the world Linotypes are in successful operation under widely varied conditions, some of the machines having been erected, operated and maintained by persons utterly without previous training on the Linotype.

It should also be stated that Linotype machinists vary in their practices as to certain adjustments, methods of lubrication, cleaning and the like. The practice given in this book is recommended by the factory engineers. It is generally agreed that standardized methods among machinists and operators should be sought. This book is offered as a means to that end.

MERGENTHALER LINOTYPE COMPANY

Preface

IN THE course of human events, the time has arrived when there should be available to those interested in the Linotype, a book explaining its mechanism and describing its range with further detail and illustration than has thus far been attempted.

Perhaps because of the fact that I am one of the oldest living inventors associated with the Mergenthaler Linotype Company, this connection covering a quarter of a century, it has fallen to my lot to write this book.

It is my intention that the volume shall be mainly one of perspective illustrations, which can be read by any one at a glance. In these the particular point or part to be described is shaded heavily, while the surrounding parts are left light. The text is largely an explanation of these illustrations.

Pictures are called "the universal language," and I have intended to use many illustrations and diagrams, so as to give, if possible, the student of the Linotype a clear understanding of its mechanism.

The Linotype machine is compact, and the levers and cams which give the different motions to its mechanism are so concealed within that it is difficult to see or understand their action when observing the machine while actually doing its work.

It is hoped, by illustrating each separate part, the motion of the moving parts, and the reason for such movements, that the mechanism can be more clearly understood; and also that by the use of these illustrations it will be possible to identify parts more surely when supplies are ordered by the customer.

The Linotype Company receives many letters asking for instructions on various points concerning the machine. These letters come principally from operator-machinists in small towns or villages, where skilled mechanics on the Linotype are not easily obtained.

A large number of these illustrations will be printed in addition to those which are bound in the book, and when writing to our customers who are seeking instruction, by enclosing one of the illustrations with notes thereon, it is believed that very much clearer information may be imparted.

The reader will find a number of repetitions throughout the book. This is intentional. Some of the parts in the Linotype machine perform more than one function and it is often necessary in describing one of these functions to repeat the description with reference to another. There are

also certain directions and warnings to the operator and machinist so important that they cannot be repeated too often.

It has also been found advisable to make a brief summary of long descriptions. In describing the different models which have many parts that are like other models this repetition of description becomes necessary.

Much time and thought have been put into this work and the proofs have been carefully read, but it is always possible in a book of this size that errors will creep in. The Company will be very appreciative if their attention is called to any such errors, which may be corrected in a later edition.

The proof of this book has been read by Mr. E. A. Sytz, Assistant Works Manager of the Mergenthaler Linotype Company. Mr. Sytz has been connected with the Company for more than thirty years, having worked with Mr. Mergenthaler in Baltimore in the early days. He has made many valuable suggestions and criticisms.

Mr. R. M. Bedell, who was for many years foreman of the assembling department in the Factory, afterward master mechanic, and is now connected with the Executive Offices of the Company, also assisted with the proofs and has made many suggestions. The technical knowledge born of the long experience of these gentlemen has been of great value in preparing this work.

Very early in the history of the Linotype it became necessary to designate the different parts of the machine so that the names of these parts could be used in the manufacture of the machine and by our customers in ordering supplies. As there are many parts in the Linotype machine, it was necessary to have a system for naming these parts. The system adopted at first, and which has been in use ever since, is that commonly used by manufacturers of machines having many different parts. The first word designates the main part of the machine to which the part belongs, and the names follow in order so as to designate beyond the possibility of a doubt each part. It thus happens that the smaller the part the longer the name. A small bracket on the machine has the following name: "vise jaw left-hand adjusting rod locking pin lift bracket." While this name is very long and clumsy it does actually describe and locate the bracket so that it is impossible to make any mistake. In addition to the name, each part has a number. The number of the "vise jaw left-hand adjusting rod locking pin lift bracket" is E-1311. It is manifest that these long names cannot be used in ordinary practice. The keyboard keybar is commonly called the keyrod or keyreed. In this book the shorter and more common names are used in the descriptions. This is made necessary by the fact that the regular names are so long and difficult to keep in mind.

As a general rule the part numbers are not used. This is because the part numbers have been subject to change during the many years since

the Linotype was placed on the market. The proper names and part numbers can be obtained from the catalogues issued by the Company which are revised and brought up to date from time to time, *and these catalogues must be used in ordering parts.*

In general, it has been the desire of the author to use the most simple language so that those who are not familiar with the mechanism of the Linotype can understand it so far as language can communicate it. It is probable that in some cases the use of technical language would be more exact and scientific. Algebraic formulæ are the most scientific and exact ways of expressing facts, but such formulæ are of no use to one who has not studied algebra. Every one will understand that the same fact may be expressed in different language by different persons. It is hoped that the language used is so simple that it can be easily understood.

J. R. R.

BROOKLYN, NEW YORK,
JANUARY, 1925.

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Foreword

UNDOUBTEDLY the invention of separate movable type, capable of being assembled, used as a "form" to print from, distributed and reassembled into other "forms," is the one invention which has made the greatest contribution to human progress. The art of printing is rightly called "the art preservative of all arts." Wendell Phillips, in his lecture on the "Lost Arts," shows that the ancients possessed much useful knowledge which was lost to the world because the only method of handing it down to succeeding generations was by word of mouth, or in very costly manuscripts, few in number. Since the art of printing came into use each succeeding generation has made marked progress, because the knowledge of arts and sciences has been handed down on the printed page to posterity. In point of importance and in amount of capital involved, the printing art now stands sixth in the United States.

From the time of Gutenberg, for nearly four hundred years, no improvement was made over his method of assembling and distributing movable type. In the assemblage each letter was picked up singly from its cell in the compositor's "case," placed in a "stick," assembled into a "form," and after the form had been used for printing, either directly from the type or by the making of electrotypes or stereotypes, the types were one at a time thrown back into the cell of the "case" by the fingers of the operator.

During this time vast improvement was made in the means for taking impressions from the "form" of type. In the original press used by Gutenberg and his immediate successors the platen was brought down upon the type by means of a screw, operated by the arm of the printer. The ink was smeared upon the form by what were called "inkballs," which were merely a means of daubing the ink upon the type, and these "inkballs" were also operated by the hand of the printer. Five hundred sheets in ten hours with these original means would be considered a good day's work for two men, and such a record was seldom achieved. During the eighteenth century a good deal of improvement was made, but the press was still manipulated entirely by hand. The ink-roller took the place of the "inkball." In the beginning of the nineteenth century rapid progress was made. Lord Stanhope changed the material of the press from wood to iron and power began to be applied to the presses. From this time the presses became more and more automatic, consequently more rapid and accurate in their work. The invention of stereotyping and electrotyping

was followed by the use of the cylinder press and the web press, printing from rolls of paper, so that by 1880 there were presses capable of turning out twenty thousand copies of an eight-page newspaper in an hour, which was considered a wonderful thing. The "perfecting press" made the manufacture of books and pamphlets very much cheaper, so that the cost of a library was very greatly reduced. During all this progress of the printing press, however, the types were assembled, distributed into the cases, and recomposed in exactly the same way as had been done by Gutenberg four hundred years before.

The desirability of means for mechanically composing and distributing the single type was recognized many years ago, and beginning in the early part of the nineteenth century many patents were obtained for machines for this purpose. Fortunes were expended in experimenting and several machines were placed on the market, but, after a limited time, all disappeared.

An early English machine was provided with finger keys by means of which the type was assembled in a continuous line, which was separated and divided into short lengths or lines which were "justified" by hand. After being used the type was transferred to an elevated part of the machine where a second keyboard was used to effect the distribution of the type into the magazines from which it had been delivered, the operator being guided by the proof or print before him. Several of these machines were built and used for a time.

Of all the machines constructed, the most notable and unfortunate was the so-called Paige Compositor—beautiful in conception, design and execution, and operated successfully to compose, justify and distribute the type. Years of time and vast amounts of money were spent in its development. Its principal promoter was "Mark Twain" (Samuel L. Clemens), who lost his fortune and large amounts contributed by friends. It is known that the various American companies expended unsuccessfully upwards of twenty million dollars in composing machines of one kind and another.

In the early seventies of the nineteenth century, the typewriter came into use. A few stenographers and official reporters in Washington, recognizing the great advantage of the typewriter for their own work over manuscript, conceived the idea that a machine similar to the typewriter could be made which would, on the touch of a key, do the work of the arm and fingers of the compositor. Their idea was to have this machine impress steel type successively into a strip of papier maché, or similar material, to be subsequently used as a matrix from which to cast the stereotype plate.

These men organized a small company which experimented along the lines above indicated, and at the same time another independent company engaged in experimenting along the same general lines.

Not daunted by the failure of others, certain of the stenographers and a few of their friends undertook developments which finally resulted in the production of the Linotype. The members of the original syndicate were: Moore, Clephane, Devine, McEwen, Warburton and Murphy. All but Moore and Warburton were identified with Congressional reporting. None of the number is now alive.

Operations were begun by the building of rotary machines, controlled by finger keys to indent the characters in long papier-maché strips which were cut into the proper length and justified by bending or lapping the paper between words. These strips were secured in parallel lines to a backing sheet and constituted a matrix for column or page, the printing form or plate being cast in type metal thereon after the manner of ordinary stereotype plates.

Moore conceived the idea of casting from the matrices separate slugs or bars, each bearing the characters to print complete lines; in other words, he was the originator of what is now known as the "linotype" or slug. These slugs were produced in a slotted mold or frame filled by hand, the slugs being planed or dressed to height on back, and the frame then separated to release them.

While the development of these slugs was a great advance in the art, the method of producing them was impracticable and failed to come into use.

Ottmar Mergenthaler, then a workman in the shops of Hahl and Company, in Baltimore, where certain of the experimental machines were built, was employed by the above named gentlemen and their associates to continue experimental work. He produced a rotary indenting machine which was not adopted. Later a machine was built with long vertical parallel bars, each bearing a complete alphabet of metal type or dies, and a fingerboard by which the selected letters for a line, one on each bar, could be brought into alignment and impressed in papier-maché, thus producing one after another justified matrix lines; the papier-maché matrices thus produced being transferred to a second machine from which the slugs or linotypes were cast, one at a time, line after line.

The next advance was the production of a machine similar to the above, except that the long bars, each having similar characters, were replaced by bars containing female characters or matrices for an entire alphabet. This machine also included a melting pot for type metal and a mold. After the matrix bars were longitudinally adjusted to bring the selected characters in line, they were presented to and closed the face of the mold slot which was then filled from the back with molten metal expelled from the pot into the mold, much as in the present Linotype machines.

This was the first machine in which the linotypes were cast against metal matrices, temporarily assembled in line. While this machine was

practical, it was slow in action, and to secure the necessary speed Mergenthaler developed a machine in which small metal matrices, bearing individual characters, were stored in a magazine from which they were released one at a time by finger keys, and assembled in line with expansible wedge spaces, and the composed line transferred to the face of the mold with which the matrices co-operated to form the type characters on the front of the slug or linotype cast in the mold, after which the matrices were elevated to the top of the machine and returned by a distributing mechanism to the magazines.

This was the first automatic continuously acting Linotype machine, in which the speed was due to the fact that one line of matrices could be composed while the second was being used at the mold and a third being distributed. This machine was modified, improved and simplified from time to time, and finally became the first commercial Linotype which was placed on the market and installed in 1886 in the offices of the *New York Tribune,* the *Chicago News,* and the *Louisville Courier-Journal.*

The justification of the lines was one of the most difficult problems. Three inventors, J. D. Schuckers of Philadelphia, Mergenthaler, and the author of this book, were experimenting in this field at one time, but a patent on the double-wedge spaceband was finally awarded to Schuckers as the first inventor. The Linotype machine of the present day represents the contribution of various inventors other than Mergenthaler.

There are now more than 49,000 Linotypes in use, setting about forty-seven languages, and the machine has been developed so that it covers the entire range of type composition.

But the mechanical development of a machine is only one side of a great business; the establishment of a factory, the organization of the business, securing the confidence of customers, overcoming prejudice and skepticism when a new art is developed, require an ability of a different sort, but no less important than that of the inventor.

The Linotype Company was very fortunate in securing early in its history the services of Mr. Philip T. Dodge, of Washington, as president and general manager. Mr. Dodge was a young patent attorney of Washington, and had prepared and solicited the patents on the Linotype from a very early period. He took hold of the business as president and general manager in November, 1891. The task before him was herculean. The Mergenthaler Printing Company and the National Typographic Company had expended upward of two million dollars and had exhausted their capital. There was no ownership of real estate. The tool equipment was limited and imperfect, and the factory consisted of a small leased building. The machine at that time was far from perfect and worked in a more or less unsatisfactory fashion. He had the opposition of those who feared that their trade would be ruined, and of those who were skeptical in view of the vast sums that had been lost in the typesetting machine business.

He had to recreate not only the machine but the tools, factory and organization to build it. Even the stockholders, who had held on hitherto with great persistence and patience, were almost at the point of despair.

In October, 1891, a new company, the Mergenthaler Linotype Company of New Jersey, was formed and succeeded to the holdings of the older companies. The new company was provided with a cash capital of only $374,000, and it was with this limited capital that Mr. Dodge was required to reestablish and carry on the business. The first dividend was not paid until August, 1894.

During the past twenty years the Linotype business has grown enormously, many new models have been produced, and the scope and range of the machine has been increased beyond the wildest dreams of the original syndicate. New models have been designed covering display work, advertising, in which faces of different sizes and styles are combined, tabular work, mathematical work and many languages in which characters in great number are used. This mechanical development has also been directed by Mr. Dodge, who has an inventive turn of mind and who has taken out many patents, and by suggestion and direction has controlled the development of the machine, as well as the business of the great corporation which the Linotype Company has now become.

The success of the Linotype Company is due fully as much to the business foresight and energy of Mr. Dodge as to the genius of Mergenthaler and others in the development of the mechanical side of the machine.

The Linotype is often spoken of as a "typesetting machine." Strictly speaking, this term is properly applied only to machines which set and distribute foundry type, such as the Thorne, Empire and others.

The Linotype makes its type in the form of a slug or solid line of type, having printing characters upon its upper edge. These slugs, when assembled together, make up a "form," which can be used for printing direct or from which an electrotype or stereotype can be made. After the form has been used the slugs are melted and run into pigs or put into the crucible direct and used over and over again indefinitely. The term "distribution" in hand composition and in the type setting machine, such as the Thorne, means the process of restoring to the cells of the case, or to the magazines, the separate, individual foundry type. In the Linotype machine the term "distribution" refers only to the process of restoring a line of matrices to their original places in the magazines, the distribution of the "form" being made by remelting the slugs as aforesaid.

Linotype Instruction Book

General Principles

THERE are a few general principles used in the Linotype machine that should be mentioned at the beginning. The Linotype is an automatic power-driven machine. With the exception of the touch of the finger on the keyboard and the starting of the assembled line to the casting mechanism, all the functions of the machine are performed automatically. The various motions in proper sequence required for the justification of the line of matrices, the casting of the slug, and the distribution of the matrices to the magazine are performed by the action of cams. Most of these cams are mounted on a single main cam shaft, and all the functions above mentioned are performed in one revolution of this cam shaft.

In the second place, with the exception of the keyboard cams and a few others, the cams upon the machine are very large, and all of the motions of the machine are made as slow as possible. This feature is very important in the matter of wear on the machine. Some Linotypes have been in constant use for nearly thirty years.

The third principle is the use of springs to cause the *positive* motion of the parts, the cams returning the moving parts to their original position. This principle makes it possible to use what are called "automatics," which are devices arranged so that if anything goes wrong the machine will stop or the spring will expand without breaking any of the parts to which it is attached. This principle is used throughout the machine wherever possible.

DIVISION OF MECHANISM

The mechanism of the Linotype machine may be divided into three general divisions.

First is the assembling of the matrices and spacebands, which is started by the touch of the finger of the operator upon the keyboard. This part of the mechanism is shown in general form in Fig. 1. Beginning with the touch of a finger upon a keybutton, the action of the keyboard cam moves the keyboard rod connected with the escapement in the magazine, and a matrix is released and falls by gravity upon a constantly running belt which delivers the matrix into the "assembler."

The second great division of the Linotype mechanism is the casting mechanism, which is shown in diagrammatic form in Fig. 33. This part of

the Linotype mechanism includes means for justifying the line of matrices by means of double wedges called "spacebands;" for bringing the mold against the justified line; bringing a crucible, or pot, of molten metal, having a suitable "mouthpiece," against the mold; pressing the "mouthpiece" against the mold and the mold against the line of matrices with great force, so as to make a tight joint; a pumping mechanism for delivering the molten metal into the mold and against the matrices; a mechanism for returning the crucible to its original position; for withdrawing the mold from the line of matrices, revolving the mold, during which action a knife trims the bottom of the slug and finally brings it opposite a pair of knives; means for ejecting the slug from the mold, passing it through the knives by which the slug is trimmed, and depositing the slug in a galley.

The third division of the Linotype mechanism, as shown in Fig. 97, comprises means for unlocking the line of matrices and spacebands; passing the line to an intermediate channel in which the line of matrices is separated from the spacebands; means for depositing the spacebands in their magazine; means for transferring the line of matrices to the upper part of the machine; means for passing the line of matrices along a mechanism called the "distributor bar," which distinguishes the different characters and allows them to fall by gravity at their proper places into the upper end of the magazine, from the lower end of which the matrices are released by the escapement.

As previously stated, the original Linotype machine has been developed, and a large number of changes and additions have been made to it, to meet the demands of the art which economic conditions constantly bring about. There are, basically, but two models of the Linotype, the single distributor and the plural distributor machine, each adapted to specific requirements of the business. In the figures and explanations given in this volume all the different styles of mechanism used will be illustrated and explained, and the particular models in which any mechanism is used will be noted, so far as possible.

I. The Keyboard

THE Linotype keyboard carries ninety keys, arranged in six rows of fifteen keys each. Each button is attached to the end of a lever. Each row of fifteen key levers is pivoted upon a round rod, which is supported by the sides of the keyboard and two supports inside. The key lever is shown in Fig. 1. For the sake of convenience, the keybuttons are arranged in three colors, the black, at the left hand of the operator, being the characters of the lower case; the blue buttons in the center, the points, figures and special characters; and the white at the right the caps. These buttons are sometimes made of a larger size than usual, so that they may contain two, and even three, characters. A somewhat different style of keybutton is used for some of the different languages set on the Linotype.

The key levers are of six different lengths, but all of them are pivoted upon the round rods at the center of the distance from the keybutton to the end of the lever. The key lever is reduced in size at the opposite end from the keybutton so that a lug or projection fits into a notch in the keyboard bars, as shown in Fig. 1. This keyboard bar *C* answers two purposes. By its weight it returns the key lever after the finger is removed from the keybutton. Also, at the upper end of this keyboard bar, there is a notch into which the rounded end of the trigger *D*, shown in Fig. 1, registers. This is also shown in Figs. 2, 3, 4, and 5.

Referring again to Fig. 2, when the keybutton is touched and the keyboard bar *C* has risen, revolving backward the trigger *D*, it allows the keyboard cam yoke *O*, carrying the keyboard cam *E*, to drop upon the keyboard rubber rolls *P*. This is shown in Figs. 3, 4, and 5. The keyboard cam *E* has teeth in part of its circumference, and when these teeth come in contact with the rubber roll *P*, *E* is caused to revolve, which carries upward the cam yoke *O*, which is pivoted at one end, and the other end of the cam yoke *O*, coming up under the reed *F*, causes the reed to rise vertically. The first part of this action is shown in Fig. 4, and the second part of the action is shown in Fig. 3. It will be plain that if the operator has removed his finger from the keybutton, and the keyboard bar *C* has returned the trigger to its place, as shown in Fig. 5, when the keyboard cam is lowered, on account of the shape of cam *E*, the keyboard yoke *O* will rest upon the trigger *D*, as shown in Fig. 5; or, in other words, it will be again in normal position. The keyboard cam *E*, on account of its momentum, will revolve until the pin *G* in said cam comes against the stop *R*. Cam *E* remains motionless until the keybutton is again touched.

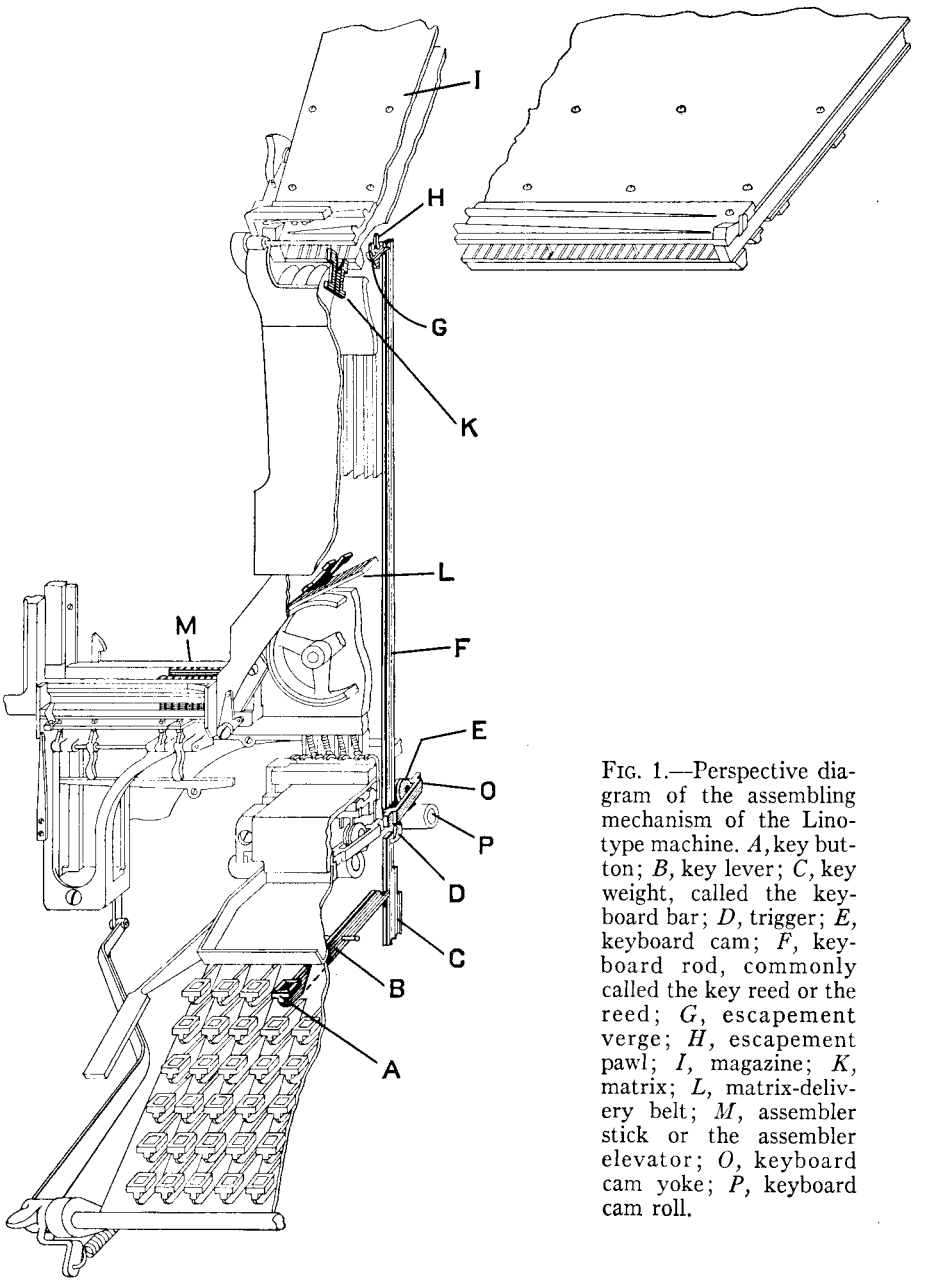


FIG. 1.—Perspective diagram of the assembling mechanism of the Linotype machine. *A*, key button; *B*, key lever; *C*, key weight, called the keyboard bar; *D*, trigger; *E*, keyboard cam; *F*, keyboard rod, commonly called the key reed or the reed; *G*, escapement verge; *H*, escapement pawl; *I*, magazine; *K*, matrix; *L*, matrix-delivery belt; *M*, assembler stick or the assembler elevator; *O*, keyboard cam yoke; *P*, keyboard cam roll.

The sequence of operations thus far described is: the touch of the keybutton with the finger; the raising of the keyboard bar *C*; the tripping of the trigger *D*; the fall of the keyboard cam yoke, bringing the keyboard cam upon the rapidly revolving rubber roll; the revolution of the keyboard cam, causing the keyboard yoke to rise, lifting the keyrod which operates the escapement for the matrix, which will now be described and explained in detail.

When the keybutton is depressed by the finger the keyboard bar *C* is raised and the trigger *D* is caused to revolve through a small arc, so

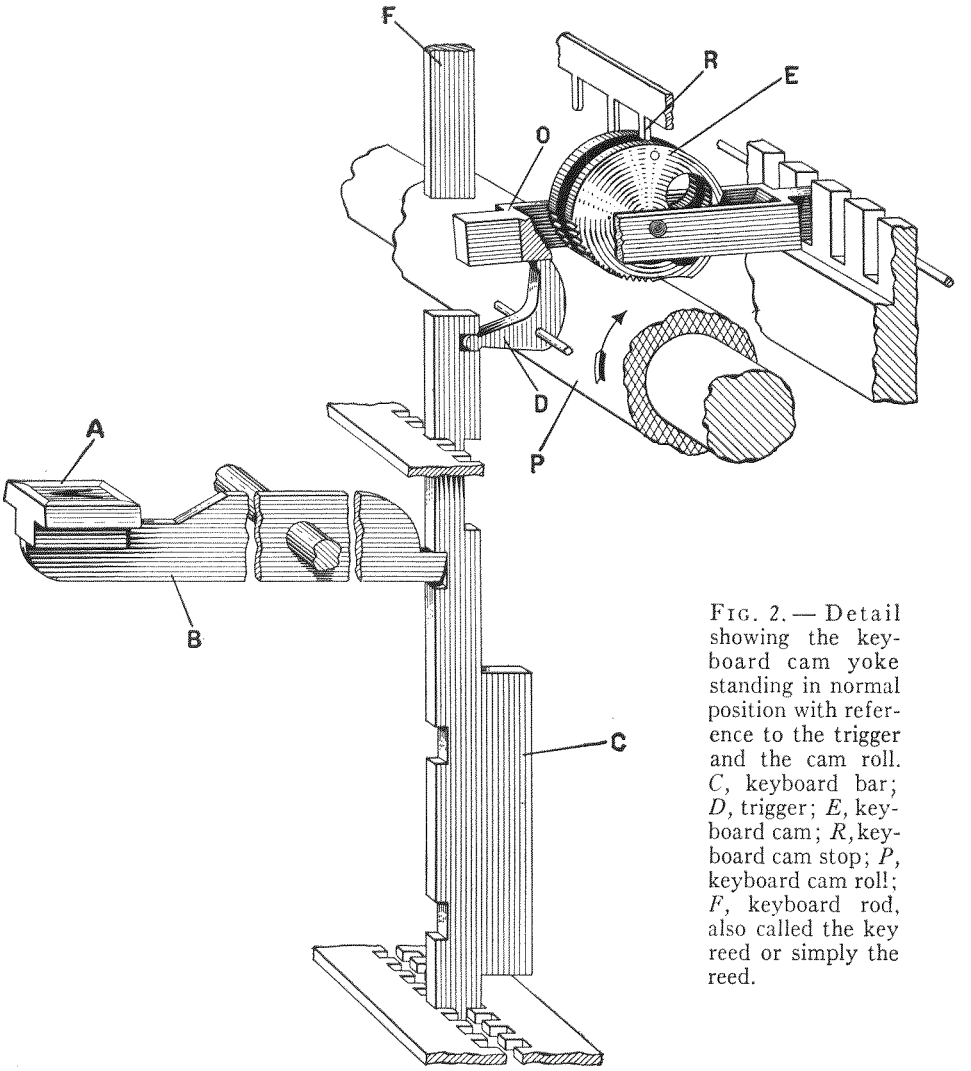


FIG. 2. — Detail showing the keyboard cam yoke standing in normal position with reference to the trigger and the cam roll. *C*, keyboard bar; *D*, trigger; *E*, keyboard cam; *R*, keyboard cam stop; *P*, keyboard cam roll; *F*, keyboard rod, also called the key reed or simply the reed.

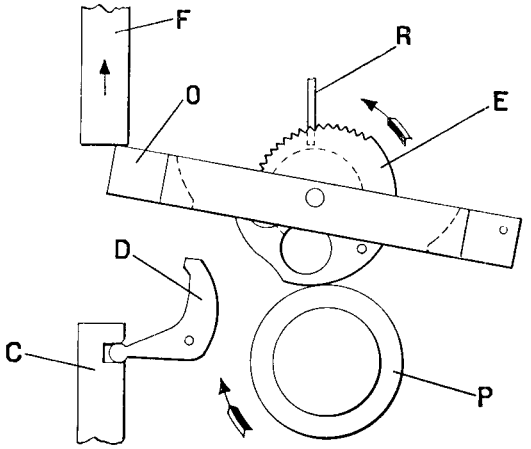


FIG. 3.—Diagram of the keyboard parts, showing the keyboard cam *E* revolved by the keyboard cam roll *P*, so as to raise the keyboard cam yoke *O* to its highest position, thereby raising the keyboard rod *F* to its highest position. This figure also shows the trigger *D* returned to its normal position by the gravity of the keyboard bar *C*.

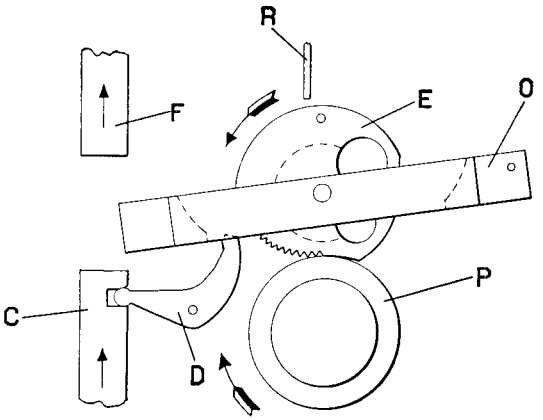


FIG. 4.—Further detail of keyboard parts, showing the keyboard cam yoke *O* released by the trigger *D* and fallen down upon the keyboard cam roll *P*. The revolution of the keyboard cam roll shown by the arrow, carrying upward the keyboard cam yoke *O*.

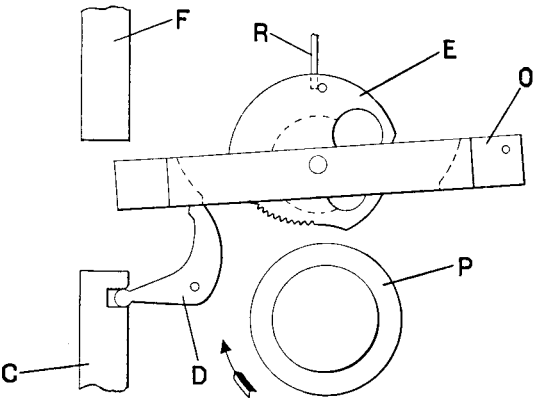


FIG. 5.—View of keyboard parts when back in normal position. *C*, keyboard key bar; *E*, keyboard cam; *F*, keyboard rod; *O*, keyboard cam yoke; *P*, keyboard cam roll; *R*, keyboard cam stop.

that the other end of said trigger gets out from under the lip of keyboard cam yoke *O*, allowing the cam yoke *O* to fall. When the finger is taken away from the keybutton, the weight of the keyboard bar *C* brings both the key lever and the trigger back into normal position, at which time the projecting part of the keyboard weight *C* rests at the bottom upon a guide which limits its downward motion. These keyboard bars or weights have a guide at the top and bottom, and their vertical movement is about one-

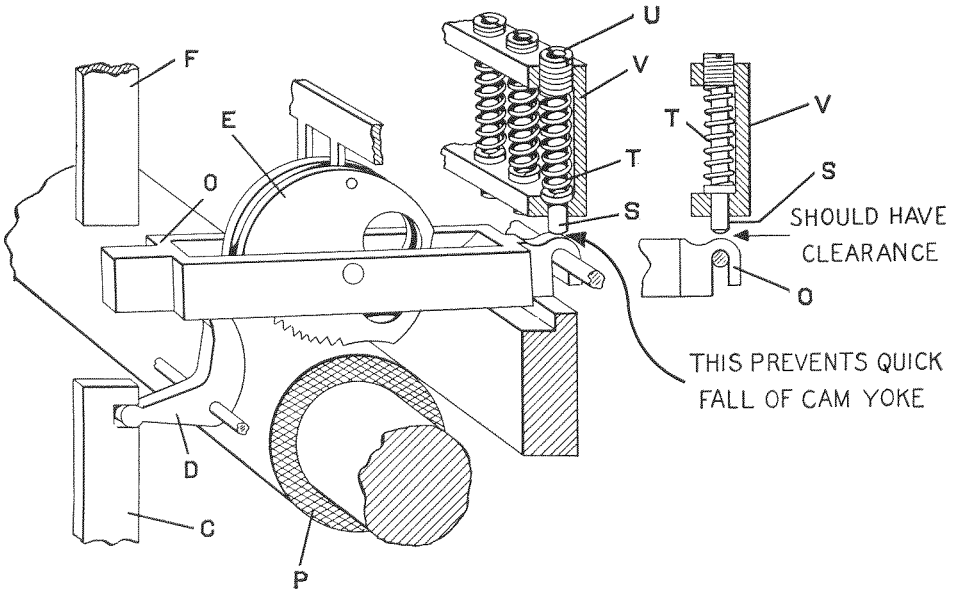


FIG. 6.—Arrangement used on the later keyboards, and is a further detail of keyboard parts. *C*, keyboard bar; *D*, trigger; *E*, keyboard cam; *O*, keyboard cam yoke; *P*, cam roll; *S*, plunger operated by the spring *T*; *U*, screw bushing for adjusting the tension of the spring *T*; *V*, frame in which the plungers and springs are mounted.

A small view shown at right indicates clearance between the plunger *S* and the cam yoke *O*. This clearance should be about the thickness of an ordinary visiting card, or about ten thousandths of an inch. If the plunger *S* rests upon the cam yoke *O*, the fall of the cam yoke when released by the trigger will be retarded, causing transpositions. This is not the case when the proper clearance exists.

eighth of an inch. The weight of the keyboard bar is small, so that the work required of the operator in depressing the keybutton with his finger will be as easy as possible. In the first machines springs were used to return the key levers instead of these weights. It was found, however, that these springs varied in tension so that the touch of one key was harder than another, whereas the weights make the work of the operator's fingers practically even. These keyboard bars or weights are so light that if any dust or dirt gets into the guides the key lever and trigger may not

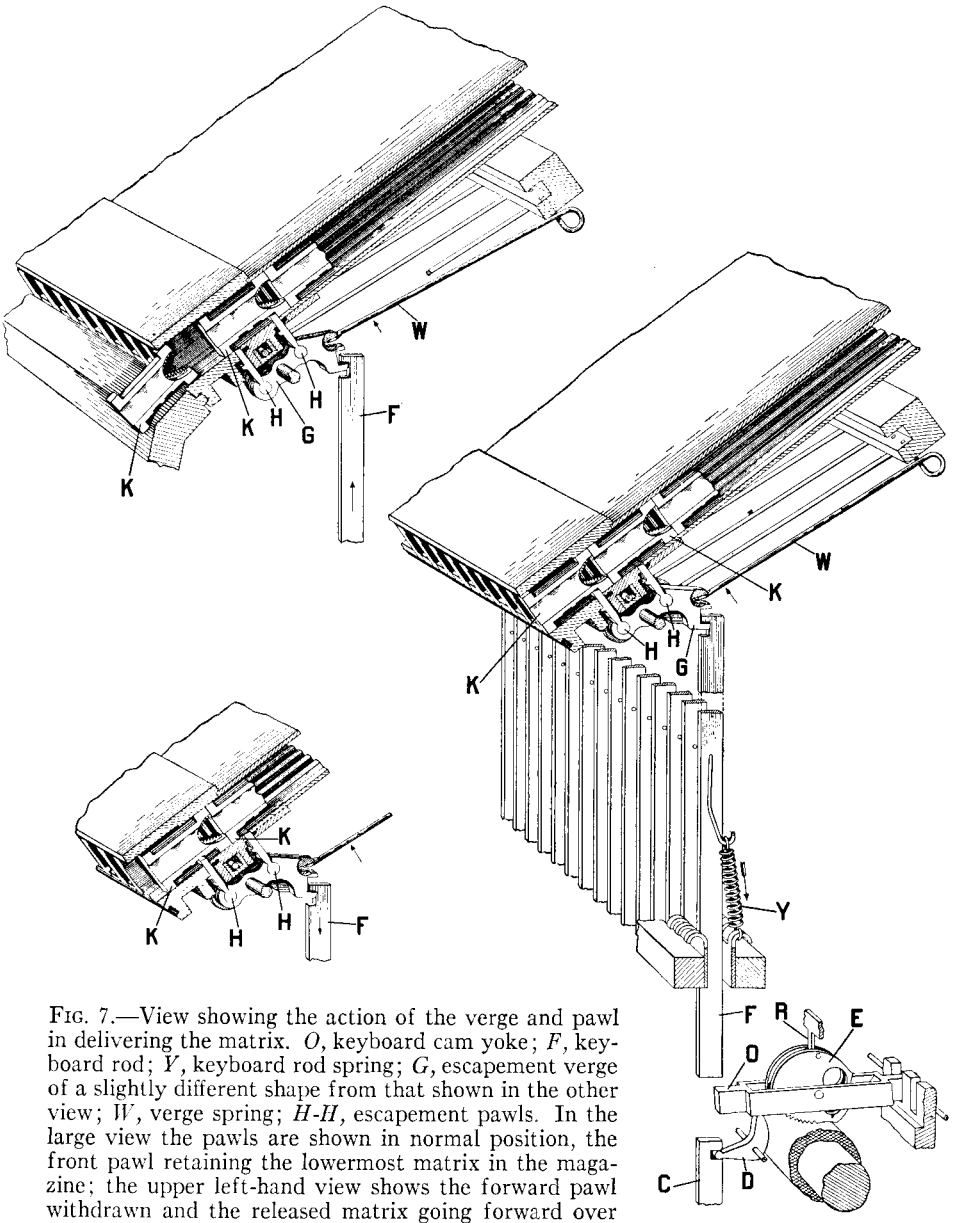


FIG. 7.—View showing the action of the verge and pawl in delivering the matrix. *O*, keyboard cam yoke; *F*, keyboard rod; *Y*, keyboard rod spring; *G*, escapement verge of a slightly different shape from that shown in the other view; *W*, verge spring; *H-H*, escapement pawls. In the large view the pawls are shown in normal position, the front pawl retaining the lowermost matrix in the magazine; the upper left-hand view shows the forward pawl withdrawn and the released matrix going forward over the assembler front.

The lower left-hand view shows the matrices in the act of sliding, the front pawl *H* having come up again and the back pawl *H* having been lowered. It is manifest that when the ear of the forward matrix shown in this view comes against the pawl, the line of matrices in the channel will be stopped and they will come to rest in the position as shown in the large view.

be returned. This could be remedied by making the weights heavier, but this would mean more work every time the operator touched the key. It is necessary, therefore, that these guides should be kept clean and free from oil or gum of any kind, in order that the keyboard may work properly. This matter will be referred to later.

The keyboard and escapement mechanisms differ slightly in different models.

The construction of the keyboard cam yoke and reed, as used in the Model 8 Linotype, is shown in Fig. 10. In this construction one end of the

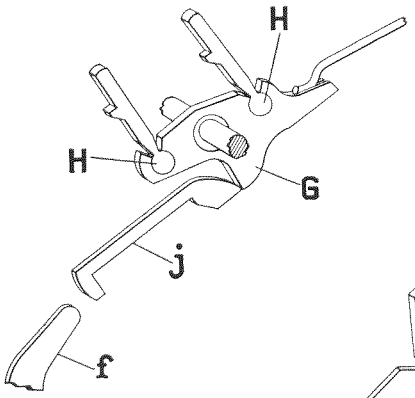


FIG. 8.—Diagram of the escapement verge pawls and plunger as used in the Model 8 Linotype.

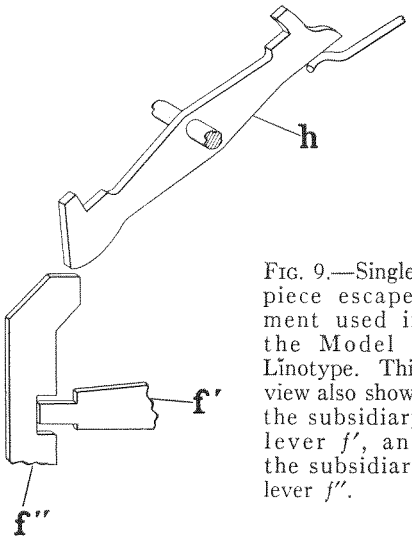


FIG. 9.—Single-piece escapement used in the Model 9 Linotype. This view also shows the subsidiary lever *f'*, and the subsidiary lever *f''*.

keyboard cam yoke has an open slot in it, the top of the slot resting upon the rod, forming a pivot for the keyboard cam yoke. Just above the pivot rod on the keyboard cam yoke there is a frame which contains a series of springs *T* and plunger *S*. The end of the plunger *S* rests just above the cam yoke. By touch of the finger, the keyboard cam yoke is released by the trigger in exactly the same way as previously shown. The action of the keyboard cam, lifting the cam yoke, lifts the keyboard rod, which does not carry any springs, but pushes up an intermediate lever *f*, as shown in Fig. 10. While the cam yoke is revolving upon the rubber roll, the rear end of the keyboard cam yoke rises a little and pivots against the spring plunger. The spring *T* is strong enough to hold the cam yoke in position, unless there is some serious interference with the action of the escapement. In this case the spring plunger *S* rises, the keyreed *F* stops its upward motion, and the keyboard cam roll revolves until it comes back into

normal position. This spring plunger and spring form an "automatic" to prevent breakage when, for any cause, the normal action of the escapement is prevented.

The keyreed *F*, as shown in Fig. 7, has mounted upon it a hook at its upper end and a spring *Y*. The tension of the spring *Y*, pulling down on the hook, tends to pull the keyrod *F* in a downward direction, as shown by

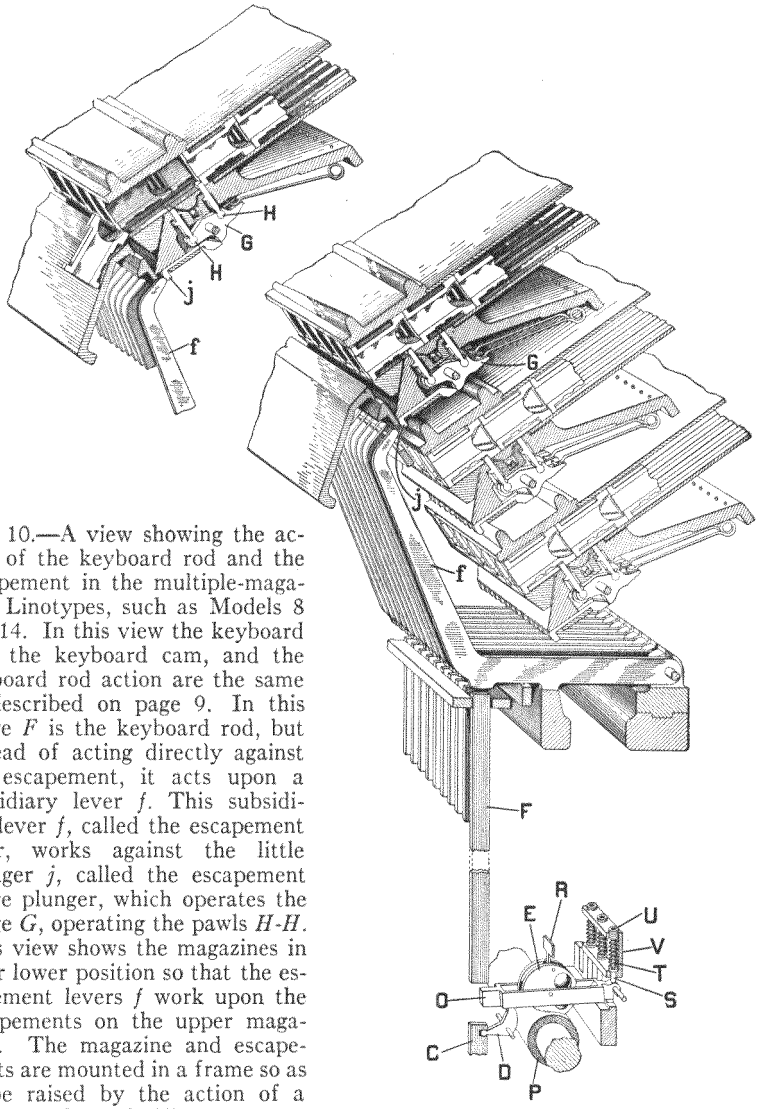


FIG. 10.—A view showing the action of the keyboard rod and the escapement in the multiple-magazine Linotypes, such as Models 8 and 14. In this view the keyboard roll, the keyboard cam, and the keyboard rod action are the same as described on page 9. In this figure *F* is the keyboard rod, but instead of acting directly against the escapement, it acts upon a subsidiary lever *f*. This subsidiary lever *f*, called the escapement lever, works against the little plunger *j*, called the escapement verge plunger, which operates the verge *G*, operating the pawls *H-H*. This view shows the magazines in their lower position so that the escapement levers *f* work upon the escapements on the upper magazine. The magazine and escapements are mounted in a frame so as to be raised by the action of a screw, as shown in Fig. 128, so as to bring any one of the three magazines into position, so that the levers *f* can work upon the corresponding plungers *j* and work upon the escapements, as described.

the arrow. At the top of the reed *F* there is a notch that engages with a part of the verge *G*. The verge *G* carries two pawls, *H* and *H*. These pawls have a shoulder. In the normal position of the reed, the shoulder of the front pawl banks against the lower part of the magazine while the other pawl is withdrawn so that it is just even with the bottom of the channel inside of the magazine. The pull of the spring *Y* on the reed *F*

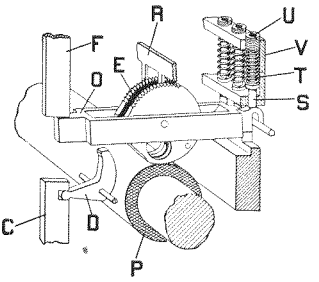


FIG. 11.—View of the keyboard cam yoke at its highest position, showing the spring *T* compressed and a little clearance in the hook at the back-end of the keyboard cam yoke. This clearance is called the overthrow and provides for wear or interference with the action of the keyboard cam *E*.

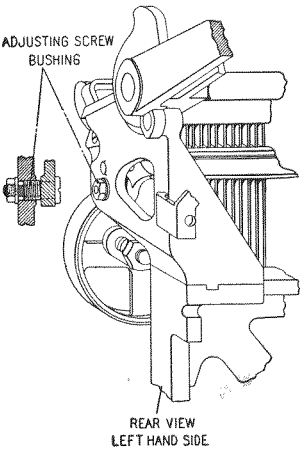


FIG. 12.—Diagram showing the adjusting screw and bushing for adjusting the key rod upper guide on the Model 3 and Model 5 Linotypes.

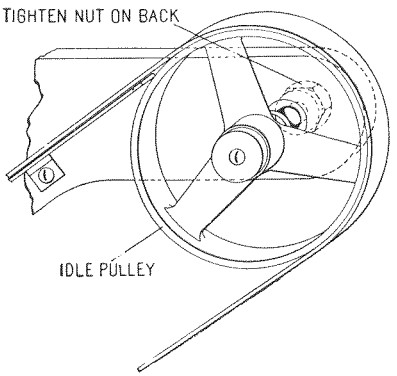


FIG. 13.—View of the idle pulley for the matrix delivery belt, showing the adjustment thereof for the purpose of tightening the belt when it gets loose. The spindle of the idle pulley is held in position by two nuts on the back of the assembler entrance in a slot, and by unlocking these nuts the pulley can be adjusted until the belt is of the right tension.

through the verge *G* comes against the shoulder of the pawl. When the keybutton is touched by the finger and the keyreed is raised, as shown in Fig. 1, and previously described, the verge *G* is pushed upward by the spring *W*, the tension of which is in the direction indicated by the arrow. This lowers the front pawl, allowing the lowest matrix in the line of

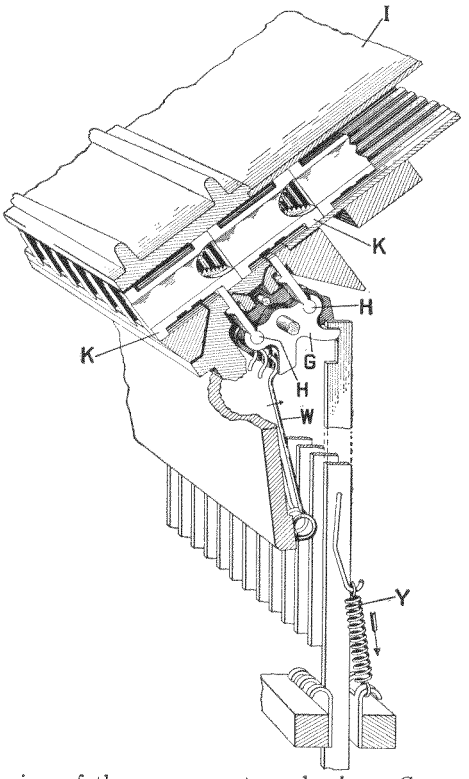


FIG. 14.—Enlarged view of the escapement mechanism. *G*, escapement verge; *H*, escapement pawl; *I*, magazine; *K-K*, matrices in the magazine; *W*, verge spring; *Y*, keyboard rod spring. This form is used in the Model 5 Linotype.

matrices to slide forward and out of the magazine. The second in the line of matrices follows and is caught by the rear pawl, as shown in Fig. 7. In Fig. 7 is shown the rear pawl coming up and the front pawl going down, illustrating clearly the action of the escapement in permitting the lowermost matrix to escape and retaining the others.

It will be noted that in the device explained above, the spring *Y* is much stronger than the spring *W*, the spring *Y* overcoming the tension of the spring *W* when the reed is in normal position. The use of one spring pulling against another is not common in mechanism, and is used here so that in case of any accident, the action being caused by springs will not cause breakage of the parts.

In the Model 8 Linotype the key reed *F* does not work against the escapement directly, but through an intermediate lever *F*, called the escapement lever, as shown in Fig. 10, and a small sliding plunger *j*, called the

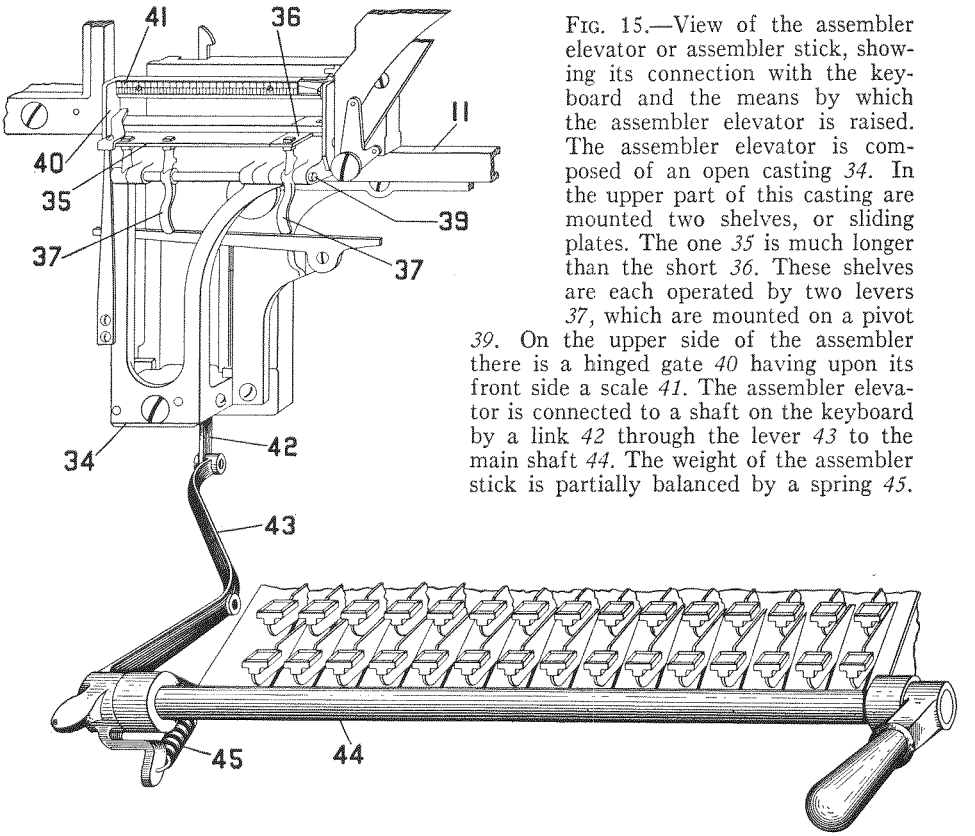
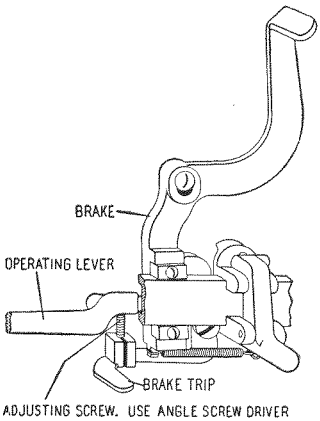


FIG. 15.—View of the assembler elevator or assembler stick, showing its connection with the keyboard and the means by which the assembler elevator is raised. The assembler elevator is composed of an open casting *34*. In the upper part of this casting are mounted two shelves, or sliding plates. The one *35* is much longer than the short *36*. These shelves are each operated by two levers *37*, which are mounted on a pivot *39*. On the upper side of the assembler there is a hinged gate *40* having upon its front side a scale *41*. The assembler elevator is connected to a shaft on the keyboard by a link *42* through the lever *43* to the main shaft *44*. The weight of the assembler stick is partially balanced by a spring *45*.

FIG. 16.—View of the brake trip on the assembler slide and the screws for adjusting same so that the assembler slide will be permitted to go freely to the left while the line is being assembled, and will be prevented from going backward until the line is sent up to be transferred to the first elevator, at which time the spring returns the assembler slide to its primary position.

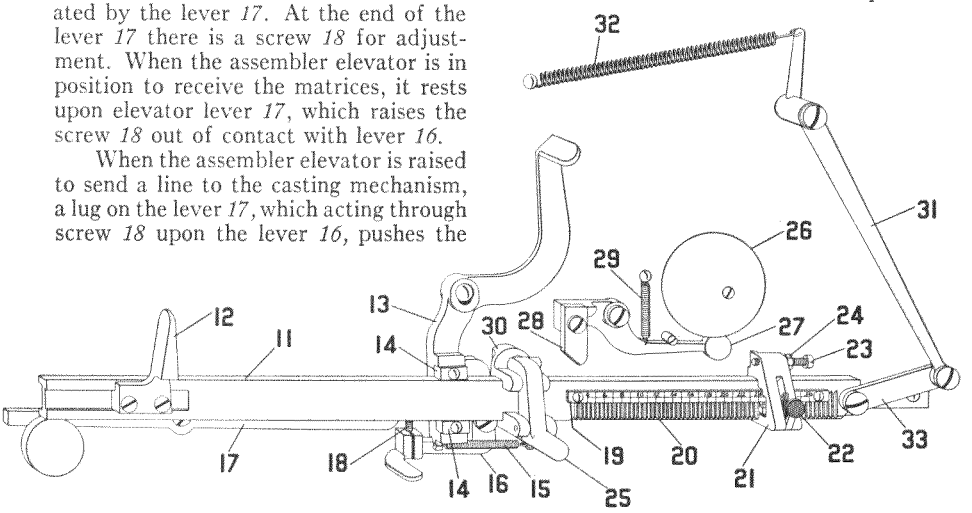


escapement verge plunger, as shown in Fig. 10. This sliding plunger acts against the escapement, causing the front escapement pawl to be lowered and the rear escapement pawl to rise, releasing the matrix. When the key

FIG. 17.—Enlarged view of the assembler slide *11* and the assembler slide finger *12*. This view also shows the locking mechanism, which consists of a lever *13*, two hardened blocks *14*, and a spring *15*. The spring *15* is fastened to the lower part of the lever *13*, and tends to bind the blocks *14* upon the assembler slide *11*. As the matrices are assembled by the star wheel against the finger *12*, the assembler slide is moved along, the blocks *14* yielding slightly and allowing the slide to travel in a forward direction, but preventing its backward motion.

Mounted on the face plate of the machine is a lever *16* which trips the lever *13* so as to allow the assembler slide to have a backward motion. This lever is operated by the lever *17*. At the end of the lever *17* there is a screw *18* for adjustment. When the assembler elevator is in position to receive the matrices, it rests upon elevator lever *17*, which raises the screw *18* out of contact with lever *16*.

When the assembler elevator is raised to send a line to the casting mechanism, a lug on the lever *17*, which acting through screw *18* upon the lever *16*, pushes the



lever *13* forward a short distance so that the blocks *14* do not press against the assembler slide. This allows the assembler slide to return to the right in readiness to receive the next line of matrices as they are assembled from the keyboard.

On the right-hand side of the assembler slide there is a scale *19*, and teeth are cut in the assembler slide immediately below the place where the scale is mounted. These teeth *20* are one nonpareil or 6 points apart. Mounted on the assembler slide is a block *21*, called the assembler slide clamp. This block has several teeth in it, and the block is so mounted as to form a stop for the left-hand or forward motion of the assembler slide. By pressing a little handle *22* the block *21* is unlocked and can be set at any point on the scale *19*. Mounted in the top of the block *21* is a screw *23* with a lock nut *24*. This screw is adapted to strike against a lever *25*. This forms a stop for the motion of the assembler slide. By the pressure of the finger this lever *25* can be moved out of the way of the screw *23* as to allow a further motion of the assembler slide to the left.

Mounted on the main frame of the machine is a bell *26*, with a lever *27*, and a trip dog *28*. In passing under the trip dog *28* the block *21* pulls the lever *27* downward a short distance, and when the block *21* passes under the trip dog *28* depressing the right hand of lever *27* which rises through the action of the spring *29*, striking the bell and sounding the alarm, which indicates to the operator that the screw *23* and the block *21* are nearly against the stop.

30 is a guide for the assembler slide and a mounting for the lever *25*.

At the extreme right of the assembler slide is a lever, *31*, which is connected to the main frame of the machine by a spring *32*, and to the assembler slide by a link *33*. The spring *32*, acting through the lever *31* and link *33*, resists the left-hand, or forward, motion of the assembler slide, but when the locking blocks *14* are tripped, as previously described, the spring *32* returns the assembler slide to its normal position in front of the star wheel to receive the succeeding line.

rod *F* goes down, following the cam yoke, the escapement lever goes back and the spring causes the escapement to return to normal position. It will be noted that the action of this spring is exactly contrary in direction to the action of the spring *W* in Fig. 7. The matrix is released by the escapement pawls in the manner shown in Fig. 7, exactly, as there described.

Fig. 14 shows a view of the form of escapement mechanism used in the Model 5 Linotype, of which there is a very large number in use. There is no difference between the action of this mechanism and that described in Fig. 7 except that the position of the spring *W*, instead of being at the rear of the escapement, is on the front side. The action of this spring has exactly the same effect as that described in Fig. 7.

ASSEMBLER BELT

The matrices when released by the escapement fall down a vertical plate called the "assembler front" or assembler entrance upon a belt which is partially shown in Fig. 1 and in a number of other figures. The matrices are prevented from twisting by vertical partitions called the "assembler entrance partitions." When the matrix falls upon the belt it is carried rapidly forward and down toward the assembler stick or assembler elevator. As it passes into the assembler stick it runs over a wheel, made of fiber, having four projections upon it. This is known as the "star wheel," and later will be more fully described. The action of the star wheel is to place the matrix in a vertical position in the assembler stick, as shown in Fig. 1.

ASSEMBLING ELEVATOR

The assembling elevator is shown in Fig. 1 and Fig. 18. This part is also known to operators as "the assembler," "the assembler stick," "the assembler elevator," and "the stick." The latter names come from the fact that this part answers the same purpose as the compositor's "stick" in hand composition. The assembling elevator is an open casting, having rails upon which the ears of the matrices may rest, and below which the long wedges of the spacebands may hang.

ASSEMBLER SLIDE

Mounted on the face plate is the assembler slide, as shown in Fig. 19. This slide is constantly pulled to the right of the operator as he faces the machine, or toward the star wheel, by spring *32*, Fig. 17. On this slide is mounted a finger, against which the line of matrices presses as the line is being assembled. Mounted on the slide, as shown at *30*, Fig. 17, is a

detent, or lock, commonly called "the assembler slide brake." This lock, or brake, allows the assembler slide to move, under a slight tension, toward the left of the operator, or away from the star wheel, but prevents its returning to the right until the brake is tripped, when the assembler elevator goes up. The star wheel presses the line of assembled matrices against the finger on the assembler slide and the assembler slide moves along, holding the line of matrices compactly together, so that the operator may read the line and judge its length. When the assembling elevator goes up to send the line to the casting mechanism the elevator trips the

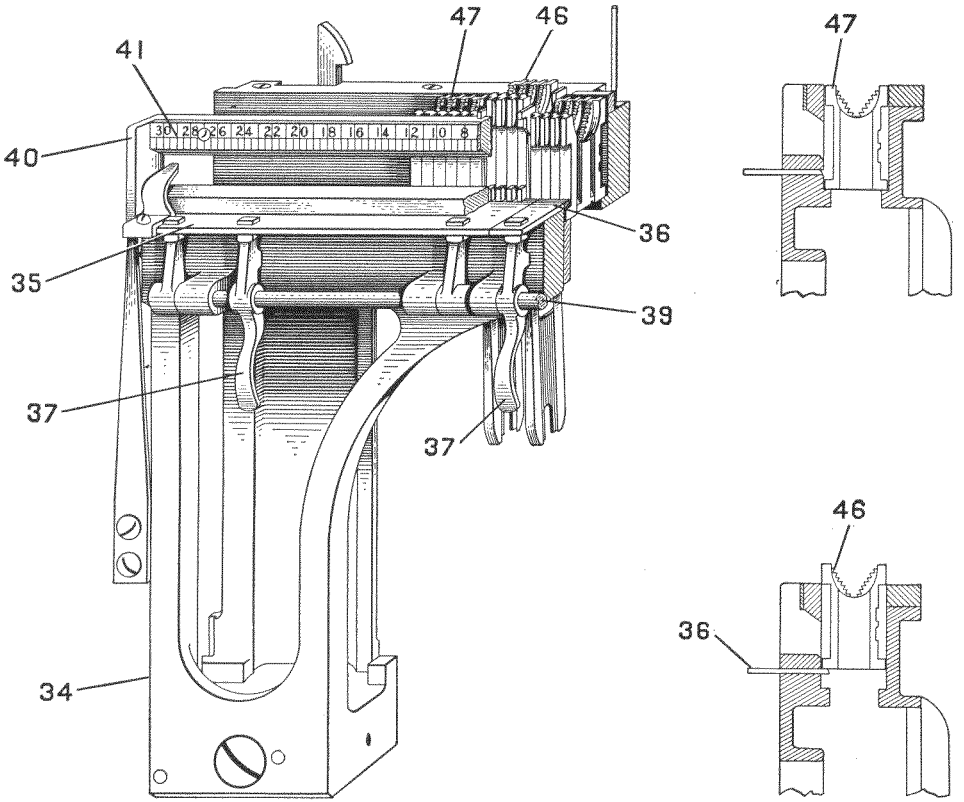


FIG. 18.—Enlarged view of the assembler stick, having a portion of it cut away so as to show the matrices at two different positions in the matter of alignment. The long shelf *35* and the short shelf *36* may be operated by the fingers through the levers *37*. When pushed inward these shelves catch the descending ears of the matrices and sustain the matrices at a higher level than in the ordinary assembling. In the figure the matrices shown at *46* are in the raised, or italic, position, and the matrices shown at *47* are in the lower, or roman, position. These two positions are shown in two smaller sectional views, one matrix being shown at *46* in the italic, or raised, position, resting upon the shelf *36*, and the other matrix in the lower, or roman, position at *47*. The raised or italic position is also called the auxiliary position, and the lower position, the regular.

lever *16*, as shown in Fig. 17, which releases the lock, or detent, and the spring *32* causes the assembler slide to return very quickly to the right to a position directly in front of the star wheel, ready for matrices of the next line when the assembler has been lowered to normal position to receive them; when the action is repeated.

ALARM MECHANISM

Mounted on the face plate is a small bell with a trip hammer, tripped by an adjustable lug or clamp on the assembler slide. This lug is called the assembler slide clamp. This adjustable lug is set for different lengths of line, so as to trip the lever and ring the bell a short time before the end of the line is reached, to warn the operator that he must use a hyphen in dividing a word, or decide upon the end of a word, if the line comes in this way. The same lug that rings the bell comes against a bracket on the assembler and forms a positive stop for the slide when it has moved over the full length of the line. All these parts are shown in Fig. 17. Slightly different forms of the mechanism shown in Fig. 17 are used in the different models but their function is the same in all.

TWO-LETTER ATTACHMENT

The first matrices used in the Linotype machine had but one character stamped upon them. In 1898 there were two characters stamped upon the matrix, and a corresponding arrangement made in the assembling elevator and the mold to assemble and cast the matrices at either one of two different levels, so as to bring at will either character into position to appear upon the slug. This permitted the use of italics or black letter, together with a roman font of the same size. Up to the time this device was placed upon the machine it was not practical to use the machine for book work and a large class of printing that required more than the ninety characters on the keyboard.

The different levels in the assembling elevator are obtained by the use of two sliding shelves, or rails, a short one and a long one. These shelves are so mounted that they can be slid forward into the assembler elevator or withdrawn from this inside position. In this way they form a shiftable rail on one side of the assembling elevator. When these shelves are thrown in, the matrices, instead of falling upon the regular fixed rails of the assembler, fall upon this shiftable rail, which brings the lower or auxiliary character upon the matrix in line with the upper character of the matrices that are assembled upon the regular rail. The object of having two of these rails, one long and one short, is that if the operator, after assembling a word or phrase in the upper position, wishes the succeeding matrices to be in the lower position, he can withdraw the short rail, leaving the long rail in position to sustain the matrices already in the upper position. It is also possible for the operator to change a single matrix or a word by hand from the upper to the lower position, or vice versa.

When the line of matrices and spacebands is assembled, the assembling elevator is raised about five inches by depressing a handle, or lever. As the elevator goes up it carries the line of assembled matrices between two fingers, one of them long and one of them considerably shorter, and they are commonly known as the "long finger" and "short finger." When the assembling elevator reaches the top of its slide it trips a mechanism that closes and grasps the line of matrices between the long and short fingers and then transfers it through the delivery channel to the casting mechanism where the slug is cast. The line of assembled matrices and spacebands is shown in Fig. 19. This mechanism will be fully described later.

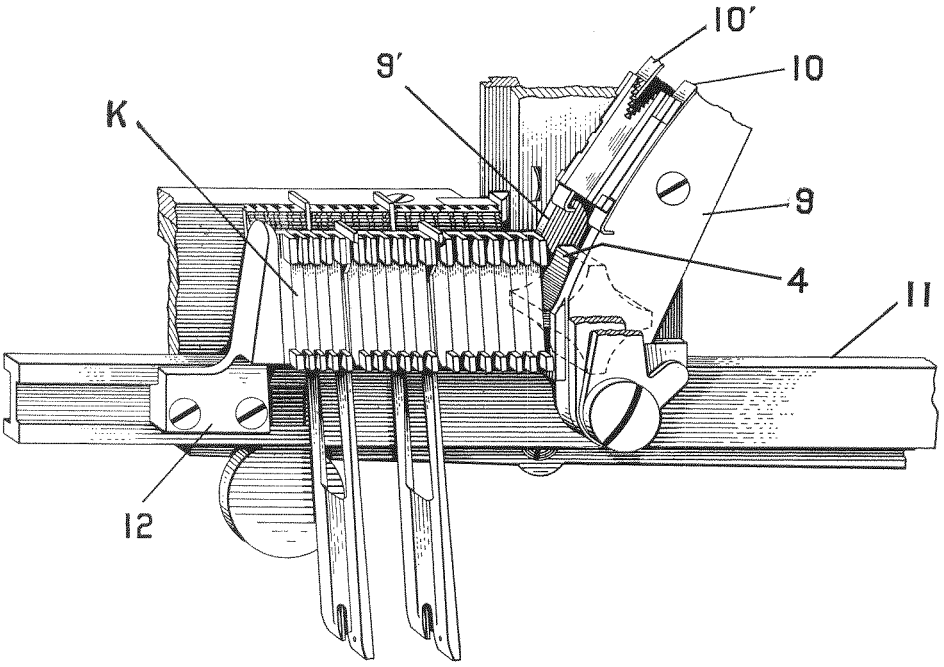


FIG. 19.—View showing a part of the assembler block and part of the assembler elevator or assembler stick. The front part of the assembling elevator is cut away so as to show the assembler slide *11*, and the finger on the assembler slide *12*. The matrices assemble against this finger *12*.

II. The Matrix

THE matrix has been frequently referred to and illustrated, but will now be described a little more in detail. By far the larger number of matrices made by the Mergenthaler Linotype Company have two characters thereon and are called "two-letter matrices." There is room upon the matrix for two characters, up to fourteen point. Beyond this size only one character can be used on the matrix. In general the matrix is a parallelogram in shape, one and one-quarter inches long, three-quarters of an

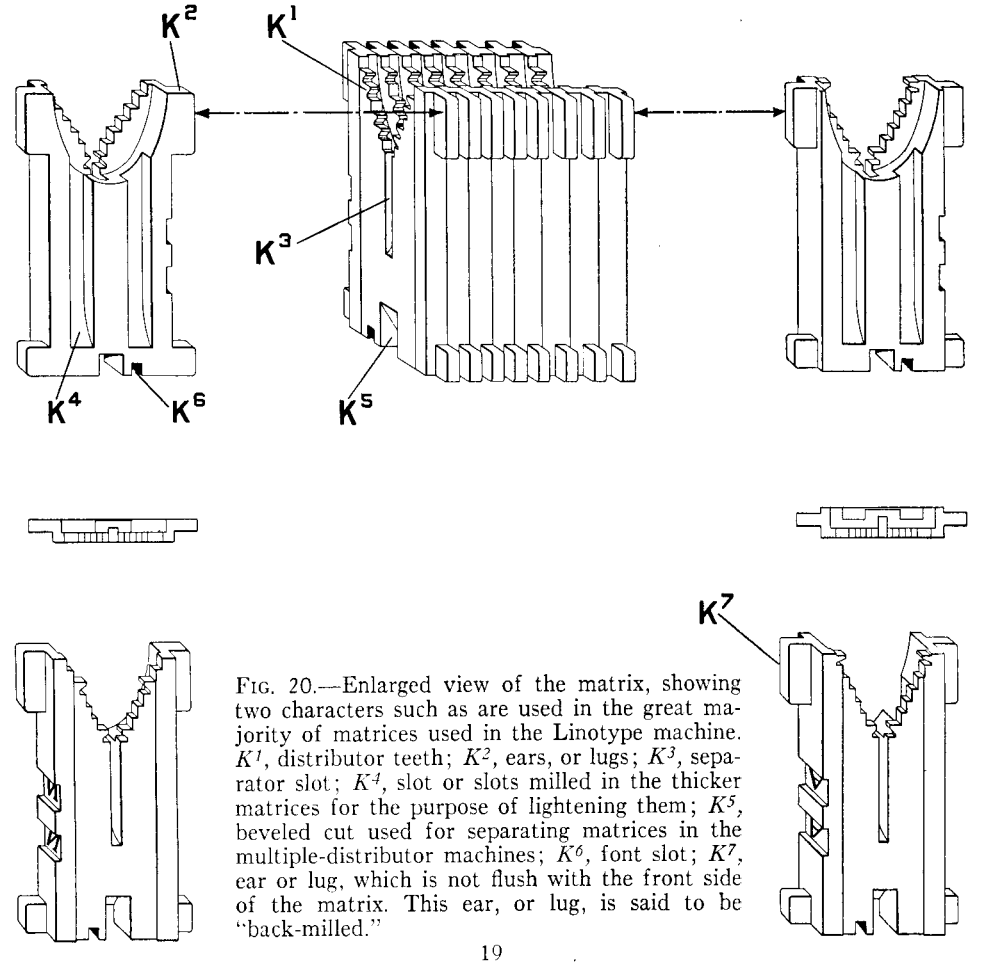


FIG. 20.—Enlarged view of the matrix, showing two characters such as are used in the great majority of matrices used in the Linotype machine. K^1, distributor teeth; K^2, ears, or lugs; K^3, separator slot; K^4, slot or slots milled in the thicker matrices for the purpose of lightening them; K^5, beveled cut used for separating matrices in the multiple-distributor machines; K^6, font slot; K^7, ear or lug, which is not flush with the front side of the matrix. This ear, or lug, is said to be "back-milled."

inch wide across the ears of the matrix, and nine sixteenths on the body of the matrix. The upper ears of the matrix are twice the length of the lower ears. The thickness of the matrices varies, of course, as do the widths of the characters to be stamped therein. The ears of the matrix are normally even, or flush, with the left-hand side of the matrix, as you look at the character. On some of the larger faces the ears are not quite flush with the left-hand side of the matrix, but are set over toward the tooth side thereof. This is called "back-milling," and such matrices are said to have "back-milled" ears. The object of this "back-milling" is to get larger faces into the magazine than it could otherwise contain. It is a case where the extra thickness of certain characters is allowed to project over on both sides of the magazine channel, instead of one side, as is generally the case.

At the top of the matrix there is a V-shaped notch, and in this notch there are combinations of teeth. These teeth are equilateral triangles one thirty-second of an inch on each side. The teeth are not the thickness of the matrix but are usually one thirty-second of an inch thick. On special matrices this thickness is increased. On the thicker matrices the teeth are usually on the opposite side from the ears.

Below the V-shaped notch is a vertical slot. It begins between the two lower teeth of the matrix and extends forward to the left side of the matrices, as you look at the character. This notch extends downward toward the foot of the matrix at least three sixteenths of an inch, and the object of this is to make all matrices of the same thickness at one point on their left-hand side. This thickness is also about one thirty-second of an inch. This slot registers with a projecting blade in the distributor box to prevent the lifting of two matrices at a time into the distributor screws.

CARE OF MATRICES

The matrices should never be washed with benzine, or any similar liquid. It was supposed in the early days of the Linotype that washing with benzine was a good practice. As a matter of fact, it was very injurious, for it washed away the dirt that accumulated on the side walls of the matrix, and rendered the surface so clean as to make it easier for metal from the pot to adhere to the matrix walls by a sort of soldering action. The only parts of the matrices that ordinarily need attention on the part of the operator are the ears. As previously stated, if oil or gum gets upon the ears of the matrix, the ears should be wiped dry and a *very little* graphite rubbed thereon. The best way of applying the dry graphite powder is to rub it into a soft-pine board that is smooth and flat; remove the loose graphite, and then take the matrix and lay it with the ear side down and give it two or three rubs, as shown in Fig. 21. Then, grasping the matrix by the thumb and finger as shown in Fig. 21, the outside edge of the ears on both sides of the matrix should be rubbed clean, and the little particles of graphite that still adhere to them will make them run

perfectly. (Method of removing burr or projection shown in Fig. 22.) In using graphite in this connection, or on any part of the machine, caution should be observed *not to use too much.* A little graphite is an excellent

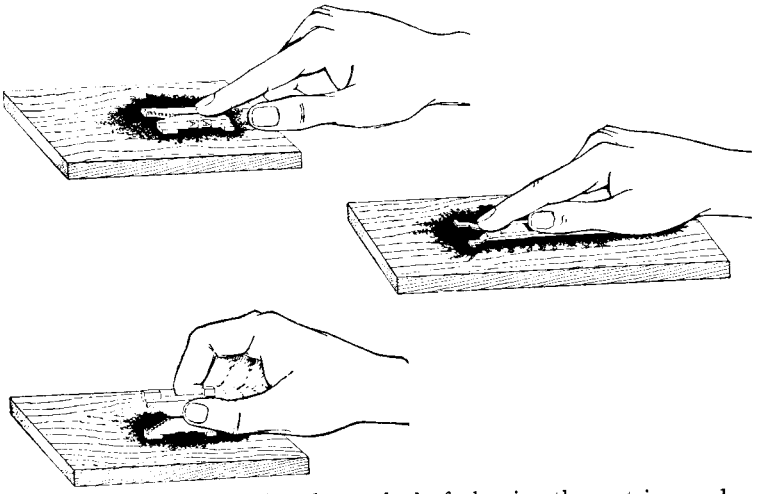


FIG. 21.—Three views illustrating the method of cleaning the matrices and spacebands and making a surface of graphite upon them so that they will pass through the machine more smoothly and rapidly.

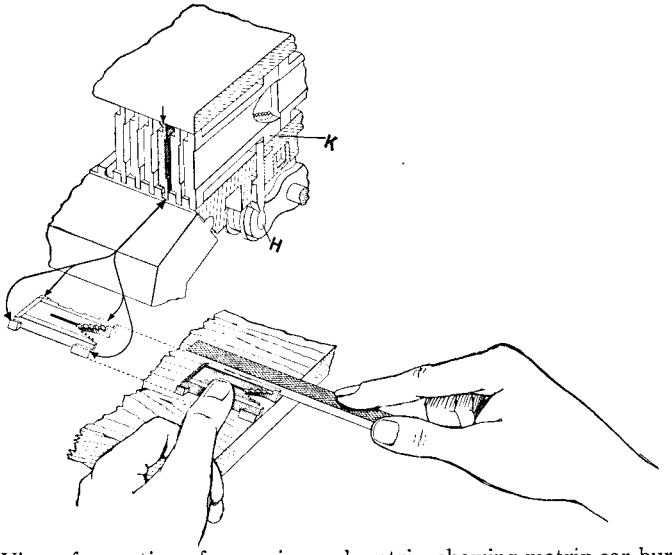


FIG. 22.—View of a portion of magazine and matrix, showing matrix ear burred or a sharp edge thrown up which prevents rapid and smooth sliding of matrix through the channel in the magazine. In this view the burr, or projection in the matrix is exaggerated. The lower part of this view shows a board, a matrix, and the method in which the burr, or projection, can be removed with a fine file. In using a file in this way, only one with a safety edge should be used, and care must be taken not to file away the body, or main portion of the ear; only the raw edge or burr upon the ear.

lubricant, but when too much is used it forms a basis for a sticky, gummy mixture of graphite, dirt, and a little oil, which is a great nuisance.

A little intelligent care of the matrices will make them answer their purpose perfectly, and will cause them to last for a long time. Sets of matrices thus cared for have been known to run as long as ten years in daily use, with the replacement of only a few of the most used characters.

SIDE WALLS

On each side of the matrix there is a thin wall of brass, only a few thousandths of an inch high and very thin, which forms the pocket into which the type metal is cast. These side walls are so thin and delicate that they may be easily bruised and pressed or bent in, and thus an opening is formed between two matrices standing side by side in the line into which the metal flows when the line is cast, and this shows up in the print, causing what are known as hair lines. These hair lines are very objectionable and pains should be taken to avoid their appearance, as they will mar an otherwise perfect piece of printed matter.

The bending or pressing in of the side walls of the matrices is caused in various ways. The matrices will sometimes pound each other as they descend into the assembler elevator. Care should be taken that the assembler rails are in proper position and that the matrix is directed into the elevator at the proper angle, as shown in Fig. 19.

The most frequent cause of hair lines is the pressing or bending in of the side walls of matrices by a little metal adhering to spacebands at the casting point.

The spacebands must be taken from the machine at least once a day and these little pieces of metal that have become soldered to the side of the spacebands removed. This is done by laying each spaceband flat upon a pine board similar to that used for the matrices, and rubbing the spaceband until the type metal is entirely removed and the spaceband is clean, with a *very little* graphite adhering to the face of it. Many careful operators remove the spacebands *twice* a day from the machine and give the treatment above mentioned. If this matter is neglected for only a few days a set of matrices may be ruined. There is no known cure for a set of matrices with damaged side walls.

However, it sometimes does happen that dirt from the machine accumulates in the ragged edge of a broken side wall and forms a side wall which holds the molten metal so that the slug gives a clear print. This is the only known place in a Linotype machine where the accumulated sticky dirt above spoken of is of any use. Everywhere else it is a great detriment.

A third cause of the destruction of the side walls is the sending in of tight lines by the operator. Tight lines will be described in connection with the casting mechanism, so it is sufficient to say here that the operator allowing tight lines to go through a machine may speedily destroy a set of matrices.

Care in regard to the points mentioned will make a great difference in the satisfactory use and maintenance of the matrices and in the cost of sorts necessary to the maintaining of a set of matrices in first-class condition.

It is very important that this care should be a regular and methodical thing, and not a spasmodic case of attention one day and then forgetting for weeks or months to give the necessary care. In the latter case the harm is done, and the only way to cure the trouble is to go to a considerable expense in procuring sorts or a new set of matrices, which a little care would have rendered unnecessary. *This is a case where "an ounce of prevention is worth a pound of cure."* We stress this point most emphatically, because it is a source of much unnecessary trouble.

TRANSPOSITIONS

As has been mentioned before, the assembling of the matrices in the Linotype machine is exceedingly rapid. Fast operators frequently touch twelve to fifteen keys in a second on certain combinations of characters. The *least hesitation* in the release of a matrix, or interference with it as it traverses its path from the magazine to the assembling stick, means a transposition. Nothing is more trying to a fast and accurate operator than frequent transpositions of characters. Some of the causes of transpositions have already been mentioned, but they will now be enumerated again, together with others.

First to be mentioned is undue pressure of the overthrow spring, shown at *T* in Fig. 6. In some cases the plunger is a little too long and presses upon the notched end of the keyboard cam yoke. There should be a slight clearance, about the thickness of a sheet of paper, between the notched end of the keyboard cam yoke and the end of the plunger. If the plunger actually rests upon the keyboard cam yoke when in normal position, it prevents the quick fall of the keyboard cam upon the rubber roll, and although this is a very small delay it is sufficient to cause transpositions. Care should be taken that the plungers have a clearance above the keyboard cam yoke. The place where this clearance should be is shown by arrow in Fig. 6.

Second, springs *Y* in Fig. 7, to hold down the reeds, should all have substantially the same tension. If two springs have different tensions the one that is lighter will be raised sooner by the keyboard cam yoke. Again, this difference in time of the release of the matrix cannot be detected by the eye, but it is sometimes sufficient to cause a transposition. The same thing is true of the springs that operate upon the verges of the escapement, as shown in Fig. 7 at *W*.

Third, the escapement verge (views which are shown in Figs. 23, 24 and 25), may be cut or get rough for lack of oil, and work hard in its guides or upon the pivot rod. Occasionally, at long intervals—say, once in three to six months—a very little *clock oil* should be placed upon the

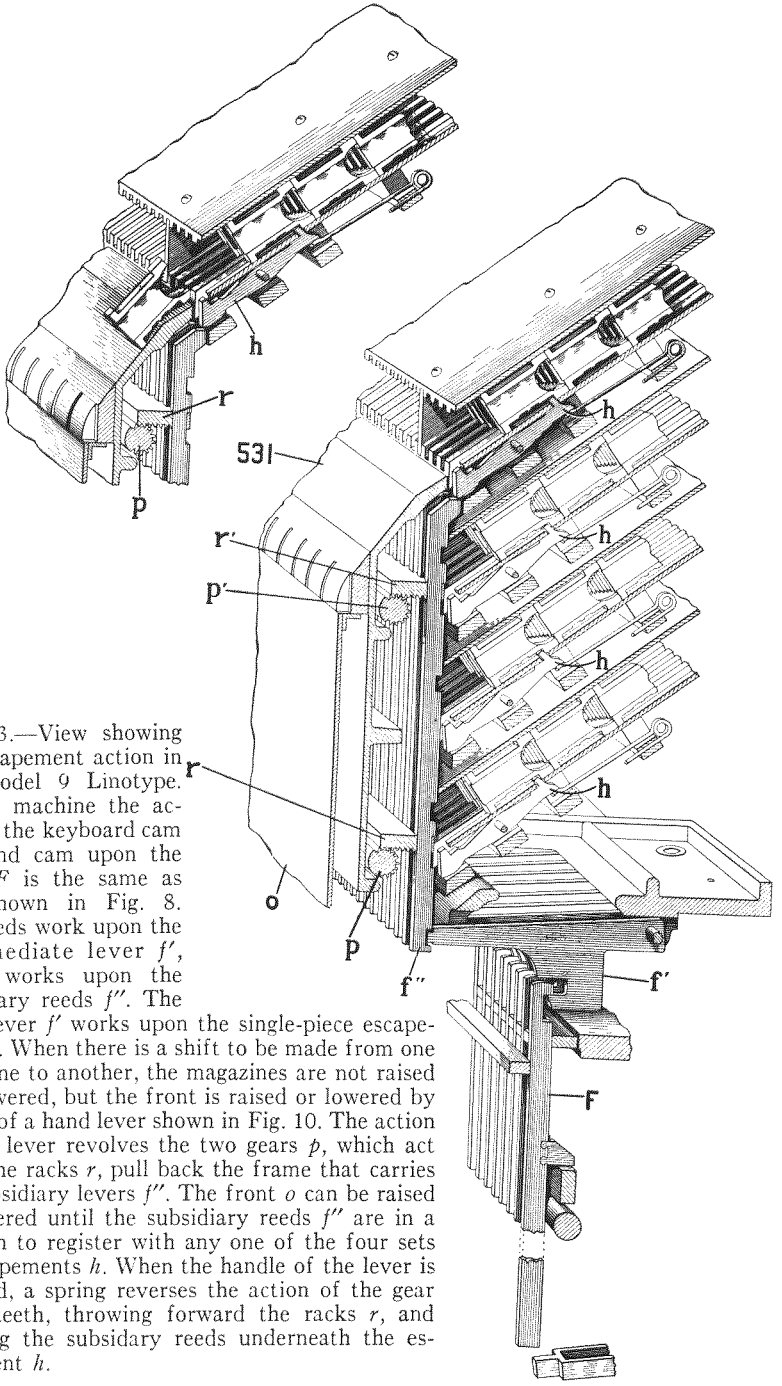


FIG. 23.—View showing the escapement action in the Model 9 Linotype. In this machine the action of the keyboard cam rolls and cam upon the reeds *F* is the same as that shown in Fig. 8. The reeds work upon the intermediate lever *f'*, which works upon the subsidiary reeds *f''*. The same lever *f'* works upon the single-piece escapement *h*. When there is a shift to be made from one magazine to another, the magazines are not raised and lowered, but the front is raised or lowered by means of a hand lever shown in Fig. 10. The action of this lever revolves the two gears *p*, which act upon the racks *r*, pull back the frame that carries the subsidiary levers *f''*. The front *o* can be raised or lowered until the subsidiary reeds *f''* are in a position to register with any one of the four sets of escapements *h*. When the handle of the lever is released, a spring reverses the action of the gear small teeth, throwing forward the racks *r*, and bringing the subsidiary reeds underneath the escapement *h*.

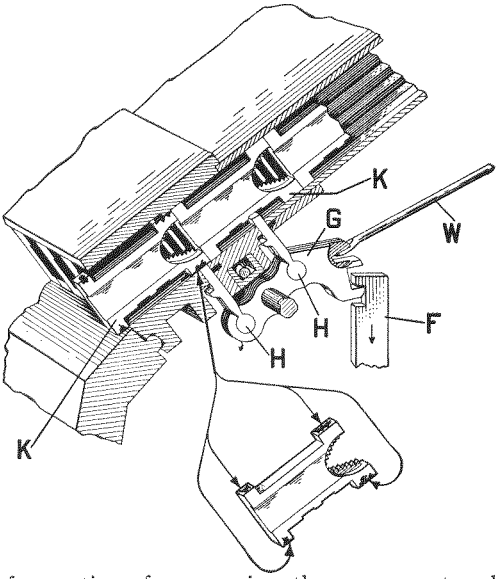


FIG. 24.—View of a portion of a magazine, the escapement and key reed, and an enlarged view of the matrix showing where dirt and gum may accumulate on the matrix and prevent its smooth and quick action.

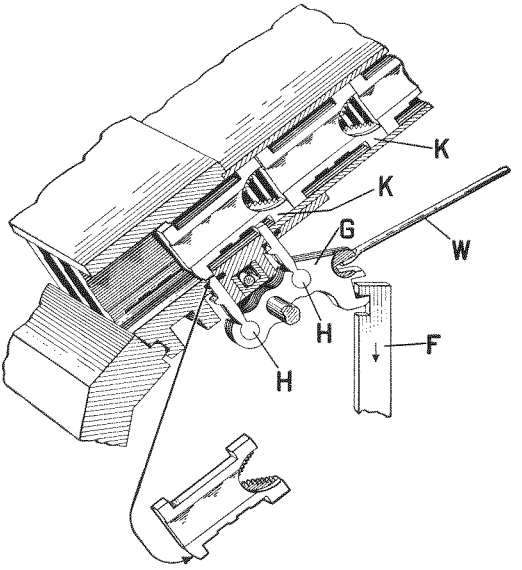


FIG. 25.—View of a portion of a magazine, the escapement and key reed, also a view of a matrix showing a worn ear. Just below the main view is a view of the matrix showing in an enlarged view the ear worn so that it may drop into the hole through which the escapement pawl *H* works. The view of the matrix shows a case of extreme wear. When worn as much as shown in the view, the matrix should be discarded. When only slightly worn, it is sometimes possible to restore the shape of the ear in the matrix swage block.

verges. This is best done with a wooden toothpick. *Care should be taken not to use too much oil,* as this is nearly as bad as none at all.

Fourth, the matrices may be sticky and gummy in one channel and not so in another. This is one of the most common causes of transpositions. The method of remedying this is by wiping the ears of the matrices clean and then rubbing them with a very little graphite, as shown in Fig. 21.

Fifth, the matter already referred to of a burr or damaged ear of the matrix. The method of correcting this is shown in Fig. 22.

Sixth, the short ear of the matrix may be so worn that the ear drops into the holes in the magazine through which the pawls pass. This is shown in Fig. 25.

Seventh, the interference of the assembler front partition with the overhanging part or body of the matrix. This is likely to occur in large faces. The partition must be adjusted so as to clear the body of the matrix.

Eighth, an irregular or uncertain motion of the assembler belt. This is caused sometimes by the belt being too loose or the friction disk 6 in Fig. 32 failing to hold; sometimes by a lack of oil upon the bearings of the assembler mechanism. The assembler belt should run very smoothly and with perfect steadiness. If any irregularity can be observed in its action see that the belt is fairly tight, that the friction disk is holding, and that all bearings are properly oiled. In oiling these bearings, only a small amount of good clock oil should be used and great care should be taken that the oil does not drip or run over in any way, so as to get on the matrices.

Ninth, the assembler chute spring must be so adjusted that it will not retard the matrices too much. No exact rule can be given for this setting of the assembler chute spring; it must be learned by experience. As a matter of fact, different operators like a slightly different setting of this spring. When just right no transposition will occur, but when out of adjustment it is one of the most frequent causes of transposition.

Tenth, one of the frequent causes of transpositions is a worn star wheel. When the points of the star wheel have worn down one sixteenth of an inch, the star wheel should be discarded and another substituted, and better results will be obtained where only one thirty-second of wear is allowed. The action of the star wheel is dependent upon the regular action of the assembler belt and the star wheel should be so kept in order that there is a smooth and regular action of the same.

Eleventh, dirty magazines will cause trouble. Once a month or so the matrices should be removed and the magazine thoroughly brushed out.

With a good magazine brush, clean all the dirt and gum from the inside of the magazine, using denatured, or wood alcohol, or gasoline on the brush. In cleaning be sure that all the little dark spots, which show where the lugs of the matrices set in the magazine, are removed. If these spots are not entirely removed, the matrices will be held back and will not drop regularly.

If there are numerous transpositions and no other cause is evident, the matter of the register of the magazine and the escapement bar should be carefully looked into.

Twelfth, the key reed sometimes gets bent or wears upon its guide, either at the top or bottom, so that it does not properly register either with the verge of the escapement at the top of the reed or with the end of the keyboard cam yoke at the lower end of the reed. This is not a very common occurrence.

Thirteenth, "doublets." It happens sometimes that when the key lever is touched the keyboard cam makes two revolutions instead of one, delivering two matrices instead of the one desired. The cause of this is the failure of the keyboard bar *C*, as shown in Fig. 2, to return the trigger in time to catch the descending cam yoke. This is almost invariably caused by dirt. Almost every form of dirt is objectionable, but the dirt formed by the action of a Linotype is one of the most objectionable forms of its kind. This dirt is composed of dust floating in the air, small bits of type metal, and the oil that must be used in any piece of machinery. This forms a peculiarly sticky and nasty compound, a very little of which causes trouble in various parts of the Linotype. The dirt on the keyboard bar *C* may be removed by taking a small can of gasoline or benzine and squirting it into the rack or guide, as shown in Fig. 26. This dissolves the sticky, gummy dirt, and allows the bar to fall freely. If the keyboard bar and the guide are washed out once a week this trouble will never occur.

Caution: Only a very little gasoline or benzine should be used. A few drops are sufficient. It should be remembered that in most cases there is a gas flame not far away from the gasoline. A small can should be used and only enough poured on to overcome the trouble.

Fourteenth, the keyboard cam rubber rolls sometimes become hard, and a sort of glazed surface forms upon them so that the keyboard cam, when it falls upon the rubber, does not take hold of it and immediately begin to revolve, but a slippage occurs between the revolving rubber roll and the cam. The cam usually takes hold after the rubber roll has revolved about one quarter of a revolution but if, when a rapid operator is touching the keys, the succeeding keyboard cam should take hold at once, it is manifest that there would be a transposition. Again, the rubber roll sometimes gets cut or worn, in which case the keyboard cam may not take hold and begin to revolve as promptly as it should. The keyboard rubber roll should be fairly soft and resilient, or the action of the keyboard cam will not be what it should be.

Fifteenth, the matrix, as it comes out of the magazine, may strike upon the assembler front partition or guide. These assembler front partitions or guides, which have been previously described, are rounded at their upper edge, where they register with the channels of the magazine, and are made as sharp as possible so as to give the matrix the greatest

possible clearance. There are twenty-seven of these partitions, and it sometimes happens that the larger sizes of matrices will strike upon the rounded top of these partitions and either stop or hesitate so as to cause a transposition. If the matrix strikes upon the partition so that it stops, the trouble is easily remedied by bending the partition slightly with a pair of pliers. It is when the matrix strikes just enough to be hindered a little in its passage, but keeps on going, that the transposition occurs. This interference of the matrix with the partition is sometimes rather hard to detect. The entire number of matrices in the magazine channel should be

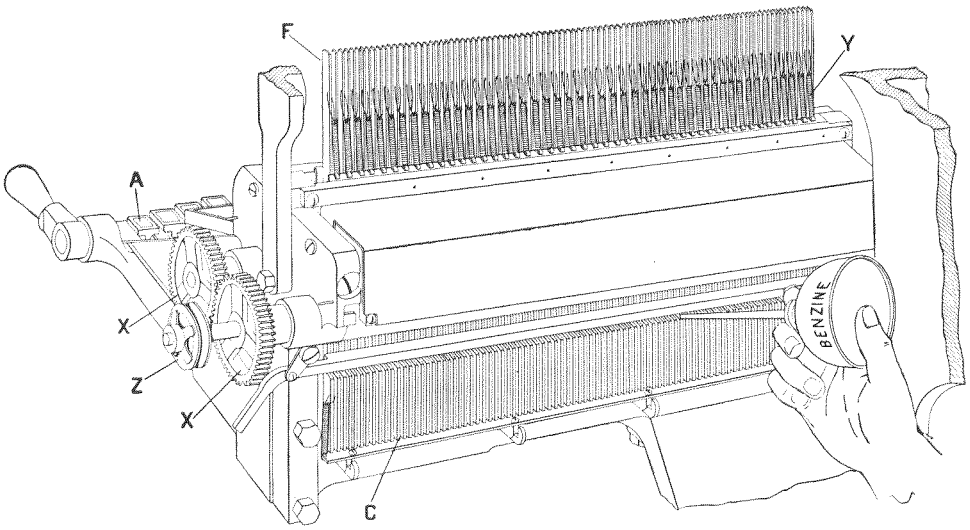


FIG. 26.—Rear view of the keyboard mechanism. *A*, keybutton; *C*, keyboard bar; *F*, keyreed; *X-X*, keyboard cam roll spur gears, which drive the keyboard rubber rolls; *Y*, keyreed spring; *Z*, keyboard cam pulley. This figure also shows the method of applying benzine to clean the keyboard bars.

run out by a touch upon the keyboard and the action closely watched. Sometimes it is necessary to take off the driving belt of the keyboard and turn the keyboard cam rolls by hand so that the action of the escapement is very slow. In this way it can be found out whether the matrix actually does strike upon the partition. This trouble is sometimes annoying because it is difficult to discover. The operator or machinist should not bend the partitions, however, until he is actually sure that the matrices are striking as above described.

Sixteenth, wear upon the escapement pawls. It occasionally happens in machines which have run for a long time that the shoulder on the escapement pawls shown in Fig. 7 wears so that the pawl projects too far into the channel of the magazine. More often it happens that the pawl pounding upon the magazine digs a hole into it, so that the pawl projects

too far into the channel of the magazine. When a new pawl is substituted for an old one it may be found to be a little too long. In either case it may be necessary to file down the pawls with a fine file so that they are on a level with the bottom of the magazine channel when the pawl is in its lower position. In filing the pawls great care should be taken not to file either the bottom or the sides of the magazine channel. It is not impossible to spoil the whole magazine when one attempts to file the pawls without knowing how to use the file.

The matrix, on being released by the escapement, slides down over the "front" and falls upon the belt. The matrix is prevented from falling sideways by the "front" partitions. These partitions are fastened to the "front" at two points. At the top of the "front" a lug on the partition rests in a slot, and the lower part of the partition is fastened to the "front" by a screw that comes in from the back side of the assembler front. The lower end of these partitions is left loose and slightly curved, so as to direct the falling matrix upon the belt at an angle. There are about twenty-seven of these partitions. They are milled off to a sharp edge at the top, where the matrix comes from the magazine. The position of the upper part of these partitions is important. They are so placed as to be between two successive channels, sidewise, in the magazine.

The matrix, after falling upon the belt, is carried down by the belt and beneath a device called the assembler chute finger or, more commonly, the chute spring.

The foregoing description of the assembling mechanism of the Linotype has been made as applying to a single-magazine Linotype, such as the Model 1 or Model 5. After the two-letter attachment, as previously described, came into use, giving one hundred and eighty characters from the keyboard instead of ninety, it was found that the art required a still greater number of characters at the immediate command of the operator. This led to the multiple-magazine Linotype, which contains a number of magazines that can be operated from the same keyboard.

In the multiple-magazine Linotype, either the magazines must be raised and lowered, using a common assembler front and distributor, as in the Model 8, or more than one set of distributor screws have to be used to return the matrices to the magazines and some means of changing the point of action of the keyboard reeds, so as to operate on the different magazine escapements. This has been carried to its highest development in the Model 9 and Model 24 Linotypes, the escapement mechanism of which is illustrated in Fig. 23.

In the Models 1 and 5 the lower spring *Y*, as shown in Fig. 14, may sometimes lose its strength so that it does not fully overcome the spring *W* on the escapement verge. All the springs in connection with the escapement and the keyreed should be examined to see that they have not been displaced, or lost their tension.

A very large number of chute springs of different forms have been contrived. The object of a chute spring is to direct the matrix downward and hold it close to the assembler rails so that it will strike upon the star wheel at the proper angle. It also retards slightly the heavy matrices so that they do not pound the matrices already in the assembler. The chute spring must be very flexible, so as to permit the passage of matrices of different thicknesses, giving them the proper direction and at the same time not checking their progress enough to cause transpositions. The correct action of this chute spring depends somewhat upon the operator and his individual practice.

The ideal operation of the keyboard requires an even touch with an exact interval of time between each action of the fingers upon the keybuttons. There are few operators, however, who finger the keyboard in this manner. There are certain combinations, such as "the," "that," "ough," "tion," etc., which come so often that the operator fingers the keyboard on these combinations of letters much more rapidly than his ordinary movement. It is this difference in the individuality of the operator that requires a slightly different adjustment of the chute spring to get the best results. Most operators learn their own methods of fingering and can adjust the chute spring to suit their own taste.

The matrix, after passing underneath the chute spring, strikes against the assembler star wheel, commonly known as the "star wheel." This is a small wheel about one inch in diameter, with four prongs, and is usually made of fiber. This wheel revolves at a rapid rate. The matrix is directed against this wheel in such a way that the lower part of the matrix strikes against the matrices already assembled and the revolving prongs of the star wheel throw up the upper end of the matrix into a vertical position, and then the friction of the prong pulls the matrix down upon the rails of the assembler, or assembling elevator. This action is so rapid that in the ordinary operation of the machine it cannot be followed by the eye. On the assembler stick are two small spring pawls, which give way, allowing the upper ears of the matrix to take a vertical position and pass into the stick, but which snap in and prevent the matrix from falling back upon the star wheel. With a chute spring properly adjusted, with a star wheel in proper relation to the rails, it is possible to put into the assembler stick as many as twelve to fifteen matrices per second. It is this action, from the light touch of the finger upon the keybutton to the action of the star wheel in putting the matrix in the stick, which makes the Linotype unrivaled in speed of composition.

WHAT TO DO WHEN MATRICES FAIL TO DROP

When matrices fail to respond to the touch of the keybutton it may be due to one or more of several causes. When it is found that a matrix does not respond, all the matrices of that character should be removed from the channel. Then, first, see if the pawls are working properly.

Sometimes grit and dirt get into the bearings of the pawls and cause them to stick. The rear pawl normally should stand exactly level with the bottom of the magazine channel, and when the keybutton is pressed the front pawl should descend exactly to the level at the bottom of the channel, in order to allow the matrix ears to slide over it. If the pawl does not work, again press the keybutton and see if the keyrod is working. If that is not working, then examine the keyboard cam and see if it is acting. If the cam does not work it is probably due to the fact that the rubber roll has become glossy on the surface, in which case the roll should be taken from the machine and rubbed with sandpaper, so as to remove the gloss, and then washed in soap and water to remove any particles of rubber that may be adhering to the surface. If the roll is not washed these particles of rubber are liable to collect in the teeth of the cam and allow it to slide over the face of the roll. Sometimes, for lack of oil, the little bearing of the keyboard cam wears a hole in the yoke, or the bearing is worn. A new cam yoke should be put in. When the cam is put in order next examine the keyreed and see that it is straight and works freely in its slots, and without friction.

Next examine the spring that controls the verge and see if it is in proper working order. Examine the channel for dirt or other foreign substance and then run the matrices back in the channel and try the keybutton again. If the matrices do not respond, remove them again from the channel and examine them for defects.

They may be dirty or the ears may have become battered or twisted. If the edges of the ears are discolored and look as though they were covered with gum, rub them on a soft-pine board or a piece of dry leather until all dirt is removed. Next examine the ears to see if they are damaged in any way. If any are found battered or twisted, they must be taken out, straightened, and the battered edges removed with a fine file. In doing this work be very careful not to change the aligning point of the lug or you will have bad alignment. The matrices should then be returned to the channel and should work properly.

A high-speeded machine, in addition to speeded keyboard, will sometimes cause matrices to fail to drop, as the action of the escapement pawls is too rapid and catches the matrices before they pass completely over the pawl. It is also sometimes necessary to file sharp edges off the escapement pawls.

Do not allow the matrices to strike the upper edge of the lower assembler glass or brass plate in passing into the assembler or against the matrix guard at the top of the magazine. This batters the lugs, and the burrs so formed will cause the matrices to stick in the channels.

The keyboard cams should start instantly and turn easily when a touch of a key causes them to drop on the rubber roll. They should be cleaned and brushed at least twice a year, or oftener if necessary, so that

they will revolve freely in their supporting yoke. In cleaning, the cam yoke should be removed, thoroughly cleansed of oil and dirt, and a small drop of oil applied to the pivots. Use clock oil only. Thick machine oil must not be used on these cams, and only a very small quantity of clock oil should be used, and this should be applied with the end of a fine broom-straw or toothpick. *Under no condition should oil be squirted into the keyboard from an oil can.*

Matrices falling to the floor should be picked up immediately. If kicked about or stepped on, hair lines will result, or the matrices be otherwise damaged.

The response of two or more letters at one touch of the keybutton, or "doubles" is almost invariably caused by the accumulation of dirt or rust under the banking bar or on the shoulder of the keybar slot at the point where the keyboard banks against the banking bar when a key is struck. This condition prevents the keybar returning quickly to its normal position, and the keyboard cam continues to revolve until the connection is broken through vibration. The under side of the banking bar and the keyboard should be kept scrupulously clean by the careful use of gasoline or benzine applied with a small piece of cheesecloth on the end of a screwdriver, or, preferably, a thin piece of wood. This point is below the keyboard rubber rolls, hence no danger or injury to them can occur through the use of benzine or gasoline.

ALIGNMENT OF MATRICES

The face alignment of the matrices is caused by the mold pressing against their vertical faces and pushing them back against the first elevator jaw; and the vertical alignment, by their lower ears or lugs rising against the under edge of the groove of the mold. The matrices are held in place by the first elevator, and, at the time of casting, the mold should move forward freely over the ears of the matrices without coming in contact with them. It is important, therefore, that the first elevator should descend fully to its place. If it does not, the advancing mold will come in contact with the lower ears of matrices and shear or cut away the upper edges of the ears.

Attention should be given to see that the vise automatic, shown in Figs. 42 and 43, is properly adjusted or set, so as to cause the machine to come to a stop in case the first elevator fails to come down to its proper position. After the mold has advanced over the ears, or lugs, of the matrices, the first elevator rises slightly, lifting the matrices and bringing the ears against the under side of the groove in the mold. It is this action that causes the vertical alignment. If the ears, or lugs, have been worn or cut away, the matrices will not align properly.

During the alignment and during the first justification, the matrices must be perfectly free, so that they may readjust themselves sidewise in the line. Hence the importance of preventing the mold from pressing

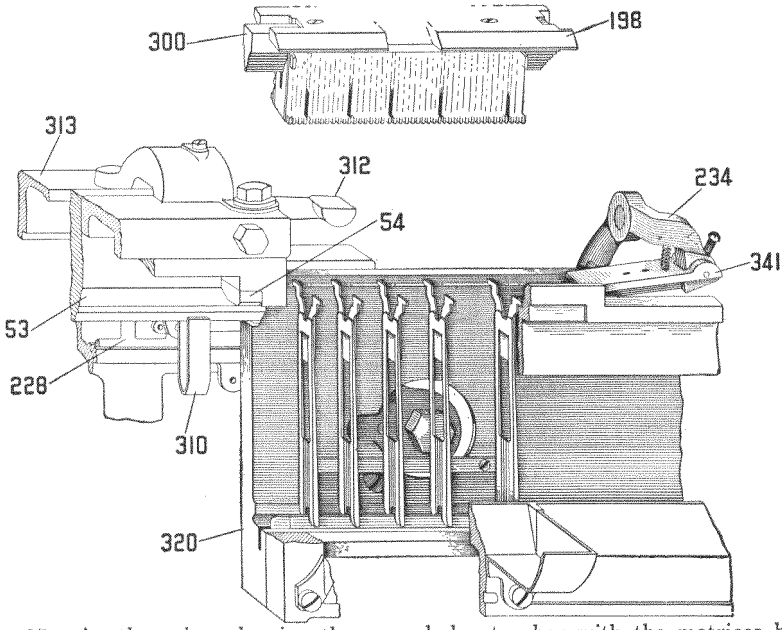


FIG. 27.—Another view showing the second-elevator bar with the matrices being carried upward by the second-elevator lever, leaving the spacebands below in the intermediate channel. The spacebands have no teeth to register with the second-elevator bar, and the ears of the wedges are wider than the ears of the matrices and register in a groove on the front side of the intermediate channel. This groove prevents the spacebands from rising when the second-elevator bar goes up.

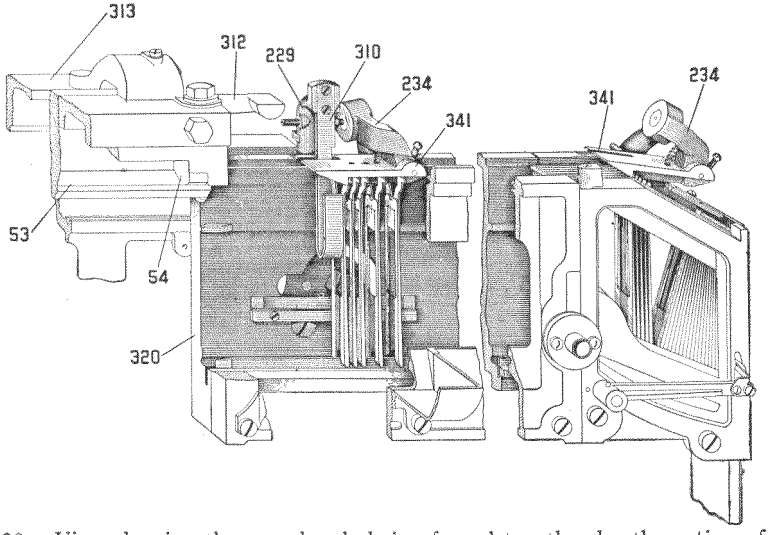


FIG. 28.—View showing the spacebands being forced together by the action of the transfer slide *229* and the spaceband lever *234*. The pawl *341* on the spaceband lever passes over the wedges of the spacebands and draws them over by the action of the lever *234* into the spaceband box, or the magazine for the spacebands.

against the matrices and spaces at its first movement forward. The mold should advance only to within ten thousandth of an inch of the vise jaw at the first movement. This distance can be obtained by an adjustment of the eccentric pin in the mold-slide cam lever.

ASSEMBLING OF SPACEBANDS

The spacebands, being of an entirely different shape and weight, cannot be passed through the magazine as are the matrices (see Fig. 27, showing spacebands in intermediate channel, and the forcing together, by the action of transfer slide and spaceband lever in Fig. 28). Their shape and weight require a different holder, or magazine, for holding them, and they are delivered in an entirely different way. The spacebands are stored normally at a point directly above the assembler stick, at its right-hand end as the operator faces the machine. The escapement that releases the spacebands is of an entirely different character from that which releases the matrices, and is shown in Figs. 29 and 31. A blade with two prongs, very sharp at the top, passes between the suspending shoulders of the spaceband, and at the same time lifts the spaceband over the projecting shoulder, allowing the spaceband to drop through a tube, or channel, directly upon the star wheel. It will be noted that the spaceband descends vertically upon the star wheel, instead of striking it at an angle as do the matrices. The blade, already referred to, which delivers the spacebands, is operated by a keyboard cam similar to that which operates the matrix, through a link and lever passing in the rear of the key reeds. The trigger which releases the cam that operates the spaceband lever is connected to a bar passing the whole length of the keyboard and having at its left end a projection for the operation of the trigger. As the spaceband falls vertically a somewhat shorter distance than the matrix, and as it weighs considerably more than the matrix, the tendency of the spaceband is to arrive at the assembler stick upon the star wheel in advance of the last letter of a word touched by the operator before he operates the spaceband lever. The spaceband keyboard cam is usually larger than the ordinary keyboard cams, so that it will take a longer time in its revolution, and it will be noted that the delivery of the spaceband by its escapement is at the end of the keyboard cam action instead of at the beginning, as in the release of the matrix. The object of all this is to give the matrix that is released by the finger of the operator, just before he touches the spaceband key, an advantage in the matter of time, so that the matrix will arrive at the star wheel before the spaceband. The matter of timing the fall of the spaceband with the fall of the matrix is very important. Rapid and correct action of the Linotype in the matter of assembling depends upon the close and accurate timing between the matrices and spacebands, so that they will be delivered into the assembler stick in the order in which the keys are touched by the operator. Fig. 31 shows spaceband box, with adjusting screw, center bar and center bar bracket.

As a general proposition, transpositions, either of matrices or spacebands, are caused by the failure of the parts to act in perfect time. As described, this failure may be due to weakness of the springs, lack of oil, or presence of dirt or grease in various places. With all the chances for transpositions of matrices and spacebands previously enumerated, it would

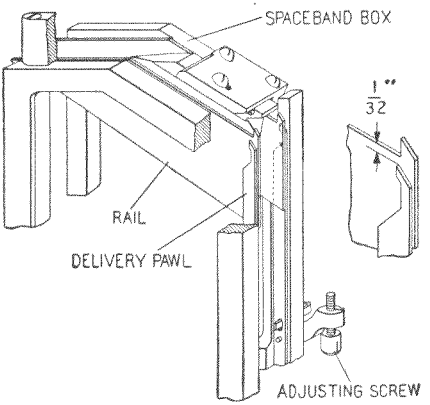


FIG. 29.—Diagram of the spaceband box and delivery pawls showing the proper position for these pawls to deliver a spaceband.

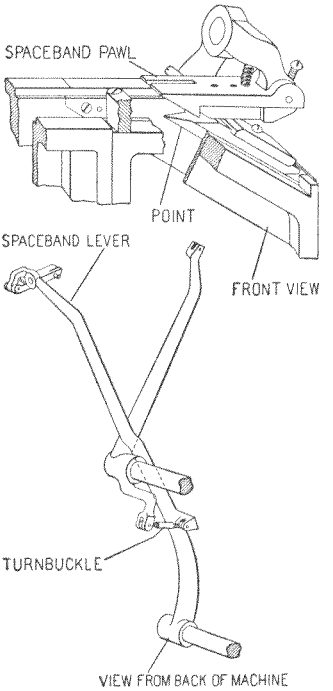


FIG. 30.—Spaceband lever and the elevator transfer lever as viewed from the back of the machine.

The view above shows the spaceband pawl at its extreme right-hand position from the front of the machine. At this position the spaceband pawl should have delivered the spacebands into their magazine.

seem as though it would be a very difficult matter to keep a machine in good condition for rapid operation. This is not the case. A little pains taken along the lines suggested will keep the machine in such condition that, no matter how fast the operator may touch the keys, the matrices and spacebands will fall in their appropriate places to make the composed line of matrices.

THE STAR WHEEL

The star wheel is driven by a belt from a pulley mounted on the intermediate bracket, as shown in Fig. 32. In the design used until recently there was a pair of spur-gear wheels, as shown in Fig. 32. On the spindle of one of these wheels at 7 there is mounted a small friction disk which is kept pressed against the disk that drives the star wheel. The object of this spring-pressed disk is to allow the star wheel to stop in case of a clog of the matrices as they are passing into the assembler. A small dog-clutch

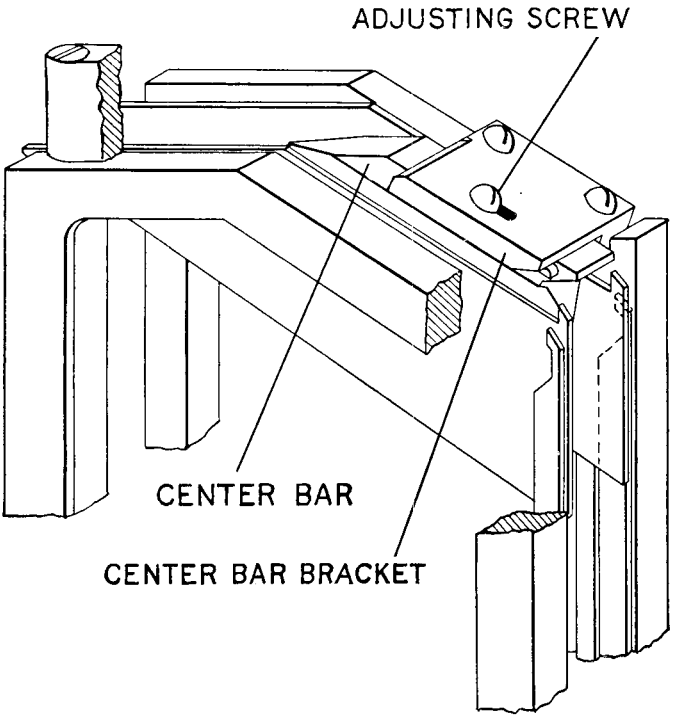


FIG. 31.—View of the spaceband box, showing the center bar and the center-bar bracket, and the screws for adjustment by which the center-bar bracket can be placed in exact position to receive the upper part of the spaceband and guide it downward to the point of storage.

operated by hand is shown in the figure, by which the spindle that drives the star wheel can be disconnected by the operator while he is clearing out the matrices in case of a clog as referred to. For some years past, instead of the flat belt driven by a pulley on the intermediate bracket, as described and illustrated, a round belt running over grooved pulleys is used, as shown in Fig. 32. There is a fast and a loose pulley in this device, and means for shifting the belt from one pulley to the other, thereby stopping and starting the star wheel.

ASSEMBLER ENTRANCE

The assembler entrance, sometimes called the "front," consists of a brass casting having slots cut in it at the top and screw bushings fastened in at proper intervals. These slots and screw bushings support the partitions or guides which are made with lugs which fit in the slots and the bushings. A wire is run through on the back side of these partitions to hold them in position.

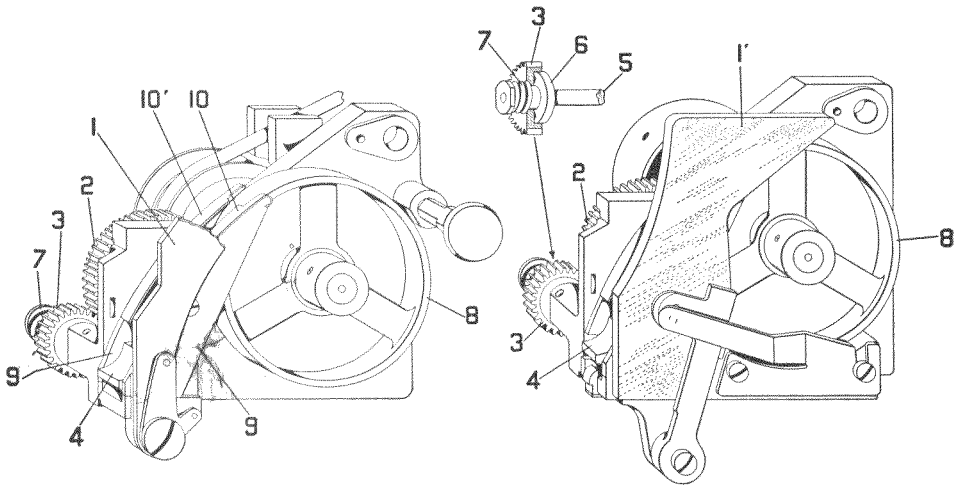


FIG. 32.—View showing the details of the assembler block. In this figure, *1* is the assembler cover which is shown broken away in the left-hand view; *2* is a gear connected by a belt to the intermediate shaft, which drives a smaller gear *3* at a high speed. The smaller gear *3* is mounted on a shaft, upon which shaft is mounted the star wheel *4*. Gear *3* is not fast upon the shaft *5*, but is held against a friction disk *6* by a spring *7*. The friction disk *6* is fastened upon the shaft *5*. If anything, such as a clog of the matrices, occurs which stops the action of the star wheel, the shaft *5* stops, while the spur gear *3* continues to revolve. The slipping action of the gear *3* against the friction disk *6* is to prevent the breakage or bending of the matrices in the case of a clog at the star wheel.

8 is the large pulley over which the assembler belt runs. The assembler belt is not here shown. *9-9* are the assembler chute rails; *10-10* are spring rails which are fastened to the fixed rails *9-9*. These rails are of such shape as to direct the matrix directly upon the star wheel.

The lower edge of the magazine containing the matrices registers at the top of this assembler front, the magazine being set just a little higher than the front. The front is of such a shape that when the partitions are in place the matrices sliding out of the magazine will slide down the face of this assembler front between the partitions which prevent them from turning sidewise. Just below the assembler casting runs the assembler belt. Most of the matrices in falling strike upon this belt and are carried down to the assembler chute.

There is a cover, hinged at the top, which fits down over the partitions, and guides the matrix down upon the belt to assembler chute. This cover was formerly made of glass but owing to the difficulty of making the glass the right shape, and the breakage, it is now made of brass.

ASSEMBLER CHUTE

At the lower part of the assembler front is mounted the assembler chute. This consists of a pair of rails mounted on a block. The upper side of these rails is covered by a pair of spring rails, so when the matrices come down over them they will strike a slightly yielding rail instead of a solid one. In the earlier forms of the machine there were no spring rails, but the rails were made out of fiber so as to avoid wear of the matrices. These rails wore out rapidly and new ones had to be substituted. All of the later machines, however, have the mechanism above described. The shape of the assembler chute and of the chute spring mounted just above it are such as to guide the matrices as they come from the belt down upon the star wheel and into the assembler stick.

III. Casting Mechanism

THE third general division of the Linotype machine is the casting mechanism. We have followed thus far the path of the matrices and the spacebands until they are assembled in the assembler elevator. They must now be transferred to the casting mechanism and a slug, or Linotype bar, cast from the line of matrices.

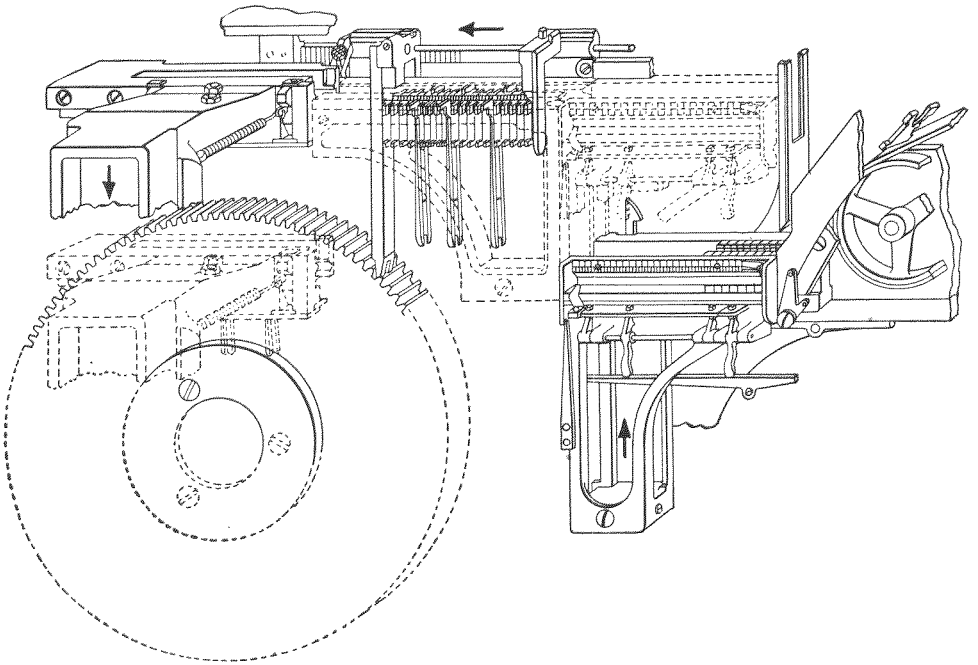


FIG. 33.—Diagrammatic view of the transfer of the line of matrices and spacebands from the assembling elevator to the first-elevator jaw to the position to cast. In this view is shown a part of a line of matrices assembled in the assembler stick. The dotted lines show a line raised to the delivery channel, a line passing through into the first-elevator jaw is shown in full lines, and in dotted lines the first-elevator jaw having descended in front of the mold and the mold disk.

To effect this transfer the assembler elevator is lifted a distance of about four inches. This brings the assembled line of matrices and spacebands between two fingers, one called "the long finger," and the other "the short finger." The long and short fingers are mounted upon a sliding

mechanism commonly called the "line delivery slide" or the "line delivery carriage." This sliding mechanism is mounted in the face plate. The delivery carriage and the two fingers are clearly shown in perspective in Fig. 34. In this mechanism there is a bar having teeth cut in it one em apart. The two fingers are mounted on the bar; the short finger is fast, the long finger is adjustable. The ends of this bar are fastened to two blocks. These blocks have beveled edges and are adapted to slide in two grooves milled in the face plate. On the left-hand side of the long finger there is a small

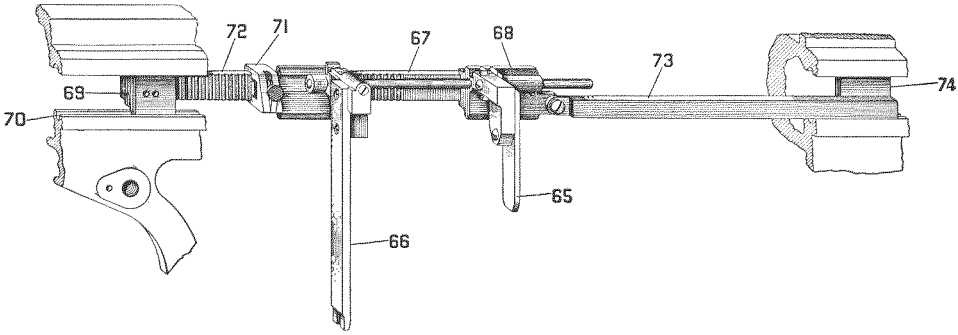


FIG. 34.—Perspective view of the delivery carriage. *65* is the short finger and *66* the long finger. The long and short fingers are mounted upon short slides *68* and *69*, which run in a groove in the face plate. The two ends of slides *68* and *69* are fitted to move easily in the groove *70* in the face plate. *71* is a small locking device adapted to fit in the grooves *72* and the slide *67*. These grooves *72* are one em apart. The long finger *66* can be adjusted for any length of line by this locking device *71*.

At the right of the view is shown assembling elevator releasing bar, commonly called "trail", consisting of bar *73* and a slide at the right *74* to guide the bar *73*. When slide finger *65* transfers the last matrix on right of line to and on delivery channel rails, the left-hand end of bar *73* trips the hook that holds the assembling elevator in position when the line is being transferred to delivery channel. The bar *73* also prevents an operator from hooking up the assembling elevator when there is a waiting line in the delivery channel.

locking mechanism, which is shown at *71* in Fig. 34. The projecting lug in the locking mechanism can be adjusted by picas along the notched bar. Between the long and short fingers there is a round rod that supports the long finger. The short finger is never adjusted, as the line always begins at the same place, but the long finger is adjusted to different lengths of line by the locking mechanism above mentioned.

The delivery carriage is connected on its back side to a lever through a link with a spring detachable detent, as shown in Fig. 36. The action of this lever is shown in Fig. 78. The lever *153* is urged to the left (as the operator faces the machine) by a spring *162*. Mounted on the carriage is a pawl detent having two teeth upon it. These teeth, shown in Fig. 35, are made so as to register with a lever having teeth in its end, which lever is mounted on the face plate. Mounted on the assembling elevator is a wire, or rod, which is adapted to strike the toothed lever, as shown in Fig. 35,

and disengage it from the fixed teeth on the carriage. The instant this is done the spring *162*, acting upon the lever *153* through the link, drives the delivery carriage to the left into the first-elevator jaw. This action of the spring is instantaneous, and would cause a pounding action were it not prevented by a dash pot, shown in Fig. 78. The dash pot consists of a cylinder, open at one end, and a piston adapted to slide in the cylinder. The piston is connected by a link and arm to shaft *154*. The piston in this dash pot compresses the air as the delivery carriage is driven over, forcing

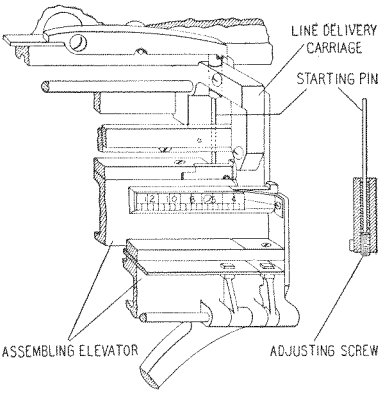


FIG. 35. — View showing the line-delivery carriage, the starting pin in a separate view, and the way in which the starting pin trips the latch, allowing the transfer carriage to transfer the line from the intermediate channel into the first elevator jaw.

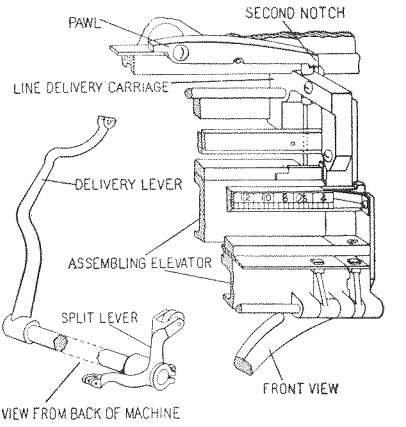


FIG. 36.—Diagram showing the parts of the transfer carriage, starting pin, assembling elevator and delivery lever in a separate view, showing how the line is carried over by said lever into the first-elevator jaw.

the air out through a small hole in the closed end of the cylinder. This cushions the blow of the delivery carriage so that it glides into the first-elevator jaw, coming to a stop gradually and smoothly. There is a little washer, shown at *163* in Fig. 78, that regulates the size of the hole in the cylinder through which the air escapes, as previously described. By adjusting this so as to make the hole larger or smaller, the escape of the air is controlled so as to obtain the proper cushion effect of the action of the spring on the delivery carriage.

The arm *153*, previously described, is pinned upon the shaft *154* in such a position that when the line of matrices has been carried just inside of the first-elevator jaws, the roll *157* will strike the starting pawl and throw it off sidewise, thereby starting the main cam shaft. The arm *155* with its roll *157* is clamped upon the shaft *154* in its proper position when the machine leaves the factory, and it is seldom necessary to adjust this, because it very seldom slips upon the shaft. If it should do this, however, it may be reset in the following manner. While the machine is standing

still, the delivery carriage should be allowed to go over until the short finger *66* is just inside of the pawls of the first elevator. The arm *153* on the shaft *154* should then be turned over until the roll *157* just strikes the starting pawl and moves it off the automatic stopping lever *159*. Then the bolts in the sleeve should be clamped down tightly. This adjustment is seldom necessary.

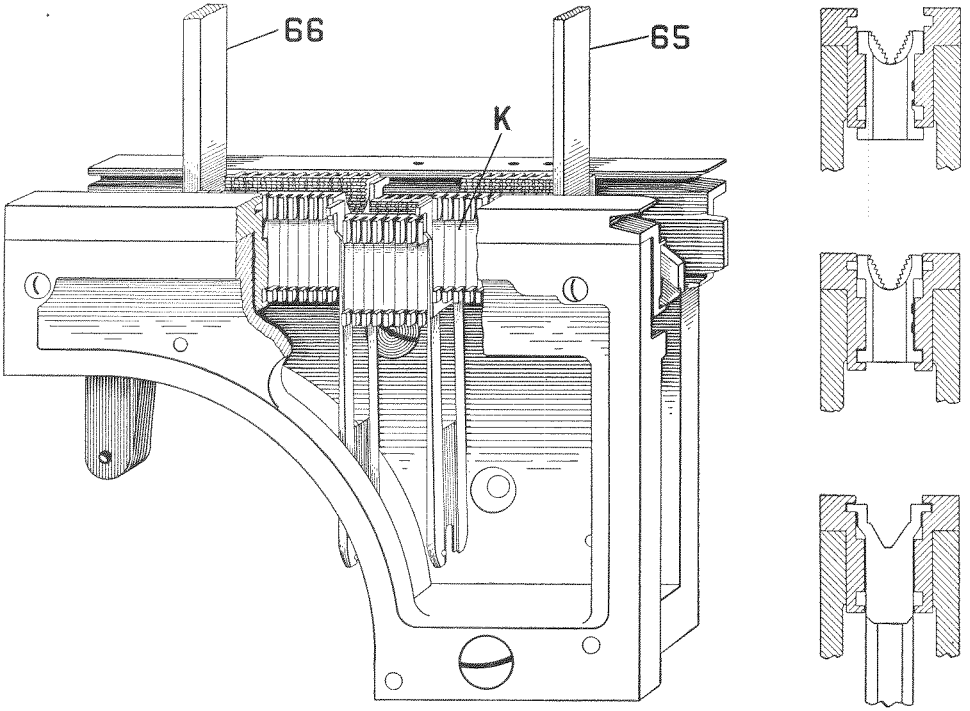


FIG. 37.—View of the intermediate channel with part of the channel cut away to show the matrices and spacebands in the different positions. This channel is simply a passageway for the matrices from the assembling elevator to the first-elevator jaw. The rails in the delivery channel are designed to support the matrices in the same position in which they are received from the assembler.

The sectional views at the right show how the matrices and spacebands are supported while passing through the intermediate channel.

INTERMEDIATE CHANNEL

The distance that the line of matrices travels to the first-elevator jaw is about nine inches, and as they pass out of the assembler into the intermediate channel two grooves in the intermediate channel register with the assembler in such a way that the lower ears of the matrices, which may be either in the upper or lower position in the assembler, are sustained in their corresponding positions while passing through the intermediate channel until they arrive in the first-elevator jaw, shown in Fig. 37.

Just as the delivery carriage reaches the end of its motion in the first-elevator jaw, the lever *153*, actuated by the spring *162*, strikes upon the pawl mounted in the cam, which, being tripped, engages the clutch on the cam shaft, causing it to make one full revolution before it stops in the pawl again.

Returning to the assembled line of the matrices and spacebands, the transfer of the line of matrices and spacebands, which has been mentioned before, is shown in diagrammatic form in Fig. 33.

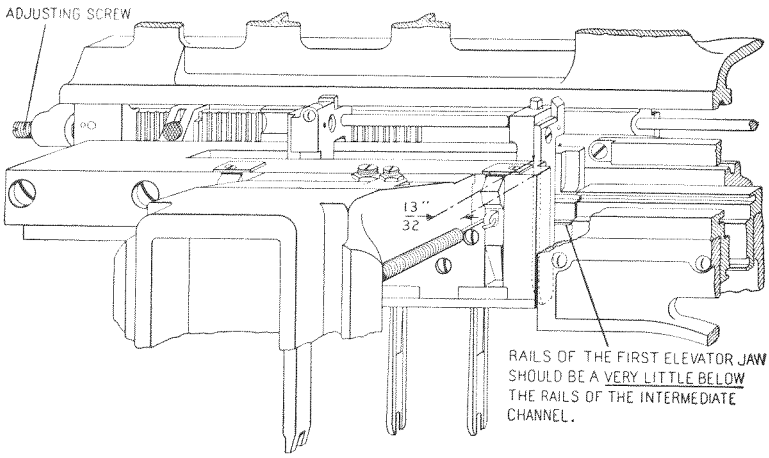


FIG. 38.—View showing the relation of the rails in the first-elevator jaws with the rails, or grooves, in the delivery channel, and the adjusting screws for same.

In Fig. 33 the assembler is shown in heavy lines in the normal position. Its upper position is shown in dotted lines. The line of matrices passing through the delivery channel is shown in full lines, and the first-elevator jaw in its normal position is shown in full lines, while in the lower or casting posittion it is shown in dotted lines. This transfer of the matrices should be smooth without pounding.

The line of matrices, as previously mentioned, passes into the first-elevator jaw. The first-elevator jaw is built up of two pieces called "the front and back jaws" and a middle piece called the separating block. These three parts are bolted together at the left-hand end, and the front jaw is bolted to the first-elevator slide, as shown in Fig. 39, leaving the right-hand end of the jaw open. At the right-hand, or open, end of the first-elevator jaw there are two small spring pawls *49*, which are bent outward by the incoming line of matrices and spacebands and allow the line to pass through, but spring back as soon as the short finger of the transfer carriage has entered the jaw. These pawls prevent the matrices from falling backward out of the jaw during the movements of the first-elevator slide. The first-elevator jaw contains rails that register with and support

the ears of the incoming matrices so as to maintain them in the upper or lower position of a two-letter matrix. One of these rails is fixed and the other movable. The first-elevator jaw contains also grooves with which the ears of the spacebands register, the ears of the spacebands being somewhat wider than the ears of the matrices. The short part, the wedge or sleeve, of the spaceband is held by these ears, so that when the long

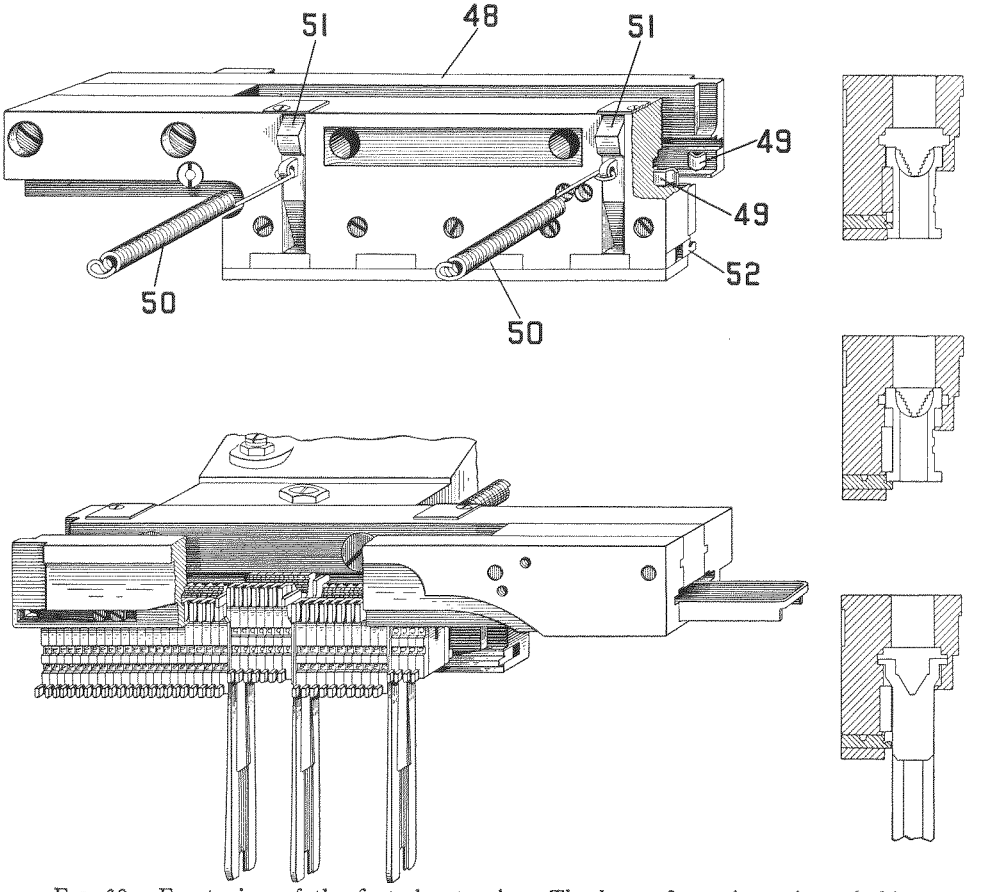


FIG. 39.—Front view of the first-elevator jaw. The lower figure is a view of this jaw from the rear of the machine, with the jaw partly broken away to show the different positions of the matrices and spacebands. *50-50* are the springs which return the shelf, called the duplex rail, upon which the matrices stand. *51-51* are the levers which move the shelf *52* in or out of position. The shelf *52* sustains the matrices which are in the italic, or upper, position until the matrices are to be distributed. When, through the levers *51*, the shelf is withdrawn, it allows all the matrices to drop to the lower, or roman, position, so that they may pass into the upper channel and onto the second elevator for distribution.

The sectional views shown at the right illustrate the matrix in the lower and upper, also called the regular and auxiliary, positions, and the spaceband, having ears wider than the matrix, running in the proper groove.

wedges or slides are driven up for justification, the wedge or sleeve part of the spaceband does not move.

The elevator jaws are fastened by screws to the first-elevator slide. The elevator slide is a long casting running in gibs mounted on the vise frame, as shown in Fig. 42. At the lower end of this slide there is a link composed of a cylinder with a piston and a spring inside of the cylinder, as shown in Fig. 40. The spring can be compressed slightly between the piston and the end of the cylinder. The lower end of this link is connected

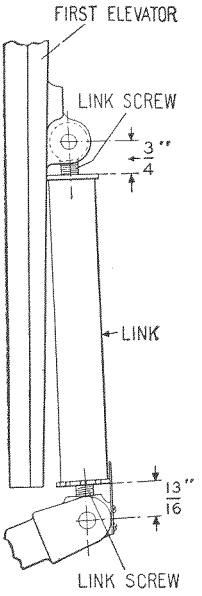


FIG. 40.—Diagram showing the link which connects the first-elevator lever to the first-elevator slide and gives the distances for adjustment, which ordinarily are right in the machine when first set up.

by a pin to a long lever running to the rear of the machine. This lever connects with another lever called the first elevator auxiliary lever, which has mounted upon it a roll adapted to engage a cam. The cam through the levers raises the first elevator at the proper time and the reverse motion is caused by gravity and a spring, as shown in Fig. 84. The alignment of the matrices is made by this cam and lever.

When the main cam shaft begins to revolve, after the starting pawl is tripped off by the delivery carriage (as shown in Fig. 36), the revolution of the cam shaft allows the first-elevator slide to descend, carrying with it the first-elevator jaw, in which is a line of matrices. This descent is about four inches. The first-elevator jaw settles down upon the vise cap in such a position that the lower, or small, ears of the matrices will register with one of the two grooves in the mold if the line has matrices in both the italic and roman position. This descent of the elevator slide is caused by the weight of the slide, and is permitted by the shape of the cam, as shown in Fig. 84.

It is very important that the first-elevator jaw should descend to exactly the right position in the vise, so that when the mold is advanced the lower ears of the matrix may enter the grooves of the mold. If for any reason the elevator slide should not descend to the proper position, when the mold comes forward it would smash or cut the ears of the matrices, because the ears do not enter the grooves in the mold. While this failure of the first-elevator slide to descend to the proper position does not very often happen, it is necessary to provide a device to prevent damage to the

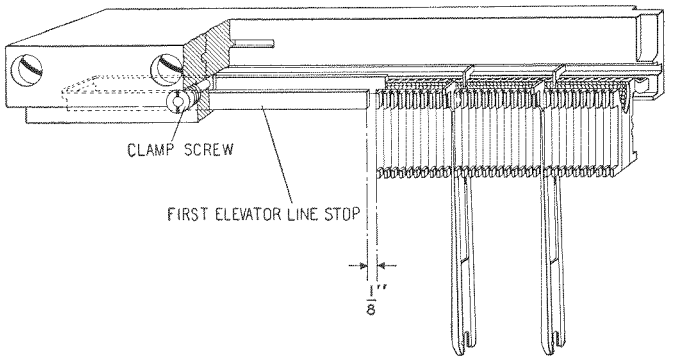


FIG. 41.—View of the inside of the first-elevator jaw, which is toward the mold, showing a line of matrices in position, and showing the first-elevator line stop and clamp screw for same.

matrices and the machine in case of this failure to descend. This device is called the "vise automatic." It consists of a vertical rod passing through a hole in the vise cap. The upper end of this rod is directly under an adjustable screw in the first-elevator slide, so that when the first-elevator slide descends it pushes the rod downward a short distance, about one thirty-second of an inch. Mounted on this rod is a projecting piece of steel with a sharp edge, as shown in Fig. 42. Mounted in the vise frame is a plunger called the "vise-automatic mold disk stop dog," as shown in Fig. 43. When the mold disk comes forward it presses the plunger forward in its guide, and if this comes in contact with the sharp edge, previously mentioned, it carries the vise-automatic rod toward the front of the machine. The lower end of the vise-automatic rod connects with a short lever which in turn operates through a series of levers to release the clutch, so that the cam shaft stops. This is clearly shown in diagrammatic form in Fig. 85.

Ordinarily, the descending first-elevator slide, coming down upon the vise-automatic rod, pushes the sharp edge downward so that the plunger operated by the advancing mold disk will just pass over it, as shown in Fig. 85. This clearance should be quite small, never more than one sixty-fourth of an inch. If the first-elevator jaw comes within one sixty-fourth of an inch of the proper position, the ears of the matrices will not be

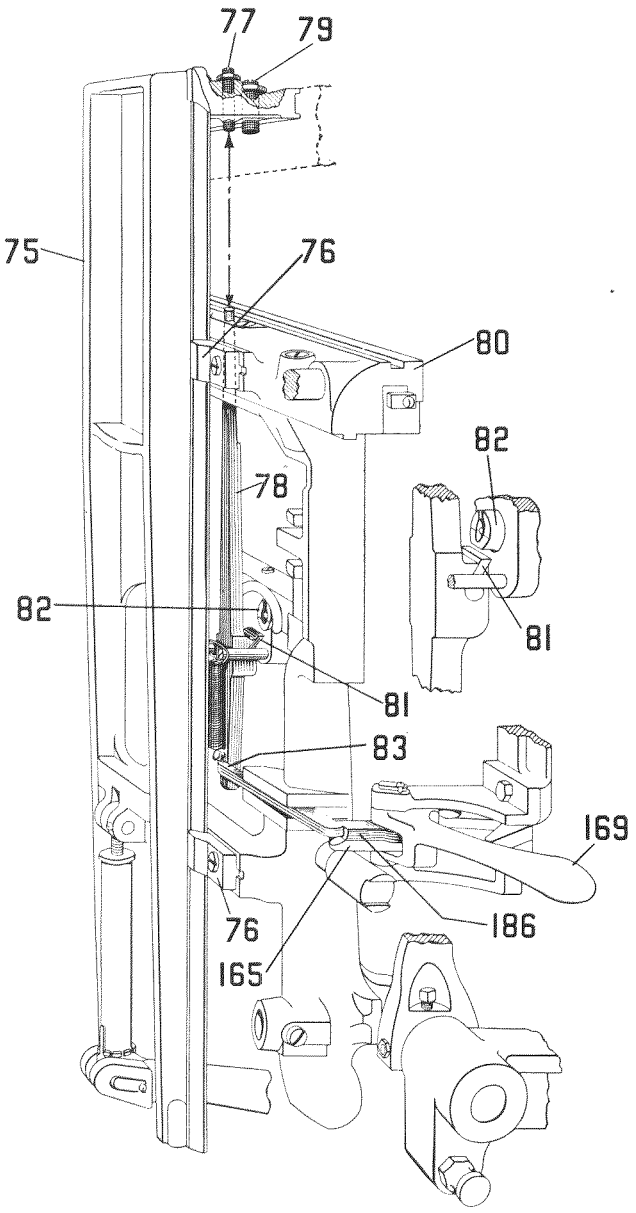


FIG. 42. — View of the first elevator and its connection. The first-elevator slide *75* is a long casting which rides in gibs *76* upon the vise frame. Mounted in the top of the slide *75* is the screw *77*, which, when the slide descends, strikes directly upon the vise automatic lever *78*. This screw is adjustable so as to depress the lever *78* to a greater or less extent. *79* is the stop screw, also mounted in the head of the slide *75*, and which strikes upon the vise cap *80*. This screw is also adjustable and limits the downward movement of the first-elevator slide *75*.

When the screw *79* strikes upon the vise cap *80* and stops the downward movement of the slide, the screw *77* should depress the lever *78* so that the blade *81* will come just below the edge of the plunger *82*. The plunger *82* is pressed forward by the mold disk, and if the blade *81* is not below the plunger *82*, the plunger *82*, striking the blade *81*, will push the lever *78* toward the front of the machine and, striking against the lever *83*, will operate the lever *186*, which will throw out the clutch, as explained in another view, and stop the revolution of the cam shaft.

In making the adjustments above described, the screw *79* should stop the slide *75* in such a position that the matrices in the first-elevator jaw will register with the groove in the advancing mold. As previously mentioned, at this time the screw *77* should have depressed the lever *78* so as to bring the blade *81* about fifteen thousandths of an inch below the dog *82*. The space between the blade *81* and lip of the dog *82* should be the thickness of thin cardboard or a thick sheet of writing paper.

damaged. The descent of the elevator slide and the register of the matrices with the mold is controlled by an adjustable stop consisting of a screw and nut in the elevator slide, as shown at *79* in Fig. 42. This adjustable stop, when once properly set, never needs adjustment, and should not be touched, except when it is jarred loose by accident. The proper setting of this stop, however, is very important in relation to the vise automatic, for

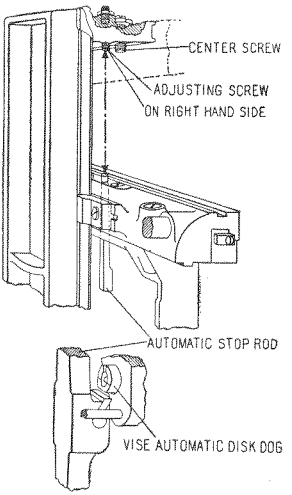


FIG. 43.—View of stop screw and adjusting screw for the automatic stop rod, showing vise-automatic disk dog just passing over the lip on the automatic stop rod.

if the elevator jaw is not in proper position the ears of the matrices will not register with the grooves in the mold, and there will be trouble. When the vise automatic is properly set, however, it is almost impossible for the machine to damage the ears of the matrices.

In case the elevator slide does not descend to the proper distance and the plunger operated by the advancing mold disk stops the machine, as previously described, it is necessary for the operator to turn the cam shaft of the machine backward slightly by hand and find out why the first-elevator jaw has not come down to its proper position. This is usually caused by a tight line.

A tight line is one where the matrices and spacebands make the line a little too long to descend between the jaws that limit the length of the line.

It is possible for the operator, by pushing downward upon the first-elevator slide, to crowd the line through if it is only very slightly too long. This is a bad practice, and does great damage to the matrices and to the machine. It is much better to remove a matrix or two from the line, which can be done by lifting up the first-elevator slide, removing a matrix, and then allowing the line to cast. Of course this slug has to be thrown away and the line reset properly.

The first-elevator slide in its descent carries down the roll *295* mounted on a small bracket *296*, as shown in Fig. *44*. This roll *295* strikes a peculiarly shaped lever *294*, which, working through the link *292*, causes the knife wiper *290* to rise and fall, and thereby wipes off the small shavings that sometimes stick on the edge of the knife. This actual wiping is done

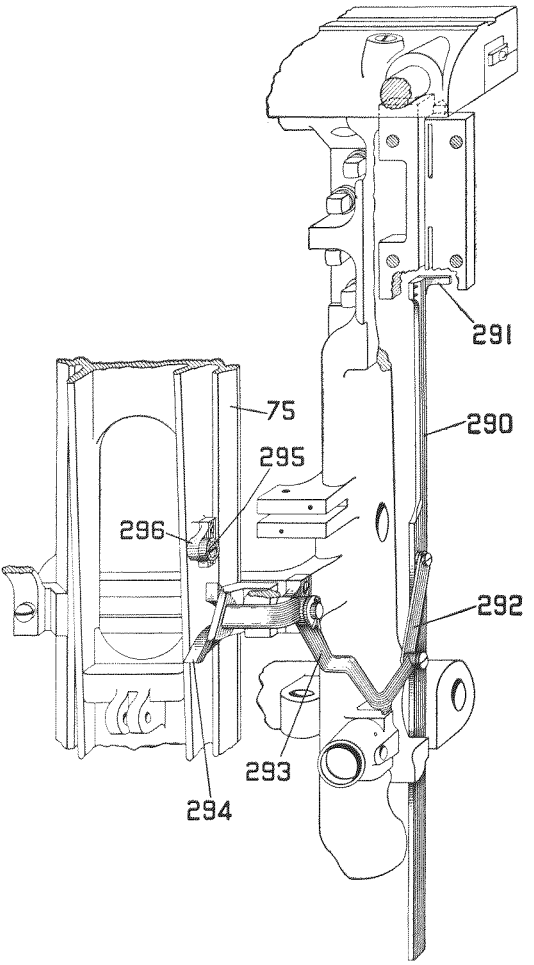


FIG. 44. — View of the knife wiper and its operating mechanism. *290* is a bar mounted to move up and down vertically, called the knife wiper bar. This bar *290* carries on its end a small lug, or projection, *291*, made out of thin brass. This projection *291* passes by the edge of the knives and wipes off the shavings that may have adhered to the sharp edges of the knives.

The lever *290* is caused to make its vertical motion through a link *292*, and a lever *293*, which is mounted on the vise frame. The other end of the lever *293* has a peculiar cam shape at its end *294*. This peculiar cam shape is adapted to engage with a roller *295*, which is mounted on a little bracket *296*, which is in turn mounted on the first-elevator slide.

As the first-elevator slide moves downward and upward, it engages with the peculiar cam shape *294*, causing the lever *290* to make the movement before mentioned. The shape of this cam *294* is such that the roller *295* can pass by it both in its upward and downward motion.

by a little brass piece *291*. This is made thin so that if it ever gets caught in the knives it will be sheared off and then must be renewed.

The line of matrices and spacebands is now between the right- and left-hand vise jaws. The first-elevator slide is resting upon the vise cap, and the automatic rod has been pushed down so as to allow the plunger to come forward over the blade. At this time the justification of the line takes place. The line of matrices and spacebands should always occupy a

little less space than the distance between the right- and left-hand vise jaws. This slack in the line which varies constantly on different lines, must now be taken up by driving up the slides, or long wedges, in the spacebands. This is done by a block, shown at 86 in Fig. 45, mounted on two vertical rods in the vise frame. The lower ends of these two rods rest upon the ends of long levers that run back to the cam shaft. Underneath

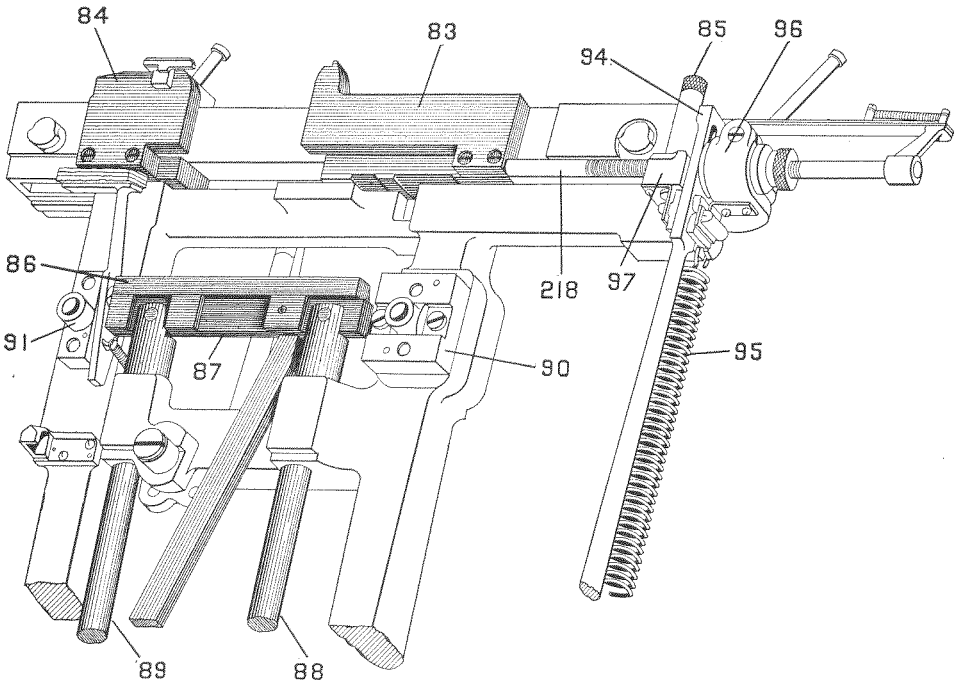


FIG. 45.—Inside view of the vise frame, or a view looking down upon the vise frame when it is lowered to second position. *83* is the left-hand vise jaw, and *84* is the right-hand vise jaw. The right-hand jaw *84* has only a slight movement to operate the pump stop elsewhere described. The left-hand jaw *83* may be set at different positions for different lengths of line. The left-hand movement of the jaw *83* is limited by the rod *218*. The rod *218* has a number of circular grooves turned in it, and these grooves are one-half pica apart, so that the jaw *83* can be set for any length of line by one-half picas. This jaw is held in place by a pin *85*, which has longitudinal grooves cut in it one-half pica apart and registering exactly with the circular grooves in the rod *218*.

When the pin *85* is lifted by hand, the rod *218* can be set at different positions, and when the pin *85* is pushed down again it locks the rod *218* in position.

86 is the vise justification block, which is mounted upon the vise justification bar *87*. The justification bar *87* is mounted upon two rods *88* and *89*. The action of these rods and the justification bar are described and illustrated in another view.

90 is the left-hand mold disk locking stud block. This is sometimes called the "floating block", as it is not absolutely fixed, but has a slight motion. *91* is another mold-disk block, which is fixed. It has no motion, and is doweled so as to have no movement.

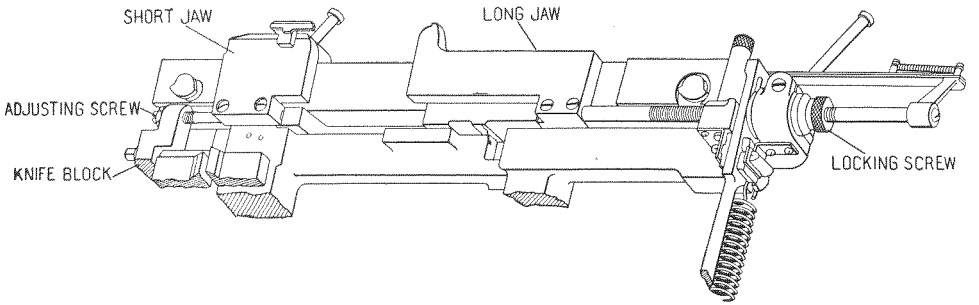


FIG. 46.—Diagram of the vise jaws looking at them when the vise is lowered. The view shows the adjusting screw for the right-hand, or short, jaw; also for the left-hand, or long, jaw; also the knife block screw for adjustment.

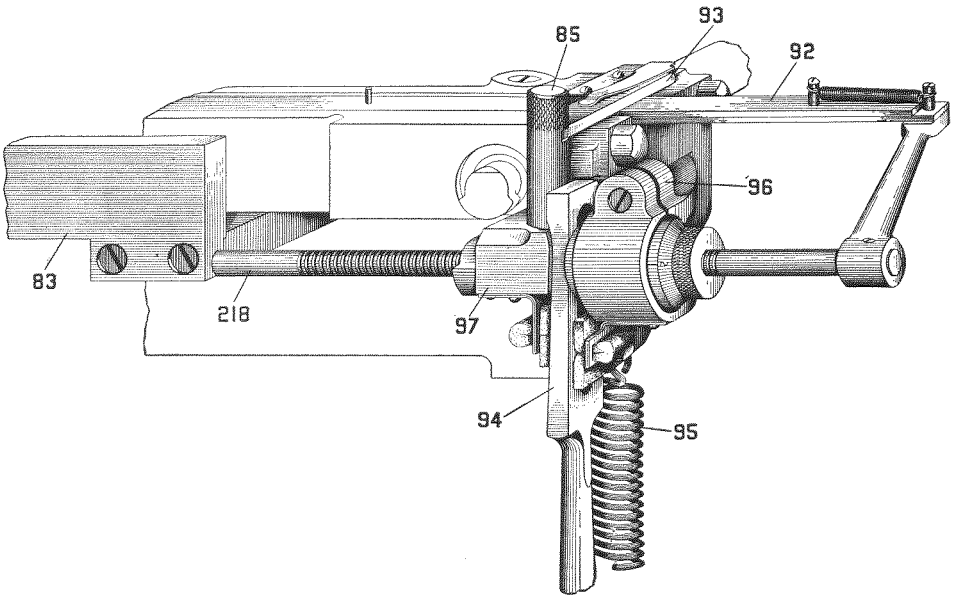


FIG. 47.—Enlarged view of the left vise jaw *83*, the adjusting rod *218*, and the locking pin *85*. The locking pin *85* in the later machines is not operated by hand, but by the rod *92*, which operates the lever *93*, which raises the pin *85*, and allows it to rise, to release, or descend so as to lock the rod *218*. By this device the operator is enabled to set the pin *85* by means of the rod *92*.

94 is a wedge which is pulled upward by a spring *95*. This wedge has two inclined surfaces and works between a bearing *96* and a block *97*, in which the locking rod *218* is mounted. The action of the upper wedge is to push in the jaw *83* a slight distance just before the first justification takes place. After the first justification the downward movement of the wedge allows a slight looseness in the line of matrices and spacebands so that the alignment of the matrices can take place. A second upward movement of the wedge *94* takes place before the second justification and presses the line of matrices and spacebands together with great force through the pull of the spring *95* and the wedge action of *94*. The downward movement of the wedge *94* against the pull of the spring *95* is caused by cam action.

these levers are powerful springs that tend to drive them upward. When the justification-slide block *86* first goes up, to drive up the wedges, it stands at a slight angle, and when the bands are driven up those at the right of the line are driven a little farther than the ones at the left. The action of the cams on the cam shaft now depresses the levers and then permits them to rise again, carrying up the justification block, but this time on a level or parallel with the floor, against the wedges of the spacebands, the lower ends of which stand at a slight angle with the floor. Therefore, the force of this second justification thrust is mainly against the spacebands at the left of the line. These are driven up successively until the line is wedged out as far as the jaws will permit and spaces each word uniformly. These actions are shown in Figs. 48, 49, 50, 51 and 83.

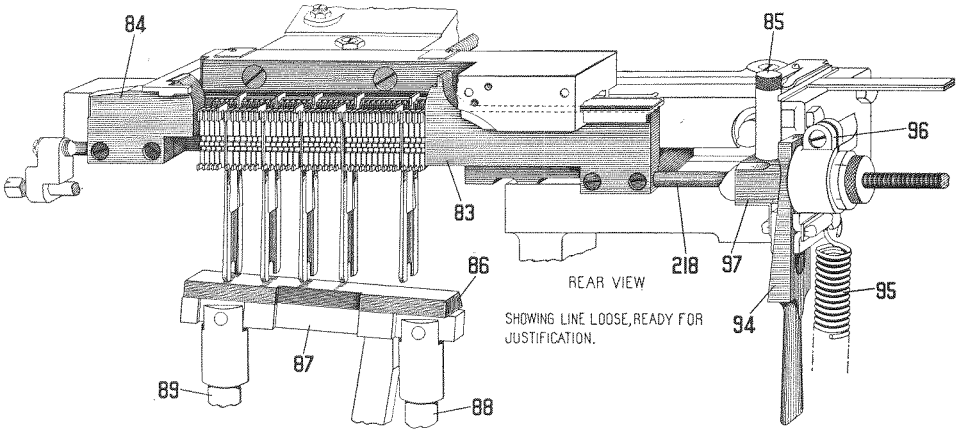


FIG. 48.—View of the justification showing the line between the jaws *83* and *84* loose, the spacebands hanging down.

It also shows the inclined position of the vise justification bar block *86*. The wedge *94* is at its lowermost position and the distance between the jaws is a little less than the slug is eventually to be.

Just before the first justification the wedge *94* rises, closing the vise jaws to the exact length of the line to be cast. Between the first and second justifications the wedge descends a little, taking off the pressure on the line of matrices so that alignment can take place.

If the descending line of matrices and spacebands is all right in length, that is, a little less than the distance between the jaws, the first elevator carries the line of matrices and spacebands between two jaws, called "vise jaws." These jaws are mounted in the vise cap, as shown at *83* and *84* in Fig. 45. The left-hand vise jaw is restrained in its movement by a toothed rod, *218* in Fig. 47. This toothed rod is locked by a toothed rod called the locking pin *85*, as shown in Fig. 47. In most of the machines now in use this locking pin is lifted by the fingers, and the toothed rod *218* can be moved in either direction and then locked by pressing down upon the pin.

In the later machines this locking pin is raised by a device mounted on the vise cap. The teeth in this toothed rod are one half-em apart. The left-hand jaw rests against this toothed rod, as above described, the

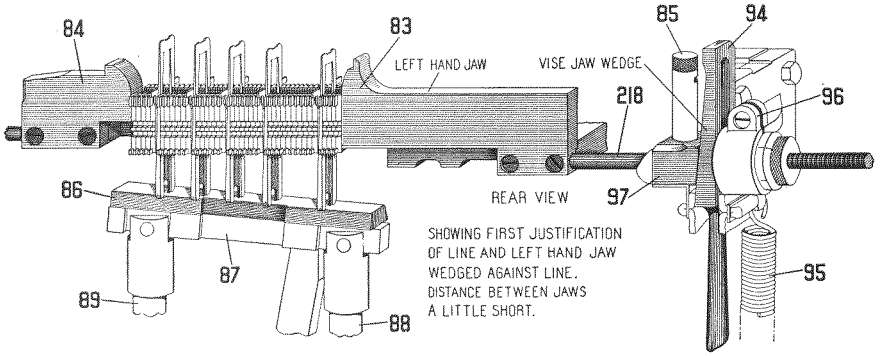


FIG. 49.—First justification of the line. The wedge *94* has gone up to its highest position and the left-hand jaw *83* is forced in, making the line the proper length. The spacebands are driven up by the inclined block *86*, being driven up an unequal distance. This view is from the rear of the machine with all the parts left out.

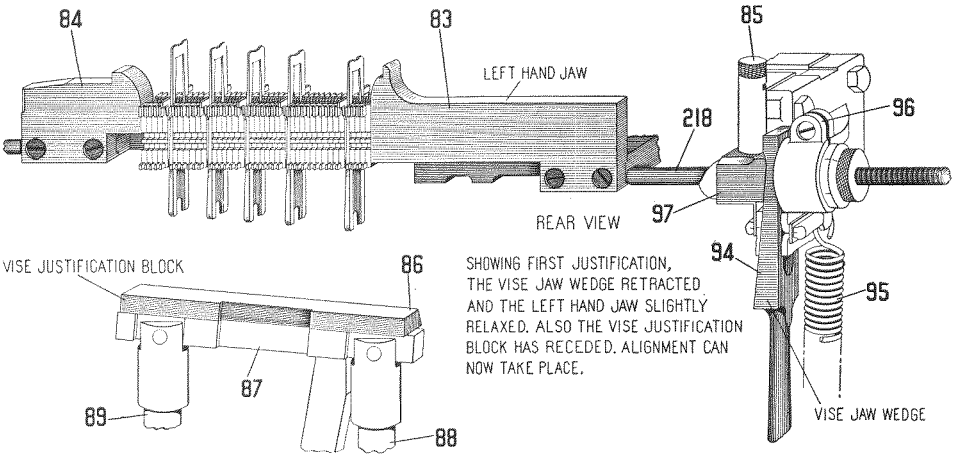


FIG. 50.—View showing the vise justification block *86* withdrawn after the first justification. The line of matrices and spacebands is between the vise jaws *83* and *84*. The wedge *94* is now drawn downward by the cam, relaxing the pressure which has been made by the spacebands in the first justification. This leaves the line of matrices and spacebands a very little loose but not enough so that the spacebands fall down again. At this time the alignment of the matrices takes place by the lifting of the first-elevator jaw.

toothed rod running through the block *97*, which carries the locking mechanism. Back of this sleeve there is a wedge *94* that is pulled upward by a powerful spring *95*. This wedge has two inclined surfaces and is the upper part of a rod, the lower end of which contains a slot, as shown in Fig. 83. Registering with the slot is a pin fastened to a lever that runs to

the rear of the machine. This lever is operated upon by a cam and tends to pull the rod downward against the action of the spring, as previously described. All this is shown in Fig. 83.

The wedge *94* when in normal position is pulled down so that the short wedge at the top pushes the block *97* and the vise jaw inward a very little so that the distance between the vise jaws is slightly less than the proper length of the line to be cast.

The action of the wedge *94* as just described is called the "locking and unlocking of the line."

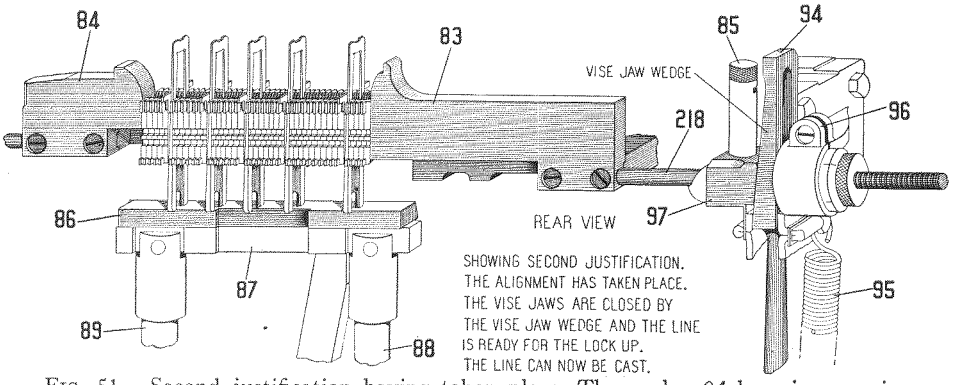


FIG. 51.—Second justification having taken place. The wedge *94* has risen, again compressing the line to proper length. The justification block *86* rises again, but this time the block is parallel to the floor and its force is exerted against the first spaceband as shown in the previous figure, and then successively on the others. If the line is fairly loose it will finally come to position as shown in the figure. It may be, however, that the entire force of the second justification will be expended on only one or two bands.

The line of matrices is now aligned and justified and is ready for the mold to come against the line, the pot following the mold, and the slug is cast.

The descent of the line in the first-elevator jaw and the spreading or justification of the line between the vise jaws having taken place, the mold moves forward against the justified line of matrices and spacebands, and is ready to have the metal pumped into it to form the slug. The mold will now be described.

THE MOLD

The mold most used in the Linotype machine is known as "the Universal Adjustable Mold." It is composed of three principal parts, the body, the cap, and the liners, as shown in Fig. 52. The body is composed of two parts, known as the body *112* and the keeper *113*. The keeper forms one of the grooves for the matrices in the upper, or italic, position, and is fastened onto the body of the mold by two screws. Four screws hold the body to the mold disk. The cap is held down upon the liners by three screws mounted in the rim of the mold disk. The body and the cap are separated by two parts called "liners" *119*. The right-hand liner varies

in thickness, but not in length, and is parallel to the surface of the mold. The left-hand liner is of varying length, and varies in thickness to match the right-hand liner. The thickness of the liners determines the size of the body of the slug, and the length of the left-hand liner determines the length of the slug.

In the cap of the mold there are a number of shallow grooves. These grooves taper in width from the front, or side, toward the operator, to

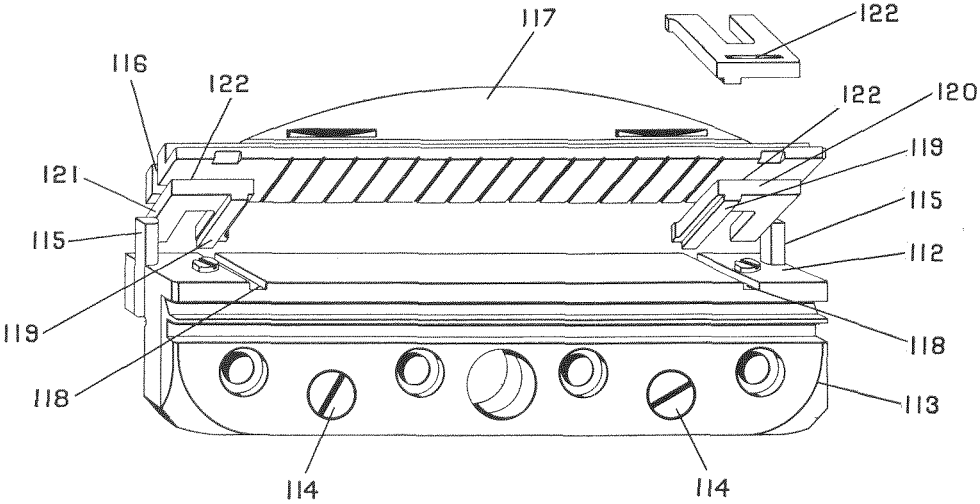


FIG. 52.—View of the mold. *112* is the mold body. On this mold body is a separate piece having a groove in it, *113*, which is called "the keeper". The keeper is fastened to the mold by screws *114*. The mold is fastened to the disk by four screws, the holes for which are shown. At each end of the mold body are two upright posts *115*. These posts fit into two notches *116* at each end of the mold cap *117*. The mold body has also in it two grooves from front to rear *118*. These grooves are for the purpose of affording a seat to a projecting rib *119* upon the liners *120* and *121*.

The right-hand liner *120* is always of the same dimension, except in the matter of thickness, which varies for every thickness of slug. The left-hand liner *121* not only varies in thickness but also in length. The distance between the liners *120* and *121* forms the limits of the length of the slug. In the mold cap *117* there are a number of transverse grooves. These grooves are about five thousandths of an inch deep on the front side, or the side toward the operator, and taper to nothing toward the rear. These grooves form recesses into which the metal flows, and form the ribs on the slugs. These ribs form a shaving surface which is more easily and accurately trimmed than if the knife cut the whole width of the slug.

In the liners *120* and *121* there are on the upper side two small notches *122*. These notches are more clearly shown in the perspective view at the right hand of the main view.

the rear, and taper also in depth. When the slug is cast, the type metal flowing into the grooves forms ribs that appear on the upper side of the slug. Their object is to afford a surface that the knives can shave, offering less resistance to this shaving than the solid body of the slug.

When the large sizes of slugs are to be used, the grooves are made much wider and deeper in the cap of the mold, to take up a large part of the space which would be occupied by the slug if cast full size. These molds are called "recessed molds." Their object is to save the use of type

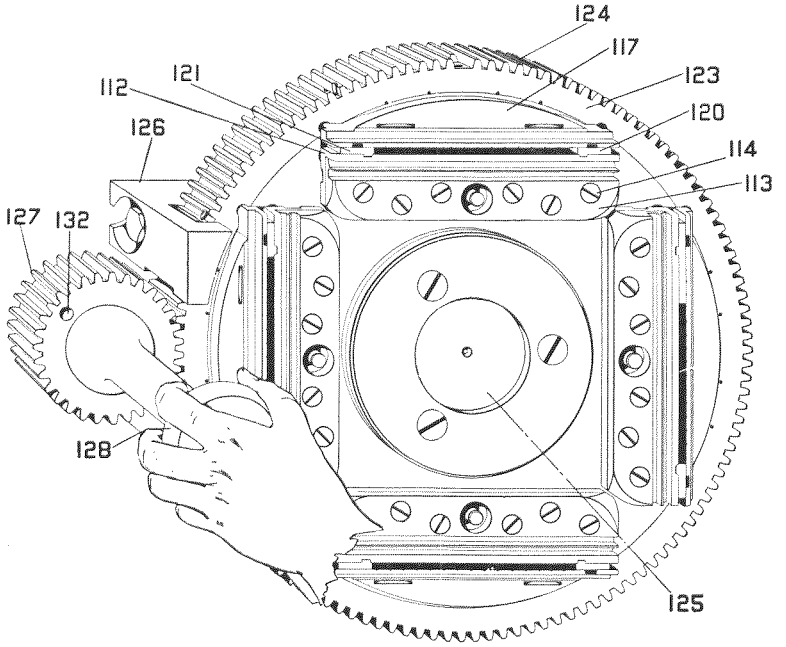


FIG. 53.—Perspective view of the mold disk containing four molds, described in another view. The mold disk *123* has teeth *124* cut in its circumference. The mold disk *123* is mounted upon the mold-disk stud *125*. In some of the machines there is a water-cooling arrangement by which water is circulated around the mold-disk stud to keep the mold disk cool.

On the left-hand side of the mold disk there are two supports called "mold disk supports" *126*. They support and hold the mold disk against the thrust of the back knife when shaving the bottom of the slug, shaving it to a uniform height to paper.

The mold disk *123* is caused to revolve by the pinion *127*. This pinion is connected to a shaft running from the front to the rear of the machine, shown in another view. On the front side of the pinion *127* is a handle *128* which may be grasped by the hand. Through this handle *128* the mold-disk pinion *127* may be disconnected from its driving shaft, and the mold disk *123* can be revolved by hand. At the proper place the mold-turning pinion *127* is reconnected to the driving shaft, and by the means just described any one of the four molds in the disk can be brought into operative position.

metal, and a better face is cast on the type than can usually be obtained on a slug of large thickness.

By unscrewing slightly the screws in the mold wheel, the cap is permitted to rise slightly, and it is possible to remove both the right-hand and the left-hand liners, inserting others that are thicker or thinner, or

with a different length of left-hand liner, and by screwing down the screws in the mold cap the mold becomes a solid slot of the size of the slug desired. This operation is shown in Fig. 60. Care should be taken to see that the liners are constantly kept clean.

CARE OF THE MOLD

The mold is made of special steel, very carefully case-hardened and ground. It has to be made with very great accuracy in all its dimensions. Screwdrivers, or other instruments of the kind should never be used around the mold, except to tighten or loosen screws. Occasionally, the mold should be removed from the machine and the surface against which the metal is cast rubbed with graphite on the end of a soft-pine stick. This will remove the slight particles of metal that adhere in the form of an oxide. This oxide usually comes off without much trouble, but sometimes it adheres quite firmly to the mold. If this oxide is allowed to accumulate in too large a degree, the slugs will be ejected with great difficulty, and there will be frequent "sticks-in-the-mold", as they are called. When inserting liners, care should be taken to see that they are clean, as before mentioned, and that the part of the mold into which they go is also free of any dirt or small pieces of metal.

The mold keeper may be damaged if the vise automatic is not properly set, as previously described. The back side of the mold may also be cut by what is known as the "back knife," which trims off the back of the slug, if it is not correctly set.

Damage to the mold may be caused by "squirts." Theoretically, squirts of metal should never occur. They do, however, happen, especially when there is carelessness in the matter of the lock-up, or in the care of the machine in other ways. When a squirt occurs, a little time and patience should be used in clearing away the type metal, and screwdrivers and other sharp instruments should not be used around the mold. If it is necessary to use anything of the kind, it should be a piece of brass or of hard wood. The mold is expensive and easily damaged, and especial care should be taken not to injure it.

In all machines there are two molds, and in many machines four molds are used, and by turning the disk by the hand wheel on the mold pinion it is possible to bring either one of the two, or any one of the four molds into position to cast. Of course, when using the four-mold disk it is possible to cast four sizes of type and four lengths of line without changing the liners as heretofore described.

MOLD WHEEL AND MOLD SLIDE

The mold or molds are carried in a circular disk having teeth on the circumference and flanges on the rear side, called the "mold wheel," or "mold disk," as shown in Fig. 53. The mold disk has two or four openings in it to receive the molds as above described. The mold disk is mounted on

a spindle in its center, and this spindle is mounted in an arm that extends to the right and is one casting with a slide having beveled edges, the arm being at right angles to the slide. This slide, called the "mold slide," is mounted in beveled bearings in the column of the machine. At the rear end

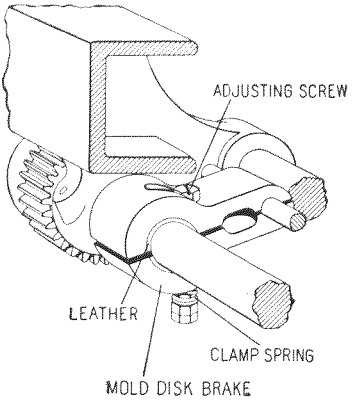


FIG. 54.—View showing the mold-disk brake with adjusting screw for holding the same for clamping it upon the shaft. The object of this brake is to prevent the momentum of the mold disk when revolving from carrying it by the proper position to go forward on the locking pins. The clamp should be adjusted so that the mold disk stops in the proper position.

As the leathers wear, the brake must be adjusted from time to time. This will usually, however, be at quite long intervals.

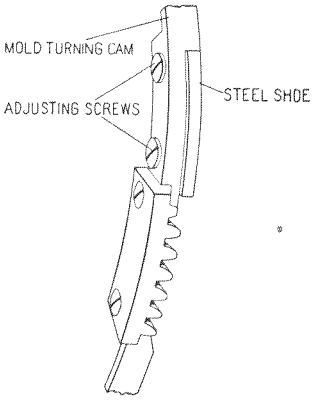


FIG. 55.—Segment of the rack which revolves the shaft turning the mold disk.

It also shows the steel shoe which runs alongside of the square block and holds the mold disk in position to slide freely on mold-disk bushings 90 and 91, Fig. 45, at casting and ejection.

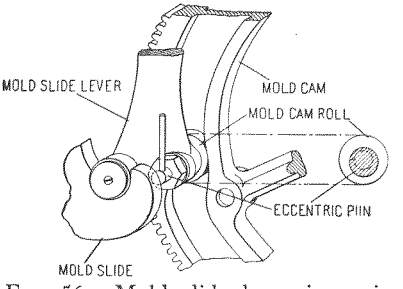


FIG. 56.—Mold slide lever in position to operate the mold slide, and also an eccentric pin and adjustment for the roll which moves the mold slide forward and back, in order to take up a slight wear.

of the slide is a semi-circular notch into which fits a roll on an arm, which arm gives the mold slide its backward and forward motion. This arm is called the mold cam lever.

The mold cam lever is mounted upon another arm in such a way that the roll can be lifted out of the notch in the mold slide so as to disengage the slide from the lever that operates it. It is then possible to pull the

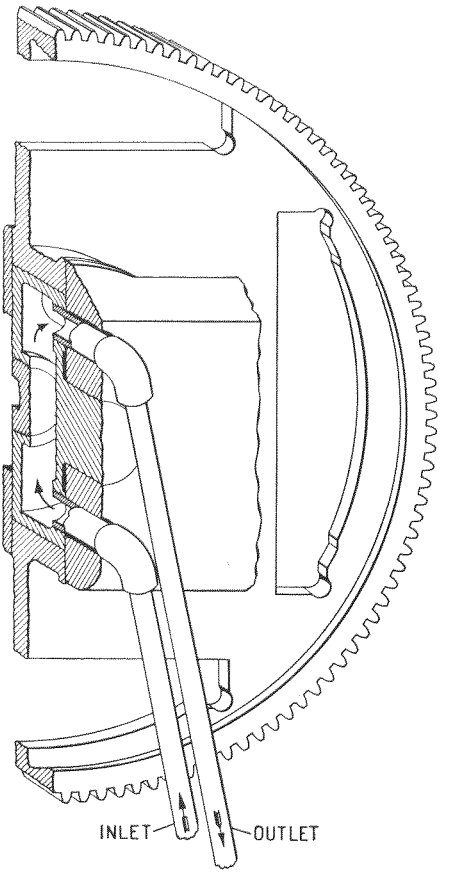


FIG. 57.—Diagram showing the water circulation in the water-cooled mold disk.

mold slide forward a few inches, or to remove it entirely from the machine by lowering the vise frame. These parts are shown in Fig. 79.

When the roll on the lever is in the notch described it is held in this position by a spring pin.

Mounted on the shaft which turns the mold disk turning pinion there is a brake shown in Fig. 54. This brake can be tightened up by means of a nut working on a clamp spring. The side of the brake is composed of two pieces of leather which bind slightly on the mold shaft. The object of

this brake is to prevent the momentum of the mold disk or wheel from carrying beyond its position when it should be stopped, and making the starting and stopping more easy and uniform.

MOLD-TURNING PINION

The revolution of the mold disk (which has been previously described), in order to bring it into the casting and then the ejecting position, is caused by two sectors of circular racks fastened upon the cam. One of these sectors is longer than the other. These racks engage and turn a small beveled pinion *127*, as shown in Figs. 53 and 61. Just in front of the pinion is a square block, which is hardened and ground, and which

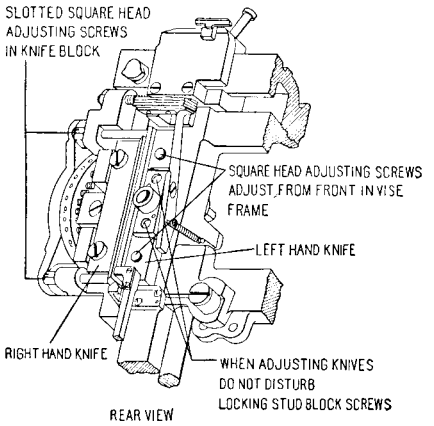


FIG. 58.—Diagram of the knife block and knives and screws when the vise is lowered. The adjustments for the knives are shown. When the right-hand knife is adjusted it should not be disturbed, and if necessary the left-hand knife should be adjusted to it.

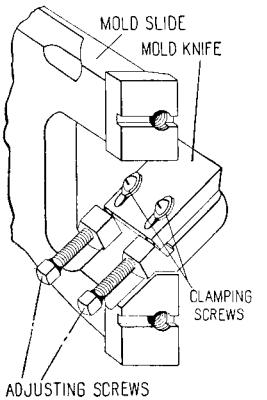


FIG. 59.—View of the back knife and the adjusting and clamping screw for bringing the edge of the knife in exact position against the mold disk, so that it will shave the back or bottom of the slug and at the same time will not cut the mold disk.

runs upon an interrupted surface on the cam. The arrangement is such that while this surface is passing by one of the sides of the square block *180* in Fig. 83 the pinion shaft is held from rotation, but when the section of the circular rack comes into register with the pinion it revolves the shaft. This arrangement is one form of a "Geneva lock."

The sectors *177* and *178* in Fig. 83 mesh with a bevel pinion on a jack shaft that runs toward the front of the machine. Fastened to this shaft is a spur gear driving a pinion on the mold disk driving shaft *129*, Fig. 83. Just opposite the mold wheel there is another pinion on this shaft which

is called the "mold-turning pinion" *127*, previously mentioned. The teeth on this pinion are wider than the teeth on the mold wheel, so that when the mold disk slides forward and back in the casting operation previously described the teeth on the pinion will remain in mesh. The mold-turning pinion is not keyed or pinned to the jack shaft in the ordinary way. Just back of the mold-turning pinion upon the jack shaft there is a collar, or disk, which has a hole in it. This disk is pinned to the jack shaft. In the

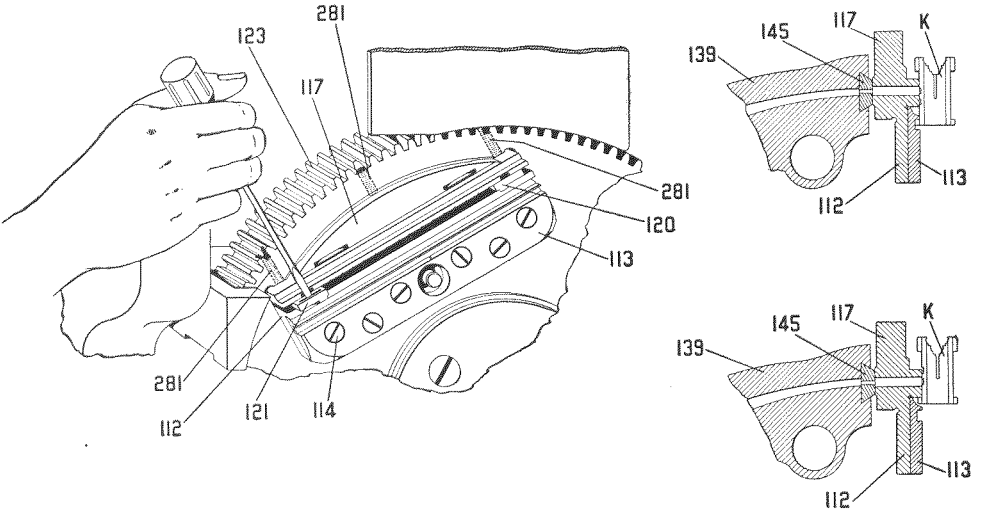


FIG. 60.—View showing the method of removing and replacing liners in the mold.

In the figure *123* is the mold disk, *121* is the liner, which has in its upper edge a small groove adapted to take in the end of the screwdriver. The screws *281* have been turned backward a little so as to relieve the mold cap *117*.

The two liners *120* and *121* can then be removed and replaced. When the length only of the line is to be changed, the liner *121* is the only one that is removed and replaced. When the body of the slug is to be changed, both the liners *120* and *121* are removed.

In making this change, it is most convenient to revolve the mold disk a little to the left (by means of the handle), as shown in the illustration.

mold-turning pinion there is a projecting pin. A spring, shown at *189* in Fig. 61, holds the mold-turning pinion against this disk. Normally the projecting pin is seated in the hole in the disk and connects the disk and pinion. In front of the mold-turning pinion there is a handle that can be grasped by the operator. The pinion can be pulled forward, pulling the pin out of the disk. It is then possible to revolve the mold wheel with the pinion by hand, so as to bring it to any one of four positions, which brings any one of the four molds in the disk into operating position. The mold-turning pinion is then allowed to be forced back by the spring, and when the pin enters the disk the mold wheel and mold-turning cam are in register. This operation is shown in Figs. 53 and 61.

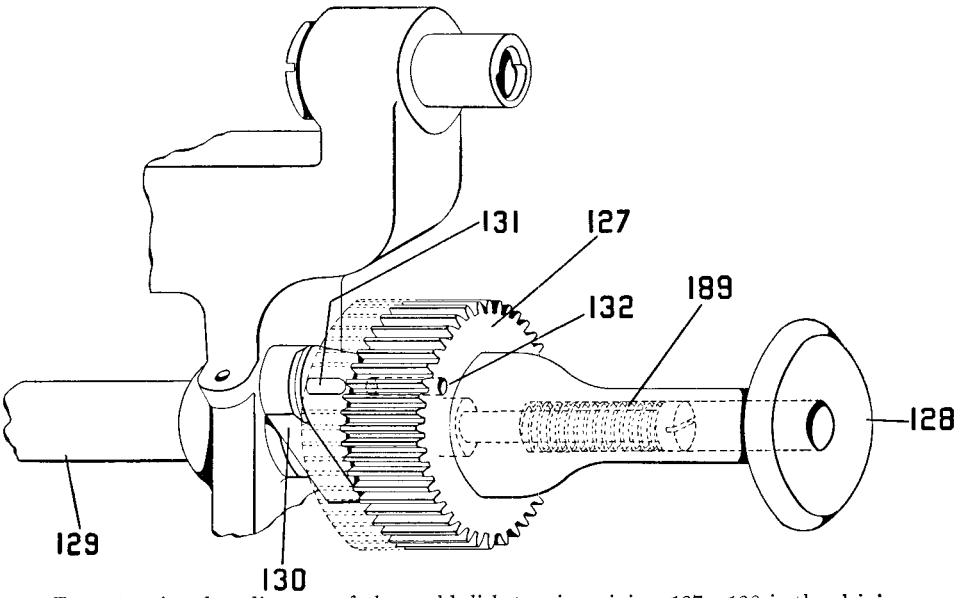


FIG. 61.—Another diagram of the mold-disk turning pinion *127*. *129* is the driving shaft for the mold disk, running from front to rear of the machine. Mounted on the shaft *129* is a sector *130*. In this sector *130* is a pin *131*. In the mold-disk turning pinion there is a hole passing entirely through it *132*. The shaft *129* drives mold-disk pinion *127* through pin *131*. When the mold-disk turning pinion *127* is pulled backward by hand, pin *131* is disengaged and the mold disk can be turned by hand. Inside of mold-disk turning pinion *127* there is a spring which urges it toward the rear of the machine and holds it in place when pin *131* is seated in the pinion.

The diameter of the mold-disk turning pinion *127* is exactly one quarter of the diameter of the mold disk, and hence one complete turn of the pinion *127* turns the mold disk one-quarter turn. It is evident that for any whole number of turns of the pinion *127* the pin *131* will register with the hole *132*.

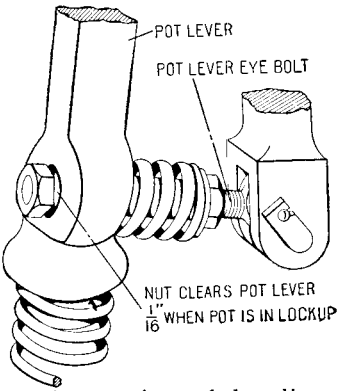


FIG. 62.—Diagram of the pot-lever spring and the adjustment therefor. The adjustment is made by the nuts and shows that the nut on the back side of the pot lever should clear the lever by about one sixteenth to one eighth of an inch when the pot crucible is locked up against the mold at the time of casting.

THE POT CRUCIBLE

The pot crucible is a casting that contains, when full, about forty pounds of type metal. It is contained in a jacket which is mounted on two rather crooked legs which come forward and are mounted on a shaft, which is in turn mounted in the base frame. At the bottom of the legs there are three bolts with lock nuts. There is one bolt at the front and one at the back side of each leg, and by these bolts the adjustment of the

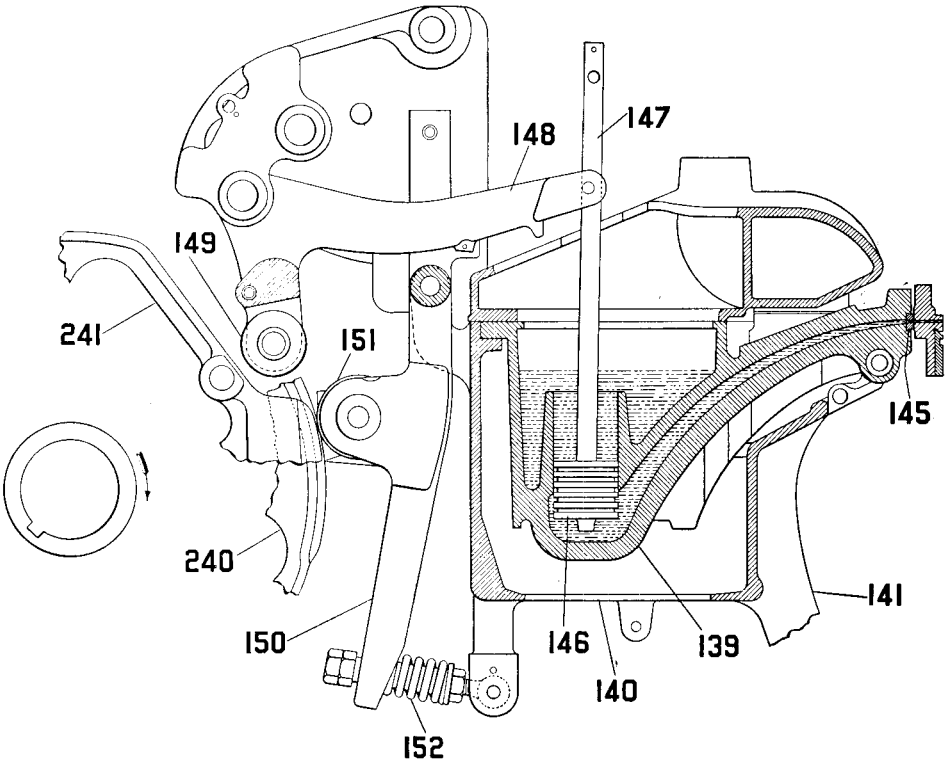


FIG. 63.—Diagram of the pump plunger at the bottom of its stroke, showing the cam *240* forcing the pot forward through the roller *151* and the spring *152*.

pot is made so as to bring the pot crucible nearer to or further away from the mold disk and to align with it. A third bolt in each of the legs gives a vertical adjustment to the pot crucible, so as to make it align perfectly with the mold slot. The pot crucible is mounted in the pot jacket. Between the pot jacket and the crucible the space is filled up with a paste made of asbestos meal, which becomes hard. The object of this asbestos, which is a poor conductor of heat, is to retain the heat in the crucible. At the top of the pot jacket there is a cover having a door through which pigs of metal can be dropped into the melting pot.

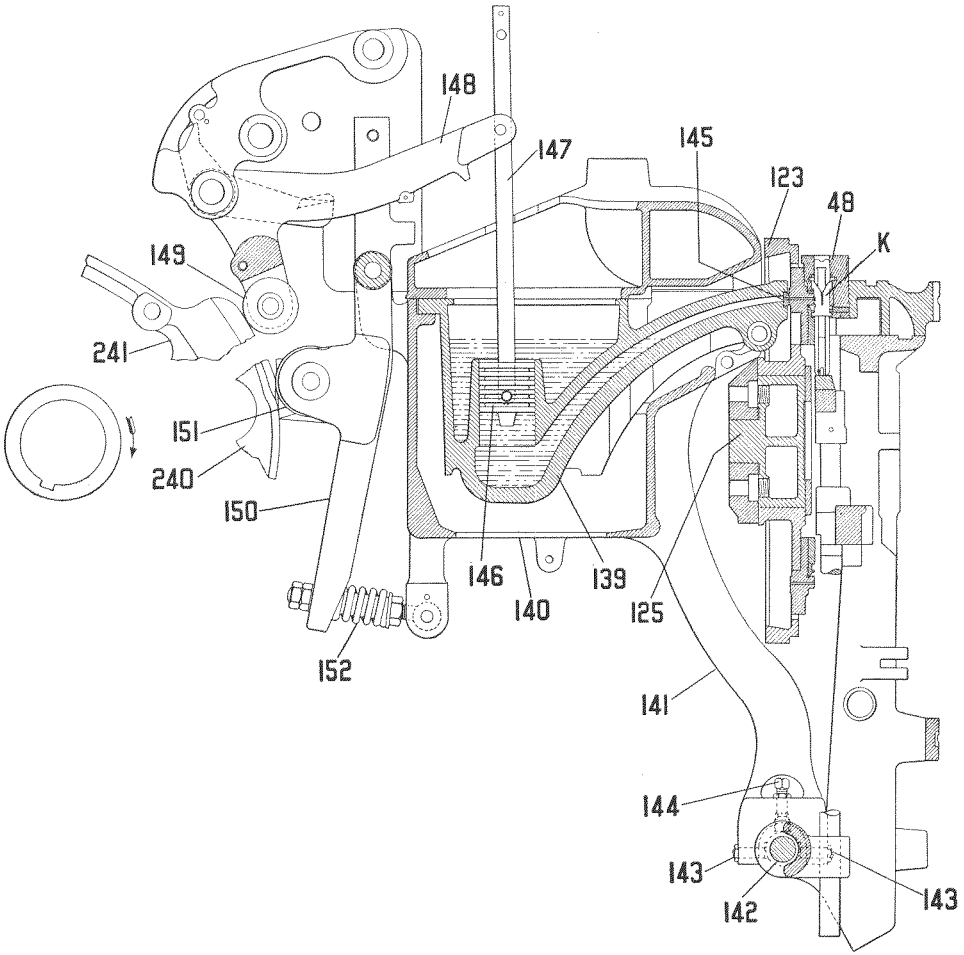


FIG. 64.—View, partly in section, of the metal pot, the mold, the first-elevator jaw, and the vise-frame; also the levers which operate the metal pot and the pump. *139* is the metal pot; *140* is the pot jacket, which surrounds the metal pot. The jacket *140* is mounted on two long crooked legs *141*. These legs rest upon trunnions *142*, and the legs of the metal pot *141* are adjustable by the screws *143*. The height is adjustable by the screw *144*. *145* is the mouthpiece, through which the metal is pumped into the mold. *146* is the pump plunger, which is operated through the lever *147* by the pump lever *148*. The pump lever *148* has at its lower end a roller *149* which rides upon the cam.

The metal pot *139* is moved forward against the line by the lever *150* which carries a roll *151*. The roll *151* rides upon a cam of the proper shape to move the pot forward and back at the proper part of the revolution of the cam shaft.

152 is the compression spring, which stands between the lever *150* and the lower part of the pot jacket *140*. This spring is very strong, and through it the pressure of the lever *150* is applied to the pot jacket and metal pot. If there is any unusual resistance this spring may compress and allow the cam shaft to go through its revolution; or, in other words, the spring *152* is a safety device.

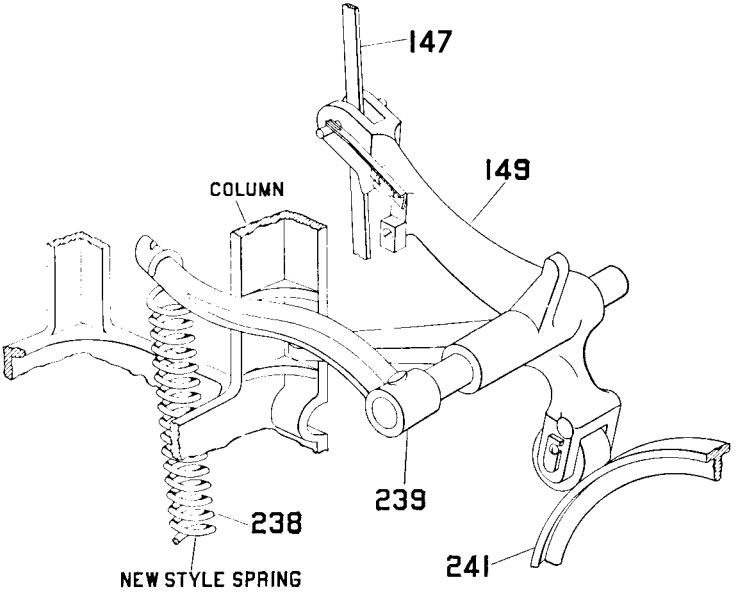


FIG. 65.—Diagram showing the action of the spring which works the pump. It is the device which has the spring *238* inside of the column.

The pot crucible contains a well in which there is a plunger. When the plunger is in normal position the bottom of it is just above two holes through the side of the well, and through these holes the metal flows into the space below the plunger. These holes must be kept open. When the plunger descends below these holes it drives the metal forward and up into the throat and through the holes in the mouthpiece into the mold and against the matrices, forming the slug. See Fig. 64.

POT JACKET AND BURNER

The pot jacket is a casting having two legs on it, as previously described in Fig. 64, and is of such shape as to contain the crucible, or pot, which is to hold the molten metal, and form a wall around said crucible. As stated before, the space between the pot jacket and the crucible is filled with a packing made of asbestos, which retains the heat imparted to the crucible and to a certain extent prevents its escape to the surrounding parts of the machine.

Underneath the pot crucible there is a burner. Three methods of heating the metal in the pot crucible are now in use. The most commonly used is the gas burner, using either natural or illuminating gas. The second in most common use is the electric pot, where electricity is used to melt the metal, and this method is described in a special pamphlet on electric pots

which will be sent on request. The third, much less common than either of the others, is the oil burner, using either gasoline or kerosene. An illustration and directions for using the gasoline burner will be sent on request. Special arrangements are usually necessary on account of insurance requirements when using gasoline.

VISE FRAME

The vise frame consists of a casting having two legs joined together by bridges, and is pivoted at the lower end of the legs on a shaft with bearings in the base, which shaft also supports the pot legs. The vise frame carries the guides for the first-elevator slide, the justification slide, the vise cap in which the vise jaws slide, the mechanism for closing the vise jaws, the knife block, the knife wiper, the slug lever, and on its front the galley for holding the slugs. The vise cap *80*, Fig. 42, is fastened to the top of the vise frame with four screws, and has on the underside of the rear a longitudinal groove in which the vise jaws *83* and *84*, Fig. 45, slide. The vise cap also takes the thrust, and supports the first-elevator jaw, when the line is locked up for casting the slug. Through the vise cap, at either end, are the vise locking screws, which hold the vise in its vertical position and lock it to the frame of the machine. The vise locking screws, which are threaded in the vise cap, have on the end a cam, which enters into two vise locking studs, one attached to the column, and the other to the mold gear arm, so that when the screws are turned they lock the vise firmly against the frame of the machine through the action of the cams.

By unlocking these studs the vise frame can be opened so as to be out of the way for the removal of the mold slide, the pot crucible, and other parts when it becomes necessary. In the later machines there is in the upper surface of the vise cap a transverse groove, in which rest two flat

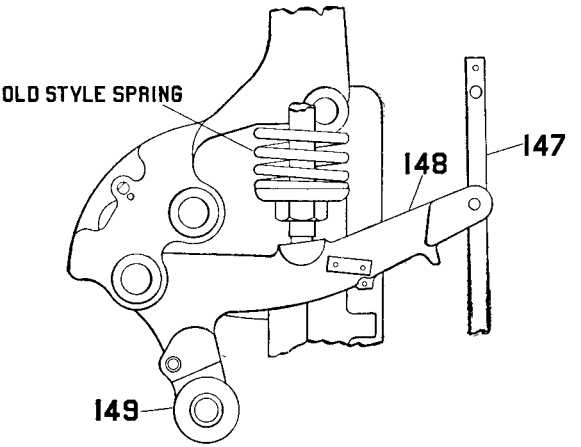


FIG. 66.—Diagram showing the action of the spring which works the pump. It shows the old-style spring which was directly over the lever which works the pump plunger.

rods that lock and unlock the toothed rod which supports the right-hand vise jaw for different lengths of a line.

At the left-hand end of the vise frame a casting is bolted on that carries the wedge mechanism for locking and unlocking the line of matrices at the time of casting, as described in Figs. 47 and 83. In the earlier machines, instead of a wedge, a screw mechanism was used for the purpose of locking and unlocking the line. At the right-hand side of the vise frame, just underneath the vise cap, the casting has a planed surface upon which the knife block is fastened. This knife block consists of two knives that trim the edges of the slug as it is being ejected. These knife blocks have various forms, which will be hereinafter described. All these parts that are mounted upon the vise frame are securely fastened to it and form a unit that can be assembled separately and added to the machine. The form now used is called the universal knife block.

EJECTING THE SLUG

After the slug has been cast and the pump-plunger lever has been raised by the cam, the pot, or crucible, rocks backward, following the cam and being forced to do so by a projecting lug on the lever *245* in Fig. 80. It usually follows the cam by gravity alone. The mold wheel is then caused to revolve through three-quarters of a turn of its circumference. While doing this, the back of the mold passes by a knife, termed the "back knife." This is mounted on the end of the arm that supports the mold disk. It presses closely against the back of the mold and shaves off any surplus metal, trimming the back of the slug so as to make it smooth and type high. At the end of the three-quarter turn of the mold disk mentioned, the slug is opposite the knife block. It must now be pushed forward out of the mold and between the knives, so as to trim the edges and ribs of the slug.

The ejection of the slug is done by means of a thin steel blade called the "ejector blade." This blade is mounted so that it can be easily removed and replaced. The width and thickness of the blade must correspond to the mold slot. This ejector blade is mounted upon a secondary slide called the "ejector slide," which runs in grooves in the mold slide. The motion of this ejector slide is obtained through a link connected to the rear side of the ejector blade, as shown at *214* in Fig. 79, and at the other end fastened to a lever *210*, as shown in Fig. 79. The motion of this lever is imparted by two lugs upon two cams. One of these lugs registers with a hook mounted on the upper end of this lever, which is called the "ejector lever," and about half way down from the top of this lever there is another lug which engages with the cam, which gives the return motion to the ejector slide. These motions are described and illustrated in diagrammatic form in Fig. 79.

At the upper end of the ejector lever there is a handle. If for any cause the slug sticks in the mold and is not ejected by the machine, it is neces-

sary for the operator to turn the cam shaft back a little so that the lug on the cam will be withdrawn, and then the operator, by taking hold of the handle, can push the slug out by a succession of pushes or light blows. This handle is shown in Fig. 67.

Before performing this operation the operator should be sure the proper ejector blade, which corresponds to the size of the mold, is in the machine. If a wrong size is used the ejector blade will come against the sides of the mold or against the left hand liner. If the operator forgets and goes through the operation described for pushing out the slug by hand, he

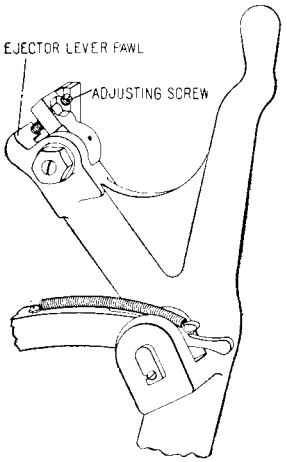


FIG. 67.—Diagram of the ejector lever and the ejector-lever pawl and screw for adjusting same so that when the cam comes around it will engage with the pawl, driving the ejector lever forward and ejecting the slug.

will do the mold or the liners damage. If, therefore, a slug sticks in the mold, the operator should be careful to see whether he has made the mistake above mentioned before he undertakes to push out the slug.

The old style ejector blade was in a single piece, as shown in Fig. 69, and this illustration shows the means of taking out and putting in an ejector blade of different width and thickness. Care should be taken that the right blade is selected.

UNIVERSAL EJECTOR

In the later machines the universal ejector blade has been used. The universal ejector consists of a series of blades connected with the ejector slide by links and so arranged that by the use of a lever, which is under the starting and stopping lever, and within easy reach of the operator, any desired number of blades can be brought into operation, thus making the width of the blade to correspond with the length of the mold slot. A scale back of a hole in the delivery channel indicates the measure for

which the blade is set. In the universal ejector the thickness of the blades is never changed, but these blades are held in a guide so rigid that they

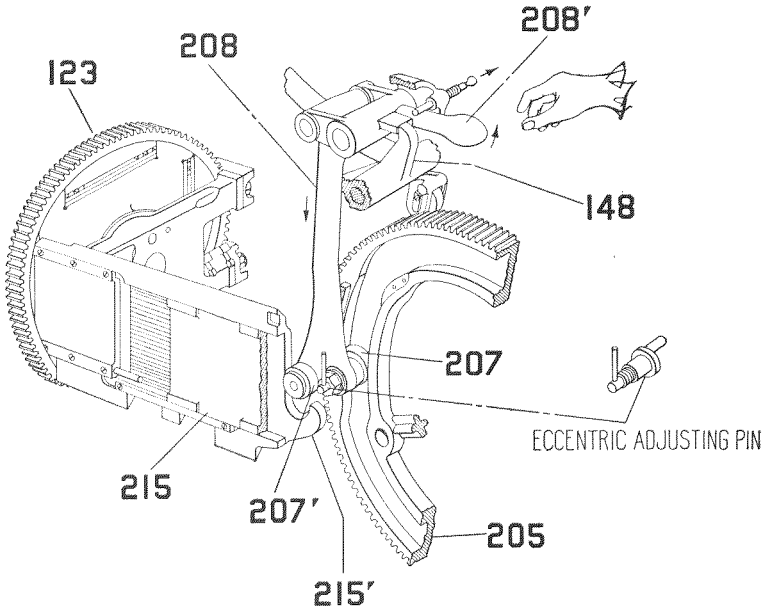


FIG. 68.—View showing the mold mechanism and the means of connecting and disconnecting the mold slide. In the view given the rolls *207′* and *207* mounted on the mold cam lever are shown lifted, the handle *208′* being underneath a little spring pin which holds it in its position. By pulling this spring outward the handle *208′* is allowed to rise, lowering the mold cam lever *208* into position to connect with the ejector slide.

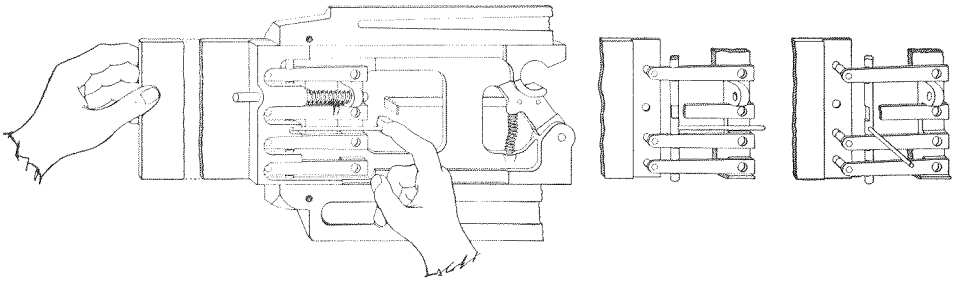


FIG. 69.—Diagram of the old-style ejector and the means for inserting and removing an ejector blade.

will eject slugs of any thickness. The universal ejector blade can be adjusted so as to eject any size or length of slug instantly.

When the ejector slide has pushed the slug forward through the knives, it passes into what is called "the galley."

There are two forms of galley. The one shown in Fig. 70 is the one which was used for many years on the machine and is still used on most newspaper machines which are not used for ad purposes. This galley, often called the "chase," as shown in Fig. 70, goes in directly behind the first-elevator slide, and an arm *101*, worked by the mold slide, pushes the slugs along into the galley. In some machines the slug lever *101* is moved by a cam on the first-elevator slide. This action interfered with the motion of the slide and it has been discontinued.

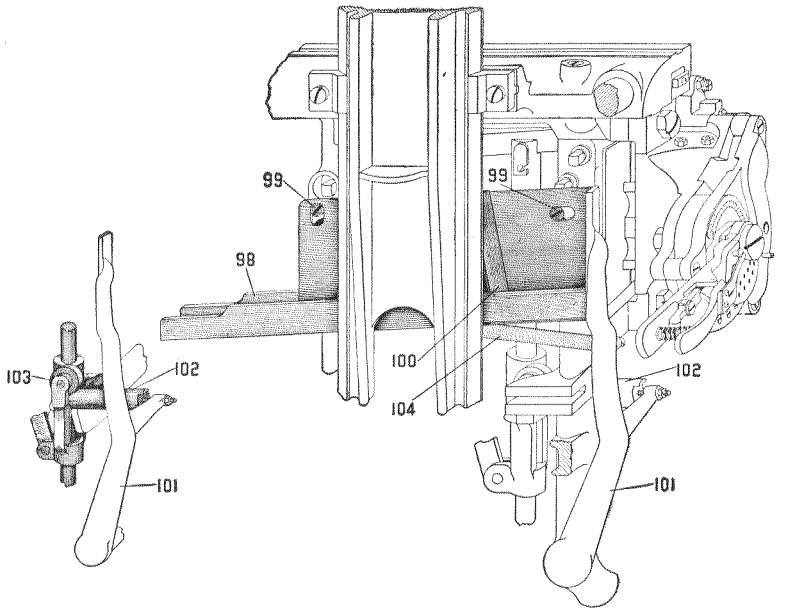


FIG. 70.—View of the vise frame and elevator slide, showing the galley or chase into which the slugs are ejected. *98* is the galley, mounted upon two button-head screws *99*, which are fast in the vise frame. *100* is the slide against which the slugs are packed, and this slide moves along as the slugs are successively fed into the galley. This sliding movement of the slugs and the slide is caused by the lever *101*. The lever *101* is operated by a small push rod *102*, which is operated by a small roller *103* mounted on the right-hand justification rod collar.

The lever *101* is returned by the spring *104* (as shown at left of the main view).

The inclined galley shown in Fig. 71 is designed to deliver the slug face up in a position to be read at a glance. The inclined position of the galley permits the slug to slide easily into place. The face of the slug does not come in contact with the metallic portion of the galley, preventing damage to slugs. It permits removal of any of the slugs or the entire galley without disturbing the operator.

With this galley there is used a long-handled mold disk pinion, permitting the mold disk to be turned by hand, which lightens the task and prevents any possible injury to the hand of the operator.

When short slugs are being cast, a secondary stop is used, and also a slide which answers the same purpose as the slide in the regular or vertical galley, as shown in Fig. 70. There is also an adjustable guide for different lengths of line.

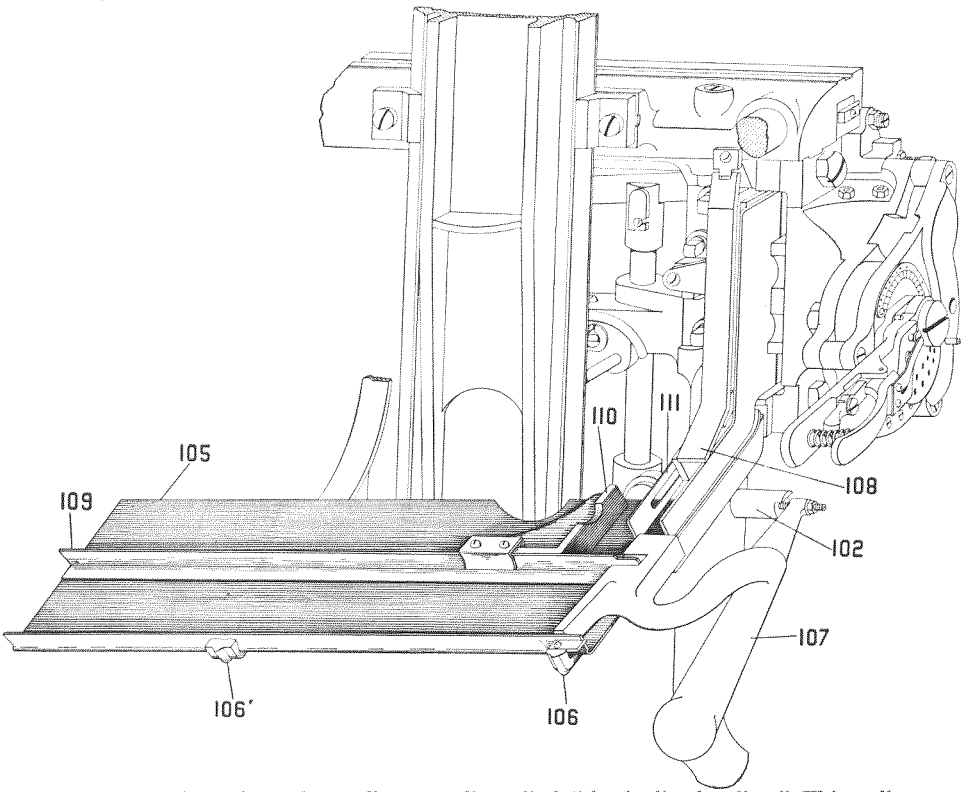


FIG. 71.—View of another galley, usually called "the inclined galley." This galley *105* is mounted on two brackets *106*, which are fastened to the vise frame and hold the galley *105* at an angle. The lever *107* corresponds to the lever *101* in the other view, but is of a different shape, though operated in the same manner. In this galley there is a suspended flap *108* which serves to cause the slugs to take a quarter-turn as they pass down the incline into the galley, instead of standing upright as in the vertical galley.

When the slugs are short, a secondary stop strip *109* is used, and on this there is a slide *110* which answers the same purpose as the slide *100* in the regular galley. There is also an adjustable guide *111* which assists in guiding the slugs into their proper position in the galley. This guide is adjustable for different lengths of slug.

This galley is mounted on two brackets which are fastened to the vise frame and hold the galley at an angle. In this galley there is suspended a flap which serves to cause the slugs to take a quarter-turn as they pass down the incline into the galley, instead of standing upright, as in the vertical galley shown in Fig. 70.

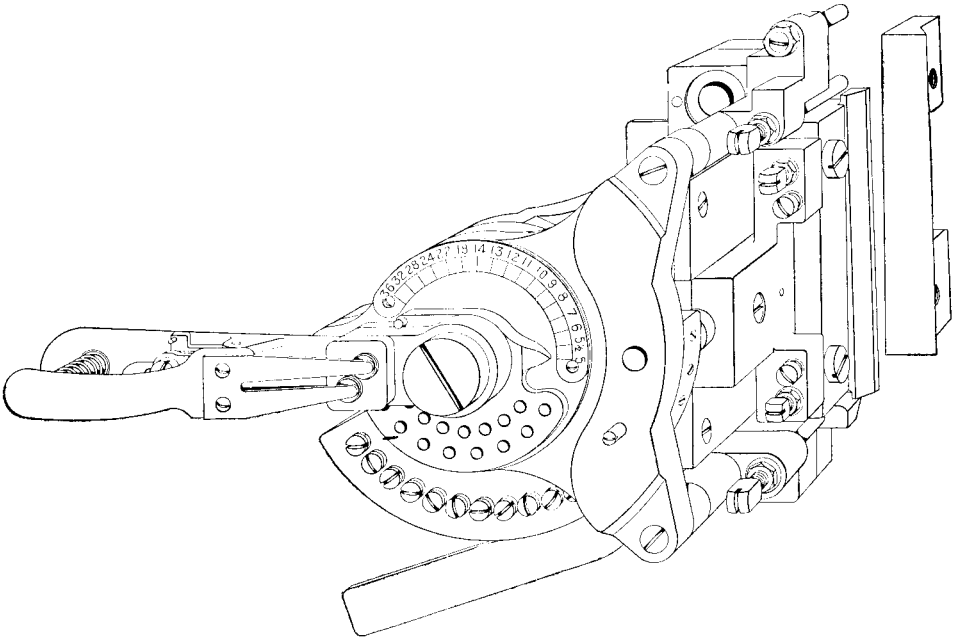


FIG. 71a.—The knife block can be instantly set to lines of any body from 5 to 36 point inclusive. It also permits an independent adjustment of knives for special bodies without affecting the adjustment for other body sizes. For example, the knives may be set to trim extremely close on 8 point, and large or leaded on 10 point, without affecting the setting for normal trimming of other bodies.

UNIVERSAL KNIFE BLOCK

The universal knife block as shown in Fig. 71a has been in use for a number of years and the majority of the machines now in use are equipped with this block.

In general, the block consists of two castings fastened to the vise frame. The left-hand knife as you sit in front of the machine is fastened to the vise frame by screws running through from the back, and is called sometimes the constant knife, as when once properly set it is not moved. This knife shaves the smooth side of the slug and should be set so as to just trim off any surplus metal on the edge of the slug but should not shave any portion of the body. The other knife shaves the ribs and brings the thickness of the slug to body size.

The vertical adjustment of this left-hand knife is made by two long screws which run through the right-hand casting, one above and one below the right-hand knife. The left-hand knife is held in position after the vertical adjustment by binding screws. The long screws mentioned give the adjustment for the knife so that it is perpendicular and in line with the smooth side of the slug, and the binding screws hold it firmly to the

casting. The right-hand knife is not fastened to the vise frame but is mounted upon a slide. There are two springs which tend continually to press this slide to the right. This slide has its bearing against a set of screws having set screws to hold them. These screws are mounted in a sector and are set so that when the slide comes against them the distance between the constant knife and the right-hand knife corresponds to various sizes of thickness of the slugs. The right-hand knife has two short set screws for setting it in vertical position and lock nuts hold these screws after the knife is in proper position, and binding screws also hold the knife firmly to the slide. The right-hand knife should be exactly parallel to the left-hand knife. The right-hand knife shaves off the ribs on the side of the slug.

Mounted on the knife block is a handle for setting the right-hand movement of the slide so as to give the proper thickness of the slug. This handle has a spring locking handle on it and this spring locking handle has two spring actuated plungers, one of which registers with one of a number of holes drilled in the casting so that when the plunger enters the hole the knife cannot be shifted until the operator compresses the handle with his hands and unlocks it. The locking screws with their nuts are mounted on a sector and the handle revolves this sector so as to bring one of these screws opposite to the slide which is forced to the right by the spring. When the operator pushes down on the handle, longer screws are introduced and the right-hand knife is pushed inward so as to shave slugs of a lesser thickness. When the handle is raised shorter screws are brought into register, the slide carrying the right-hand knife is pushed further over to the right, and wider slugs are trimmed. The slide, the knife on it, the movable sector, and locking handle are all mounted on a casting which is fastened to the vise frame by two large screws.

One of the good features of the universal knife block is that the screws which determine the thickness of the slug can be set for any desired thickness. It sometimes happens that on a job instead of even points, half or quarter points are desired, so as to shave the slug closely and make no leading, or on the other hand, sometimes to shave very little and make the ribs equivalent to a lead. By this means an adjustment of each body size may be made independently.

HOW TO ADJUST TRIMMING KNIVES

The left-hand knife should be adjusted so as to be exactly in line with the left side of the mold. This knife should remove fine metallic hairs or fins which may be formed at the edge of the slug. It is not intended to remove metal from the smooth side of the slug.

The right-hand knife, which trims the ribbed side of the slug, must be adjusted so that its edge is exactly parallel with the opposite knife, in order to make the slugs of equal thickness at the two ends. If there is any variation in the distance between the knives at the two ends, such variation should be corrected by the adjusting screws. Before adjusting

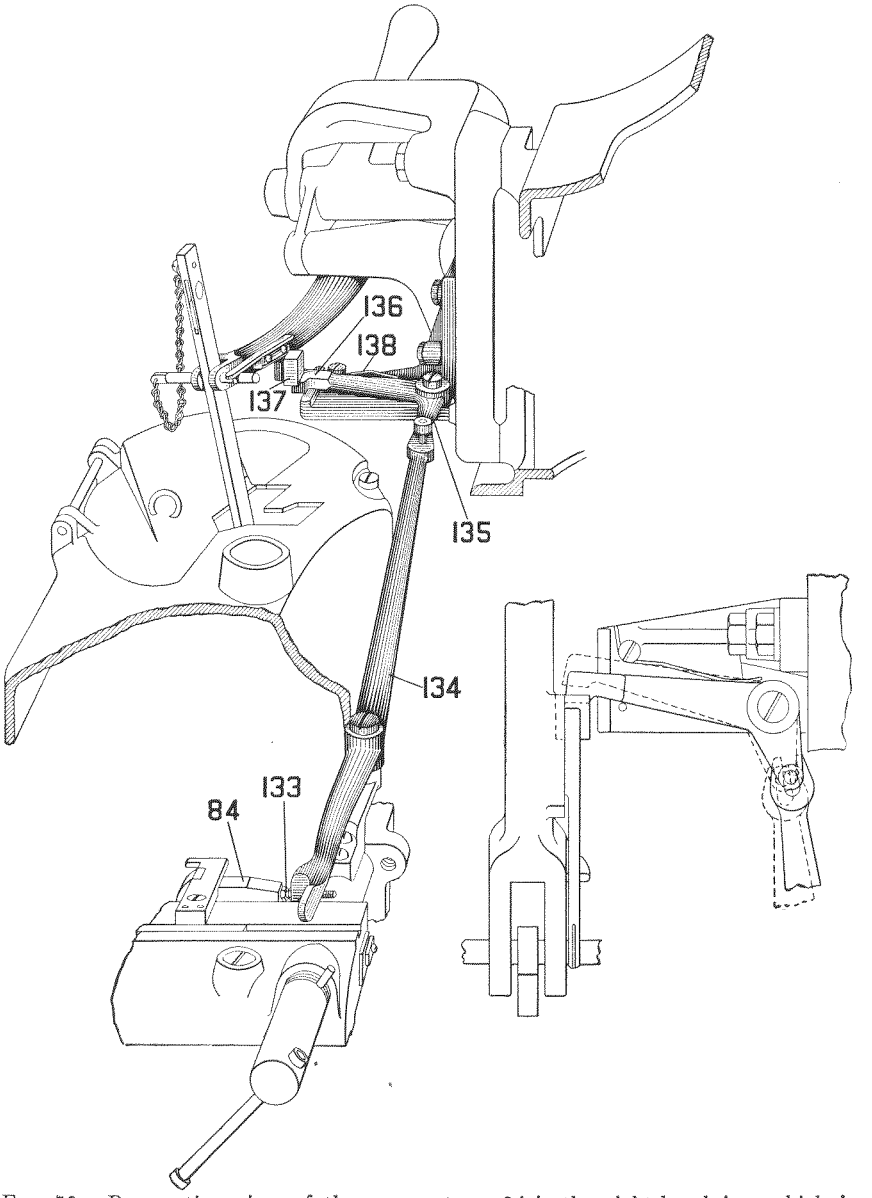


FIG. 72.—Perspective view of the pump stop. *84* is the right-hand jaw which is mounted in the vise frame so as to have a slight movement. The jaw *84* strikes against a screw *133*. The screw *133* is adjustable and is mounted on the short arm of a lever *134*. The long arm of this lever is connected to the short arm of another lever *135;* the long arm of the lever *135* has upon its outer end a hardened block. Mounted upon the pump lever is another block *137*. The block *136* is normally under the block *137*, being held there by a spring *138*.

When jaw *84* is moved to the right by the justification of the line, the motion of the vise jaw *84* is multiplied through the levers *134* and *135*, and the block on the end of the lever is moved so that it is not under the block *136* on the pump lever. In this position the pump lever is free to descend and the metal is pumped into the mold.

If the line is too short, so that the justification wedges do not move the jaw *84*, the lever remains underneath the block *137* and the pump lever cannot descend; hence no metal is pumped.

The screw *133* should be adjusted so that the block *136* just clears the lever when the jaw *84* is at its full right-hand movement.

the right-hand knife, slightly loosen the binding screws by which it is held to the knife block.

After the knife is adjusted the screws should be slightly tightened to hold it in place. Never use a hammer to adjust the left-hand knife; see that the spring is in place, and use the wrench provided for that purpose. (See under caption "Knife Block Liners.")

PUMP-STOP LEVER

Mounted on the column of the machine, just to the right of the mold disk, is a lever running parallel with the floor. This lever has upon its forward end a screw adjustment, as shown at *133* in Fig. 72, and the rear end of the lever connects with another lever that passes under a lug on the pump cam lever. The long arm of the lever *135* is normally held by a screw underneath a lug on the pump cam lever. The right-hand vise jaw *84* has a short motion to the right. When the line is justified it presses the right-hand vise jaw to the right against the lever *134* and the long lever *134* pulls the long arm of the small lever *135* out from underneath the pump lever, allowing it to descend and drive the metal into the mold. It is manifest that if the line of matrices and spacebands when justified, *i.e.*, when the wedges of the spacebands are driven up their full length, does not fill out the line, the right-hand vise jaw will not be pressed to the

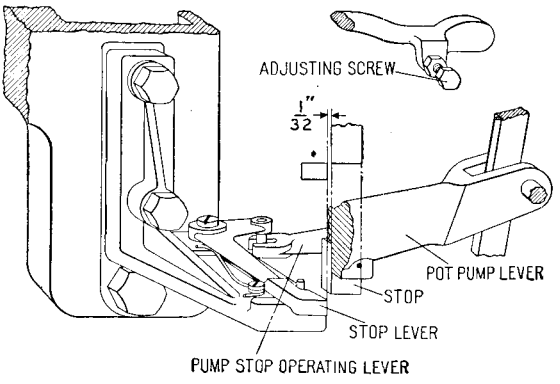


FIG. 73.—View of the pump stop mechanism showing the adjusting screws and the distance for adjustment on the device.

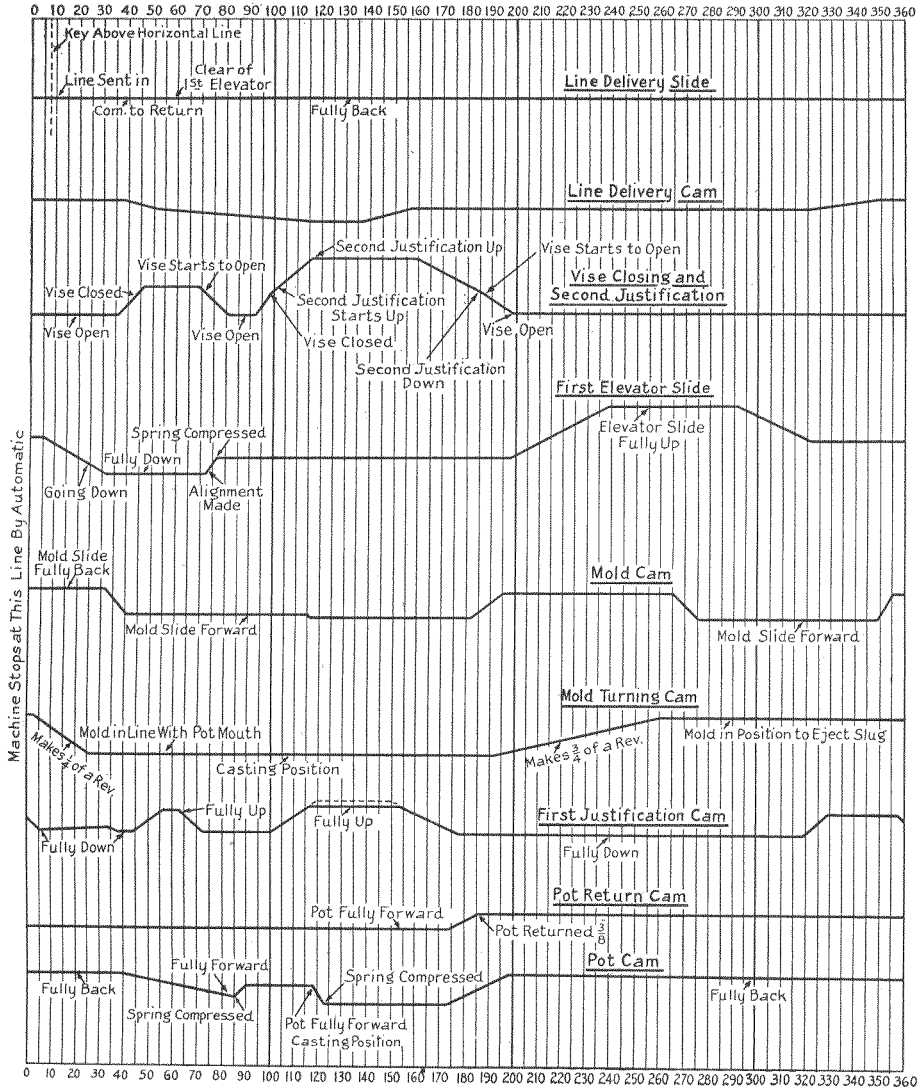


FIG. 74.

Figures 74 and 74a show the cam shaft actions by degrees of a circle. At the top of the chart are the degrees running by 10 degrees from zero to 360. The vertical lines, therefore, indicate 10 degrees of one revolution of the cam shaft. In this chart the cams do not follow the order of their number as given on Page 79. They follow the order of the actions of these cams.

The line delivery slide, which is not a cam at all, goes over to the left as you stand in front of the machine, and starts the main cam shaft. The straight line shows the number of degrees that the line delivery slide remains in position, and its return is indicated by the change in position of the line.

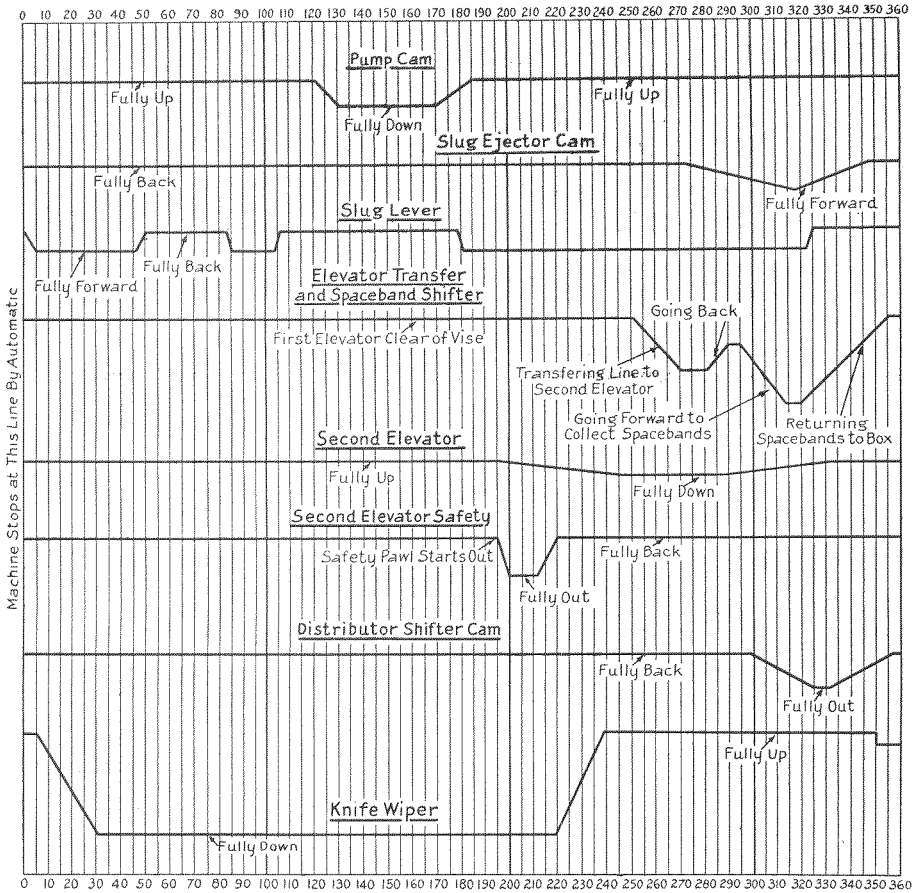


FIG. 74a.

In all these charts when the line goes downward it indicates a depression in the periphery of the cam. When the line goes upward it indicates a projection or "steep," as it is usually called, on the cam, and the number of degrees is indicated by the number of vertical lines traversed by the line indicating the cam.

This cam chart shows the relation of one cam to another and where the pockets or "steeps" of the cams come in relation to each other. A little study will make the action of the cams plain. In these charts the actions follow one another as is done in one full revolution of the main cam shaft.

Fig. 74 shows performance of line-delivery slide (by Cam No. 1), line-delivery cam (Cam No. 10), vise-closing and second justification (Cam No. 4), first-elevator slide (Cam No. 1), mold cam (Cam No. 9), mold-turning cam (Cam No. 3), first justification cam (Cam No. 5), pot return cam (Cam No. 9), pot cam (Cam No. 8).

Fig. 74a continues with: pump cam (Cam No. 7), slug ejector cam (Cam No. 9), slug lever (Cam No. 9), elevator transfer and spaceband shifter (Cam No. 10), second elevator (Cam No. 6), second elevator safety (Cam No. 10), distributor shifter cam (Cam No. 2), and knife wiper (Cam No. 1).

right, the short lever will remain underneath the pump lever, and the pump plunger will not be allowed to descend. The object of this is manifestly to prevent a "squirt" of metal into the loose line of matrices.

THE CAM SHAFT

All the motions previously described, and others that have not yet been mentioned, are caused by the revolution of the cam shaft. This cam shaft is mounted on bearings at the rear of the machine. These cams are very large in size, in proportion to the general dimensions of the machine. This has proved, however, to be good designing, because the wear on the cams is distributed over so large a surface. Many of these cams have run for twenty years or more without serious wear.

The timing of the different motions in the Linotype machine is caused by the shape of the cams and their position on the cam shaft. All of the cams are fastened to the cam shaft by a spline running the full length of the shaft, and the timing of the cams starts from this point. Fig. 74 is a cam chart, where the circumference is represented by vertical lines. The distance between these vertical lines represents five degrees of the circle of three hundred and sixty degrees traversed by the cam shaft in one revolution. On the cam chart, a line running parallel to the bottom of the sheet means that this portion of the cam is a circle having for its center the center of the cam shaft. When the line ascends it means that the "steep" of the cam departs from the center; and where the line descends, it means that the cam surface descends nearer to the center of the cam shaft. There are ten main cams upon the cam shaft, and their names, which are given on the cam chart, are as follows: 1, first elevator cam; 2, distributor-shifter cam; 3, mold-turning cam; 4, vise-closing cam; 5, justification cam; 6, second-elevator cam; 7, pump cam; 8, pot cam; 9, mold cam and driving gear; 10, delivery and elevator-transfer cam.

Fig. 75 is a rear view of these cams, and the names of the cams are indicated by the numbers.

In nearly all cases the surfaces of these cams act upon levers through rolls, most of which are about two inches in diameter. Care should be taken that the bearings of these rolls are oiled occasionally, so that they do not get stuck, in which case the roll ceases to revolve and sometimes wears a flat place on the cam roller, entirely ruining it. Some operators oil the surface of the cam where the roll bears upon it. This is of no particular use.

The operation of the large cams on the cam shaft will at this time be described. The numbering of these cams was done a long time ago and to prevent confusion these numbers are retained. Reading from left to right as you stand in back of the machine cam No. 10 is at the left and so the cams are described in their numbering order.

Cam No. 1 is the first-elevator cam. This cam operates through the first-elevator lever upon the first-elevator slide. The cam, which is of a

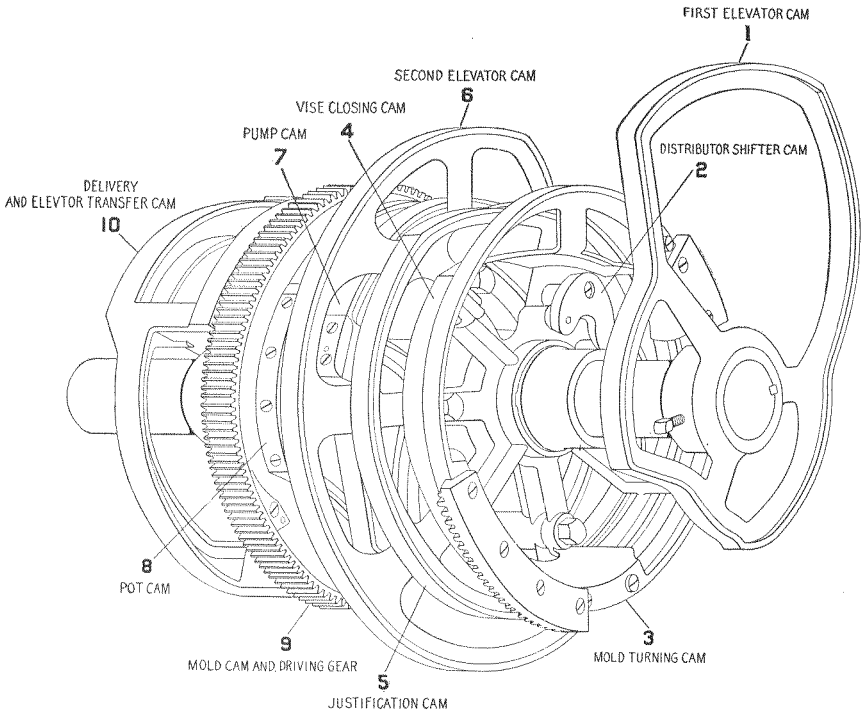


FIG. 75.—Cams assembled on the cam shaft. The cams are numbered, beginning from the right toward the left.

very peculiar shape, operates to place the first-elevator slide in five successive positions. First, the normal position, where it holds the first-elevator jaw in position to receive the line of matrices when sent from the assembler elevator; second, when the first elevator jaw is lowered to a point opposite the mold; third, after a slight upward movement to cause the alignment of the matrices; fourth, the raising of the slide so that the matrices and spacebands can be transferred to the intermediate channel; and last, bringing back the slide to normal position at which time the first-elevator jaw is ready to receive the line of matrices.

No. 2 is the distributor shifter cam which operates the distributor shifter lever and through it the distributor shifter slide, transferring the line of matrices from the second elevator at its highest position to the distributor box.

No. 3 is the vise-closing and mold-turning cam. This is a double cam or two cams in one casting. It operates the mold disk through two toothed segments, commonly called the long and short segments, to turn the mold disk at the proper time. The short segment turns the mold disk one quarter of a turn from the ejecting position to the casting position. The long

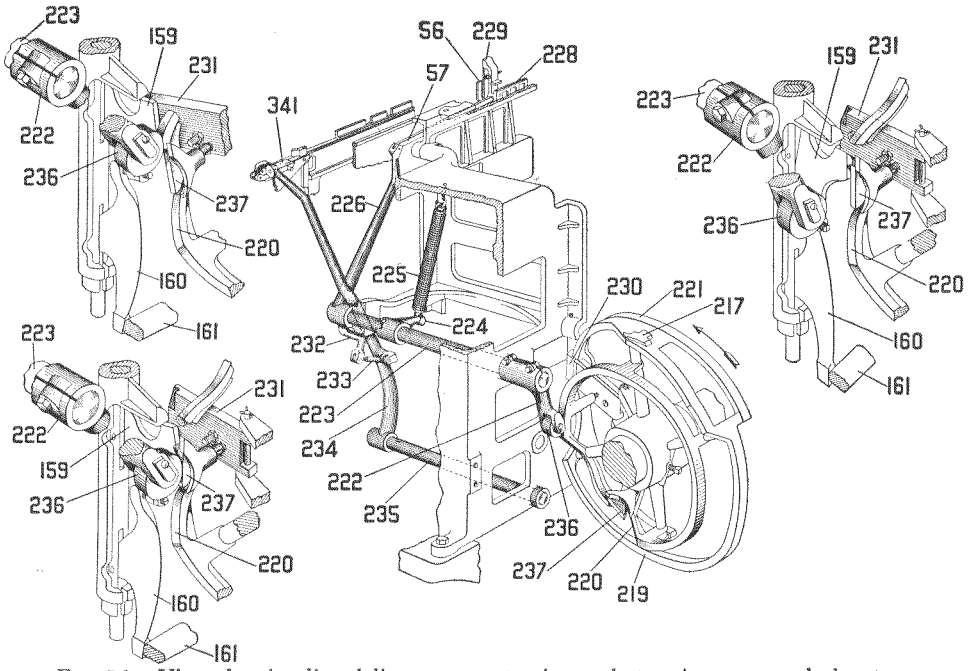


FIG. 76.—View showing line-delivery cam, starting and stopping cam, and elevator-transfer cam. These cams, while they work separately, are in one casting.

219 is the cam surface which controls the delivery of the line of matrices and spacebands from the assembler elevator to the first-elevator jaw and returns the slide, or transfer carriage after the line has descended to the casting point.

220 is the surface which controls the transfer of the line of matrices from the first-elevator jaw into the intermediate channel after the cast has taken place, and also controls the spaceband-delivery lever, which carries the spacebands into the spaceband box after the matrices have gone up on the second-elevator lever.

The cam *219* carries in the same casting the starting and stopping pawl *230*. The cam *220* carries the safety pawl *231*. The cam surface *221* operates to return the ejector lever and holds this lever so that it cannot move forward against the mold.

The functions of these cams will now be described separately. The line-delivery cam *219* has its surface so shaped that it delivers the line into the first-elevator jaw from the assembler stick. This has been more fully described in another view.

220 is the surface which operates the transfer carriage and the spaceband-delivery lever. Cam *220* operates through a short adjustable arm *222*, having a roll on the end which bears against the cam. The arm *222*, is mounted on a shaft *223*, which is mounted in the column. The shaft *223* has upon it another short arm *224* operated by a spring *225*.

The operation of the spring *225* tends to revolve the shaft *223* when the shape of the cam *220* allows it to do so. On the end of the shaft *223* is a lever *226*. The long arm of this lever *226* connects with a link *227* which connects to a sliding carriage *228*. Mounted upon the carriage *228* is an arm *229* of a peculiar shape, which is adapted to carry the matrices out of the first-elevator jaw into the intermediate channel on second elevator. The other end of the lever *226* is a short arm *232*, which connects by an adjustable link *233* with the spaceband-return lever *234*. This lever *234* is operated through the link *233*. The lever *234* is mounted upon a shaft *235*, which is mounted in the column of the machine.

The three small views are enlarged views of the safety device on the cam *220*. The arm *222* carries on its end a roller *236*. The shape of the cam *220* is such that when the roller *236* descends into the hollow, it strikes against the safety pawl *231* through a projection *237*. This pushes the safety pawl *231* out of the way so that it misses the starting and stopping pawl *159*. If, however, for a reason which will hereafter be explained, the lever *226* has not moved to the right, the roll *236* does not strike against the projection *237*, and the safety pawl coming against the lever *159*, operating through the lever *160* against the lever *161*, throws out the clutch and stops the machine.

segment turns the mold disk three-quarters of a turn from the casting position back to the ejecting position.

No. 4 is the vise-closing cam. This cam also has two actions. The first operates through the wedge the vise-closing mechanism, and the second action operates the justification lever in making the second justification.

No. 5 is the justification cam which operates the justification lever. The action of the cam presses down the justification lever and the motion upward is permitted by the shape of the cam, and this motion is caused by a powerful spring.

No. 6 is the second-elevator cam which operates the second-elevator lever. The second elevator transfers the matrices from the intermediate channel to the highest position where the matrices can be transferred to the distributor box. The second elevator is raised by the cam and goes down by gravity, being started by the operation of the second-elevator starting spring.

No. 7 is the pump cam. This operates the pot pump plunger through the link and the pump pot lever. The roll on the pot pump lever is continually urged downward by the pot pump spring and the shape of the cam allows this spring to act on a certain portion of the revolution of the

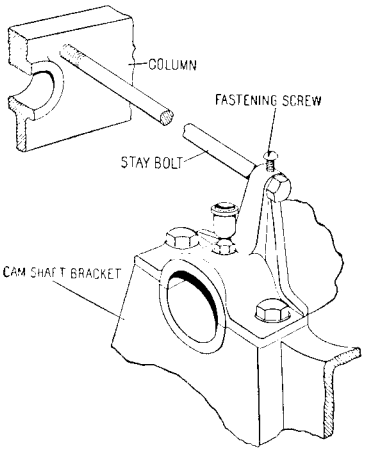


FIG. 77.—View of stay bolt supporting column against camshaft bracket.

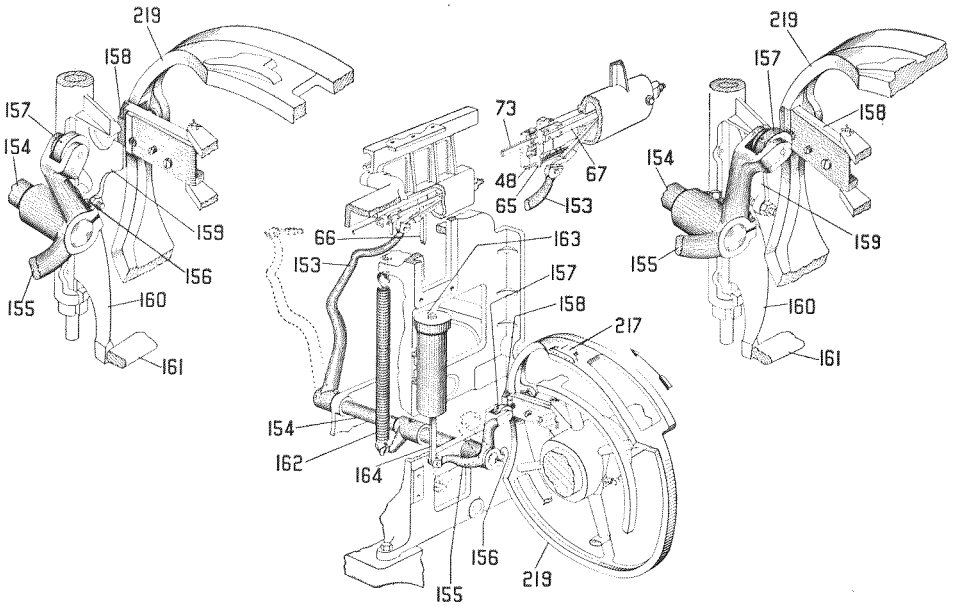


FIG. 78.—View of the automatic starting device, which causes one revolution of the cam shaft when the line of matrices is sent in to the first-elevator jaw. In this view *153* is the line-delivery lever. *154* is the shaft on which this lever is mounted. *155* is a short lever having two arms also mounted on the shaft *154*. The lever *155* is adjustable through the bolt *156*, which clamps the lever *155* upon the shaft *154*. At the end of the lever *155* is a roll *157* which strikes upon the automatic pawl, *158*. The starting pawl, *158*, is pushed sideways off the automatic starting and stopping lever *159*.

The right-hand figure shows the roll *157* at its innermost position, at which time the line has been delivered into the elevator jaw. As soon as the pawl *158* is pushed off the lever *159*, the lower part of this lever is thrown outward, the lever *160* is thrown inward, and through the forked lever releases the clutch spring, which causes the clutch to engage, and the cam shaft begins to revolve, and continues until the automatic stopping pawl *158* strikes upon the automatic stopping lever *159*, thereby throwing out the lever *160* and through lever *161* and the forked lever throws out the clutch and stops the machine.

The movement of the shaft *154* is caused by the strong spring *162*. The sudden action of the spring *162* is resisted by the piston inside of the cylinder *163*. The piston is connected by the shaft *164* to the lever *155*, and as this lever is clamped on the shaft *154*, as the piston compresses the air in the cylinder *163*, the sudden action of the spring *162* is cushioned so that the line when delivered into the first-elevator jaw comes to a stop slowly and not with a bang.

main cam shaft to pump the metal into the mold and against the matrices. After this pumping action has taken place the shape of the cam raises the pot pump lever and through it the pot pump plunger, thereby sucking back the unsolidified metal from the mold.

No. 8 is the pot cam. This cam acts on the pot lever to force the pot forward against the mold and matrices at the time the slug is cast. The

shape of this moves the pot forward first against the mold and matrices making the face alignment. The pot is then withdrawn slightly for alignment and justification. The next movement forces the pot against the mold and matrices with great force and at this time the pump plunger descends casting the slug. The cam does not act directly upon the pot but on a pot lever. Between the pot and this lever there is a pot-lever spring. This acts as a safety device in case anything interferes with the proper movements of the pot.

No. 9 is the mold cam and driving gear. The periphery of this cam is circular and has 132 teeth in it. In the side of the cam there is a groove. This grooved cam operates to advance the mold slide carrying the mold disk to a position where the lugs of the matrices register with the grooves in the mold for the alignment of the matrices. After the slug has been cast it returns the mold disk to allow it to revolve and then moves the mold disk forward again at the time the slug is ejected. Mounted on this cam there is also a lug which withdraws the pot from the mold after casting and there is also mounted on it a pawl called the ejector pawl which operates the lever for ejecting the slug from the mold. This one casting, therefore, causes four operations.

No. 10 is the line-delivery and spaceband-shifter cam. This actuates the lever which transfers the matrix line from the first-elevator jaw into the intermediate channel. It actuates the lever which returns the spacebands. A lug on the cam carries the ejector lever back. This cam also acts to release the safety hook which locks the second elevator in position. It also carries the stopping pawl and the safety pawl, the first of which stops the shaft after it has made one revolution, and the safety pawl acts when some of the proper motions of the levers have not taken place.

The safety pawl operates usually when for any reason the second elevator does not come down to receive the line to be transferred from the first elevator jaw. This occurs when for any reason a line of matrices has not been pushed off the second elevator bar by the distributor shifter. This occurs when the distributor stops and the operator does not notice it and continues to send in a line. It occasionally happens when the operator is using a long line and is setting it very rapidly so that the line does not get out of the way before it is time for the second elevator to descend. In any of these cases the safety pawl acts and stops the revolution of the cam shaft until the line is cleared from the second elevator bar and the second elevator lever is lowered into position. When the transfer levers work they automatically knock off the safety pawl, thus permitting the cam shaft to complete its revolution.

It is sometimes necessary to hold the second elevator lever back a little so as to keep the second elevator bar and the bar in the distributor box in exact alignment. As soon as the matrices have been pushed off the second elevator bar the second elevator lever can be lowered.

Whenever the safety pawl acts, stopping the revolution of the cam shaft, the operator must immediately lock the spaceband transfer lever with the pawl on top of the intermediate channel until the second elevator bar has been cleared and lowered into position, at which time the operator unlocks the pawl and allows the transfer levers to work, thereby starting

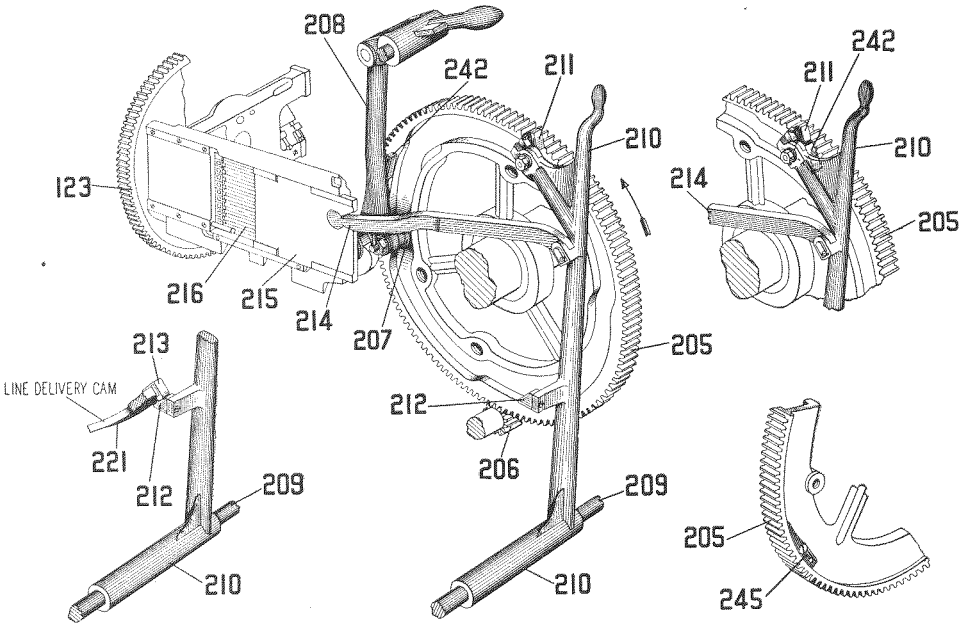


FIG. 79.—View showing the ejector lever and the cam which operates it, together with the large gear meshing with the pinion on the jack shaft. This gear causes the revolution of the main cam shaft.

205 is the gear meshing with the pinion *206*. There are 132 teeth on the gear *205* and eight teeth on the pinion *206*.

Near the circumference on the gear *205* there is a groove cam in which runs the roller *207*. This roller is mounted on a shaft which is mounted in a dependent lever *208*, and is connected with the mold slide.

When the gear *205* revolves, the shape of the groove cam causes the mold slide to go forward, carrying the mold against the matrices at the proper time, holding it there during the casting operation, and withdrawing it again to its normal position.

Mounted on a shaft *209* is the ejector lever *210*. This lever *210* has upon it two lugs *211* and *212*. Mounted on the rim of the wheel *205* is another lug *242*. This lug *242* engages with the lug *211* at a certain point in the revolution of the gear *205* and carries the lever *210* forward.

On the lever *210* there is a link *214*. This link *214* connects with a slide *215*, called the "ejector slide." This ejector slide *215* pushes the ejector blade or blades *216* forward so as to eject the slug. The ejector blade is described more at length in another place.

When ejector cam *242* has passed ejector pawl *211* the lug *213* on delivery cam engages the ejector lever shoe *212* and pushes the ejector lever *210* back to its normal position.

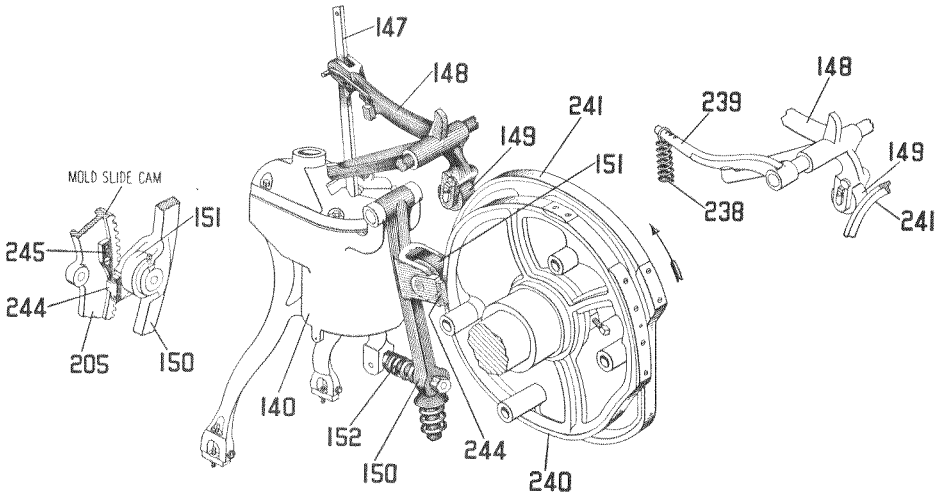


FIG. 80.—View showing the pot cam *240*, the pot lever *150*, and the spring *152* in their relation to the pot jacket *140*. This figure also shows the pump cam *241*, the pump lever *148*, the pump roll *149*, and the pump plunger lever *147*.

The shape of the pot cam *240* is such as to press the pot forward through the roll *151*. Through the lever *150* and the spring *152* the pot crucible goes forward to effect the face alignment of the matrices at the proper time, goes back a little for vertical alignment, and holds the pot firmly against the mold at the time of casting, and then retracts it after the casting.

The pot, after the cast is made, usually goes back by its own gravity. In case, however, it does not, there is a lug *244* on the lever *150*. A small cam *245* in the mold-slide cam engages with this lug *244* and pulls the pot back positively.

The shape of the cam *241* is such as to hold the roller *149* in a position to keep the pump shaft *147* and the pump plunger stationary until the time when the cast is to be made. A "steep" on the cam then allows the roller *149* to descend toward the center of the cam very quickly, and through the force of the pump spring *238*, the pump plunger is caused to descend and force the metal into the mold.

the machine. It is best to hold the spaceband transfer lever with the fingers so that the action of the transfer levers which is caused by a spring, shall not be too violent. After a little practice and experience the operator can make this transfer very smoothly.

DRIVING MECHANISM

The main cam shaft is caused to revolve by a mechanism that will now be described. A short shaft is mounted below the main cam shaft, sometimes called the "jack shaft." The jack shaft has a small pinion upon it, as shown at *206*, Fig. 79. This pinion registers with the teeth on the large driving cam *205*, shown in Fig. 79. The outer end of this jack shaft is hollow and inside of it there is a rod carrying a smaller shaft. Around this rod there is a spring, bearing against a collar, shown in Fig. 85. The spring tends to push the rod inward. The inner end of the rod is held by a long screw, having a pin on the end of it, to the collar, shown in Fig. 85.

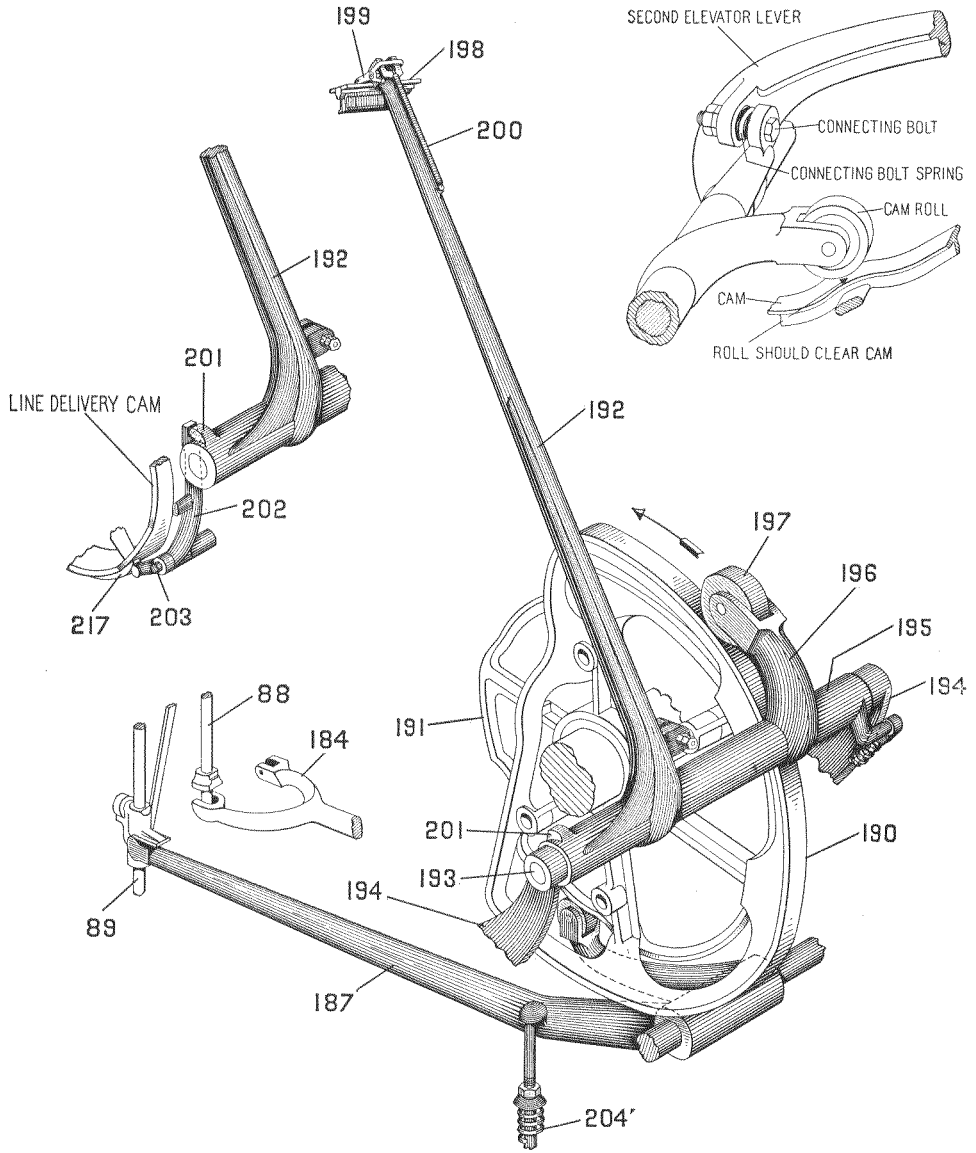


FIG. 81.—View of the second-elevator lever cam *190* and the justification cam *191*. These two cams are in one casting. The second elevator *192* is mounted on a shaft *193* supported by bearings *194* which fasten on to the main frame.

The lever *192* is in one casting with a sleeve which bears on the shaft *193*. Another casting, *195*, is also mounted on the shaft *193* and this casting has upon it an arm *196* and roller *197*. The casting *195* and the casting which carries the lever *192* are connected together by a bolt and screw. This bolt passes through two projections on each of the castings. Between these lugs or projections is a short spring. This spring performs several important functions. It is used for final adjustment

and it also prevents damaging the distributor shifter slide if a sudden mishap occurs to it, causing it to stop in the path of second elevator. The spring cushions the blow and saves distributor slide and prevents breaking the second elevator cam lever *195*. It acts as a cushion when second elevator enters the distributor shifter guide.

The roller *197* bears on the cam *190* and the periphery of the cam is such as to raise and lower the second-elevator lever *192* at a certain portion of the revolution of the main cam shaft and hold it stationary in its upward position during the remainder of the revolution of the main cam shaft.

At its upper end the second-elevator lever carries a short section of distributor bar mounted in a plate *198*. *198* is held to the lever *192* by a short lever *199*. This bar *199* is held normally in a certain position by a spring *200*. The bar *199* is constructed so that it may have a limited motion around its pivot point.

The sleeve carrying the elevator lever has at its left-hand end, as you stand behind the machine, a lug, or projection *201*. This lug, or projection, *201* engages with a short lever *202* which is mounted on a short shaft *203*. A short arm of this lever is engaged by a projection *217* on the cam *190*. (See also Fig. 76, delivery cam *219*.)

In the revolution of the machine, if the upper transfer lever has acted properly, the projection *217*, acting upon the short arm of the lever *202*, pushes the upper part of said lever out of the way of the projection, or lug, *201*, allowing the lever *192* to descend to receive a line of matrices. If, however, the transfer lever has not functioned properly the lever *202* will not be thrown out of the way, and will cause the second-elevator lever *192* to be stopped in its descent. In this case the safety pawl on the starting and stopping cam will stop the revolution of the cam shaft so as to prevent harm to the mechanism.

This pin passes through a slot in the shaft. The collar goes around the shaft. The slot in the shaft extends lengthwise of the shaft, so that when the collar is moved longitudinally the rod is likewise moved. Resting against this collar is a fork formed on the end of a lever *161*. When the forked lever *161* presses upon the collar it overcomes the pressure of the spring *171* and tends to move the rod outward. When the pressure upon the forked lever is released the spring *171*, acting upon the rod, tends to draw the rod inward. The outward movement of the rod releases the clutch: the inward movement of the rod engages the clutch.

Very little attention needs to be paid to this mechanism in the jack shaft. This spring ordinarily will last a long time. The only cause for difficulty in this part of the mechanism is due to the leathers mounted on the arms which press against the inside of the main driving wheel. These leathers should be kept clean and should not be allowed to get soaked with oil and dirt. It is necessary once in a while to take off these leathers, clean them, and replace them with a piece of hard paper underneath the leathers to compensate for the scraping that has been done which lessens the thickness of the leather.

Once in a great while the spring gives out and must be removed and stretched a little to give it more tension. The inside rim of the main driving clutch should be cleaned every day and wiped dry. Graphite, oil or greasy dirt will make the clutch slip and it will fail to eject.

Some machinists use rosin, printers' ink, belt dressing and other substances of this kind to make the clutch leathers adhere and pull. This prac-

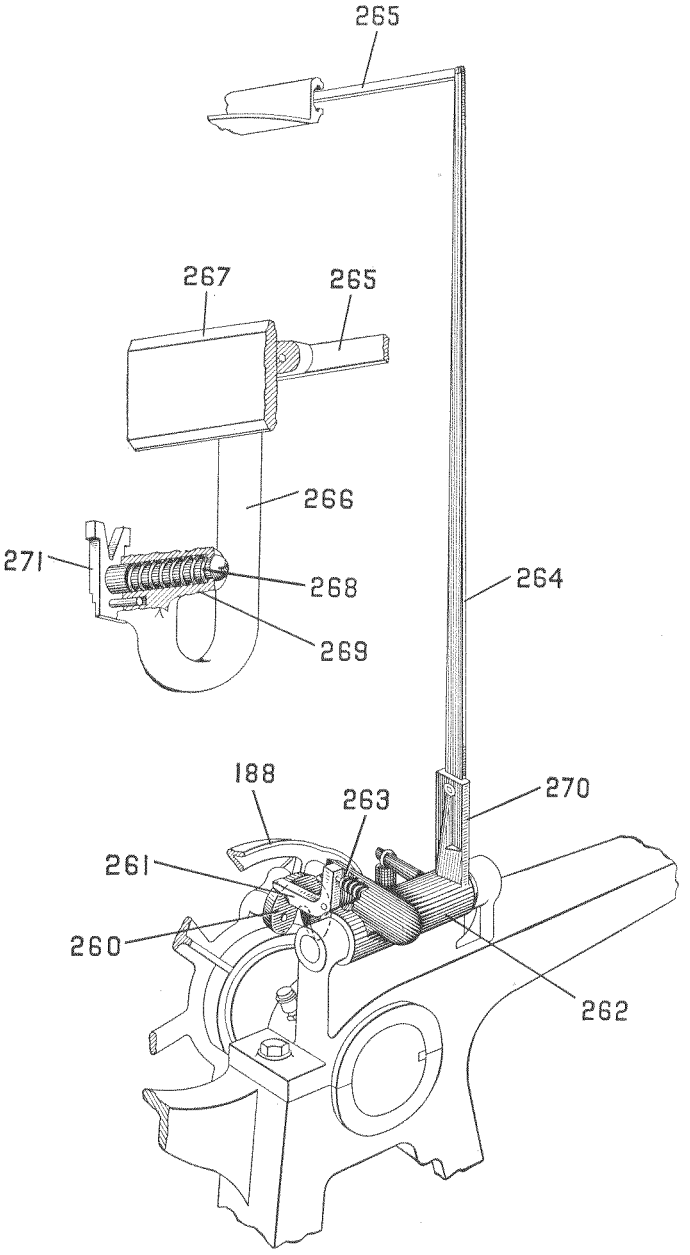


FIG. 82.—View shows distributor shifter cam *260* mounted on mold-turning cam. This cam operates through a small bell crank lever *261* through a spring *263* which acts as a safety device if distributor slide *266* catches or stops, as stated in previous Fig. 81. The spring compresses and prevents the lever *266* from breaking. The lever

262 is mounted on a shaft on the mold-arm bracket. The lever *262* has a short arm *270*, in which is mounted a long lever *264*, which carries at the upper end a link *265*. The link *265* at its upper end is connected with the distributor-shifter pusher *266*. The distributor-shifter pusher *266* has at its upper part a slide *267* adapted to run in grooves in the distributor beam.

The lower end of the distributor-shifter pusher *266* is curved and carries a pusher *271*, mounted on the spring in a short barrel. The spring *268* has a slight movement in the barrel *269*, which is in one casting with the distributor-shifter pusher, with which it functions.

tice is not a good one and should never be necessary. If the leathers are clean, the spring has the proper tension, and there is nothing wrong with the other mechanism in the machine, the clutch should work perfectly and give no trouble in ejecting the slugs or in revolving the main cam shaft with a regular motion.

On the outer end of the rod are mounted two levers, that act upon two spindles. These spindles are mounted upon the clutch wheel. These levers *174* act upon these spindles through a sort of toggle joint. At the outer side of these toggle joints there are surfaces faced with leather. When the rod *172* is pushed outward by the forked lever *161*, previously described, the leather surfaces are drawn away from the inside surface of the driving pulley. When the forked lever is withdrawn, allowing the spring *171* to act, the spring pulls the rod inward, and acting through the levers and the toggle joint described, presses the leather surfaces against the rim of the driving pulley, making a friction clutch. This clutch carries the pulley around, which drives the cam shaft through the pinion *206* mentioned. The cam being fast to the main shaft carries it around. When one revolution of the cam shaft has taken place, a dog on the cam strikes against the forked lever *161*, pushing the collar, overcoming the spring *171* on the rod, pushing the levers *174* outward, releasing the pressure of the leather surfaces upon the driving wheel, whereupon the cam shaft stops.

It is important that the leather surfaces of the clutch be kept dry and free from oil and dirt, and that the inner surface of the driving pulley be kept clean. It is necessary at times to unscrew the nut *173* and remove the clutch arms and scrape the leather surfaces to cleanse them and roughen them up so that they will take hold promptly. Before doing this, the position of the nuts should be noted, so as to replace them as before removal. This nut *173* is the adjustment for the pressure of the spring, and by screwing it in or out a little, the tension of the spring may be increased or diminished. Sometimes after long use the spring loses its tension, and it is necessary to take out the spring and stretch it. As the friction clutch described is the driving mechanism for the whole machine during its cycle of operation, for the smooth and effective working of same it is important that the clutch should work smoothly and effectively; hence this part of the mechanism should not be neglected.

In this connection it may be well to speak of the driving power.

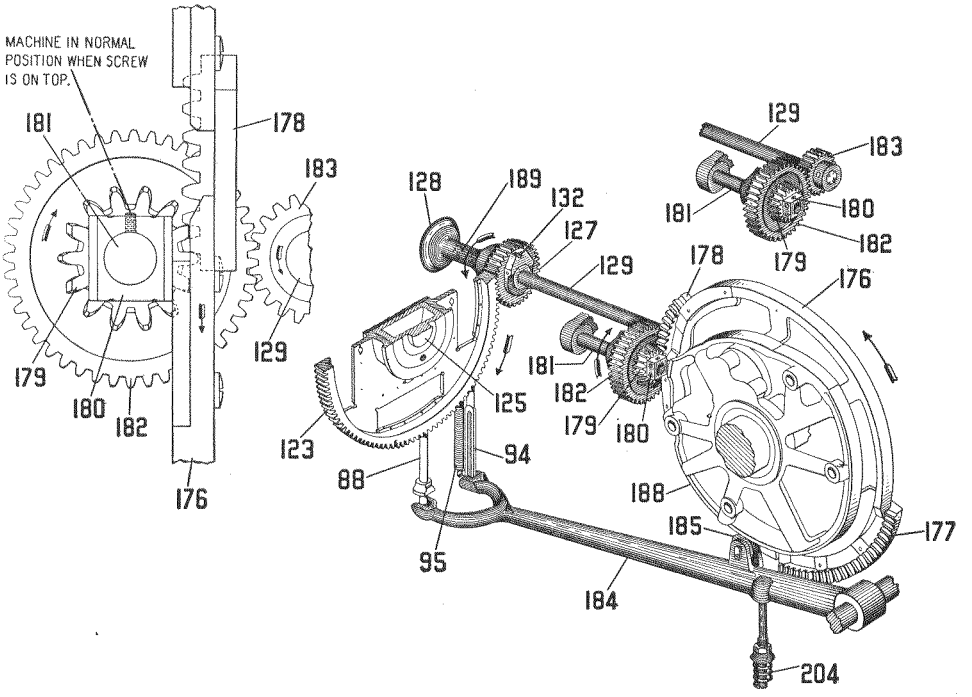


FIG. 83.—View showing the mold-turning and justifying cam and the method by which the mold disk is revolved and held in position at the points of casting and ejection. *176* is the cam casting. *177* is the long segment and *178* the short segment. These segments *177* and *178* are portions of a circular beveled gear and are fastened to the cam casting *176*. These segments in the revolution of the cam at certain parts of the revolution engage with the beveled pinion *179*.

Just back of the beveled pinion *179* is a square block *180*. This block rides on a surface of the cam casting *176*. This surface is cut away at certain points so as to permit the block *180* to revolve. At this time the segments *177* and *178* are in mesh with the beveled pinion *179*.

While the block *180* is riding on the inside surface of the cam *176*, the beveled pinion *179* cannot turn and the shaft *181*, on which the beveled pinion is mounted, is also held against revolution.

In front of the beveled-gear pinion is a spur pinion *182* mounted on the shaft *181* and fastened to it. This pinion *182* is in constant mesh with a pinion *183* mounted on a shaft *129*. This shaft runs forward and has at the front end of it another pinion *127* mounted.

When the segments *177* and *178* are in mesh with the beveled pinion *179*, the shaft *129* is caused to revolve through the spur pinions *182* and *183*. When the segments *177* and *178* are not in mesh, the block *179* holds the shaft *129* stationary. This arrangement is what is known in mechanics as a "Geneva lock".

It will be noted that on the pinions *177* and *178* the tooth that engages first with the beveled-gear pinion is partly cut away.

The pinion *127* is not fast to the shaft *129*, but is held to the shaft by a device which embraces a hand wheel *128* and a pin *132*, shown in another view. The pin *132* engages in a hole in the pinion *127*, and is held in this position by a spring *189*, not shown because it is inside of the pinion.

It will be readily seen that the revolution of the cam *176*, acting through the sectors *177*, *178*, the beveled pinion *179*, the spur gears *182* and *183*, will revolve the shaft *129*, turning the pinion *179*, and thereby revolving the mold disk *123*.

On the other hand, when the block *180* is riding upon the surface of the cam *176* and the sectors are not in mesh with the beveled pinion *179*, the shaft *129* is held against revolution and the mold disk is likewise held. This is at the time when the casting and ejecting take place.

184 is one of the justification levers which also carries the locking and unlocking devices described in another place. Through the roller *185* this cam bears against the justification cam surface *188*. The justification lever *184* is urged upward continually by the justification spring *204*. The cam surface *188* is of a shape to allow the spring *204*, acting through the lever *184* to force upward the spacebands for the justification of the line illustrated and described elsewhere.

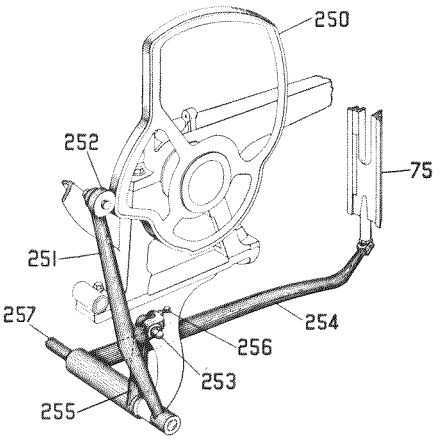


FIG. 84.—View of the first-elevator slide cam. In this view *250* is the cam surface. This surface has a very peculiar shape and gives to the first elevator five different movements in the course of one revolution.

The cam surface *250* acts against the lever *251* through the roll *252*. The lever *251* has a lug, or projection, upon it, and in this lug, or projection, a bolt *253* passes through, connecting the elevator lever *251* to another lever *254* through a short arm *255*.

The bolt *253* passes through a hole which is not round, but slightly enlarged laterally, and a bolt *256* makes a slight adjustment between the levers *251* and *254*.

The outer end of the long lever *254* connects with the first-elevator slide *75* through the spring barrel.

Both the levers *251* and *254* are mounted on a shaft *257* which is supported in bearing on base.

Just above has been mentioned the subject of the clutch and sometimes the clutch is suspected of being wrong and attempts are made to fix the clutch when the trouble is with the power or the application of it to the driving of the machine. Most Linotypes are now driven by individual motor and these motors are nominally one-third horse power and use both A.C. and D.C. current. In different places and offices on account of the voltage and various other causes the machine sometimes runs irregularly, running faster at one time than another. It is important that when the cam

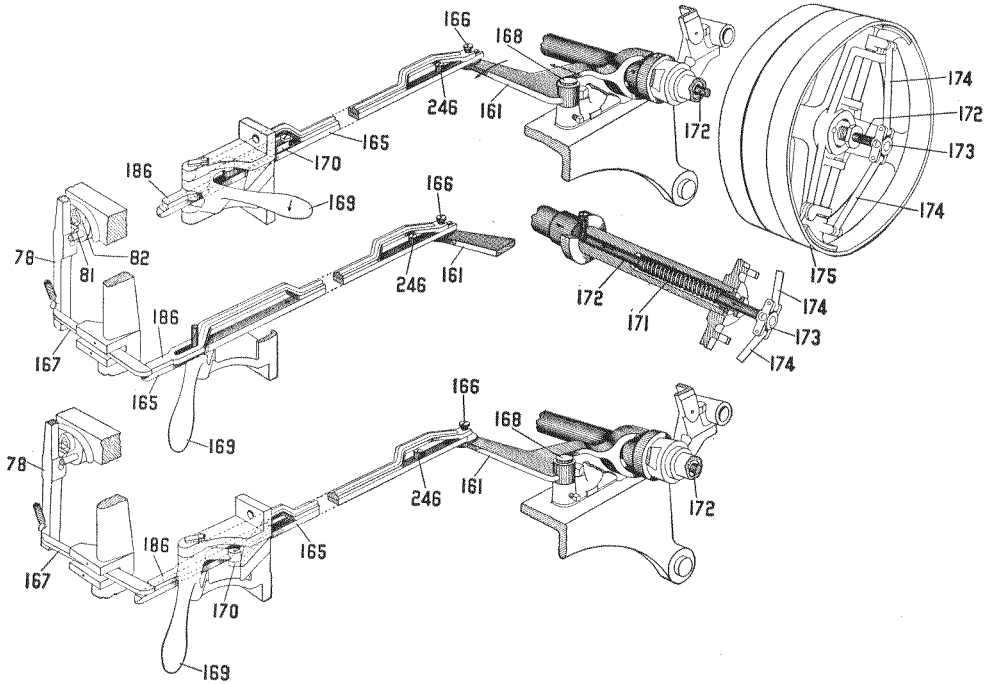


FIG. 85.—View of the starting and stopping lever in various positions and the connections of this lever to the driving shaft friction clutch.

169 is the hand lever by which the operator can start or stop the cam shaft at any period of its revolution.

165 is a rod which connects the lever *169* with the lever *161*. This lever is forked over the driving shaft. This fork works against a collar on the driving shaft to throw out the clutch.

172 is a rod running inside of the driving shaft and is actuated inward by a spring. When this spring is permitted to act it engages the clutch causing the driving shaft to revolve and the cam shaft to make its revolution.

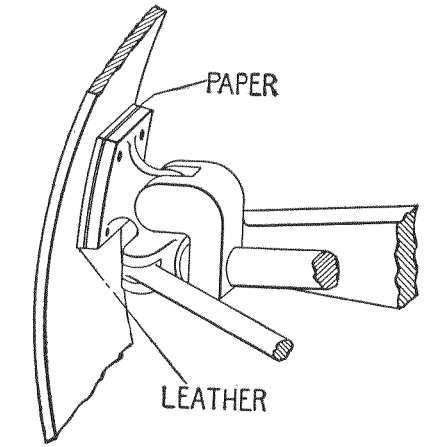


FIG. 86.—Diagram showing a method of packing out the leathers in the clutch. If these leathers become worn, if the clutch is removed from the machine and a piece of hard manila paper placed underneath the leathers, it will pack them out so that they can be used for a longer period. This packing operation with paper can be renewed several times before the leather is completely worn.

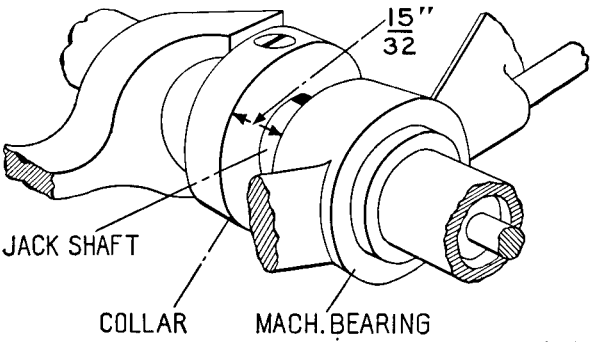


FIG. 87.—Diagram of the operation of the clutch, showing the jack shaft, collar, the bearing of the machine, and the distance that the collar should stand from the bearing of the machine, as set forth in the description.

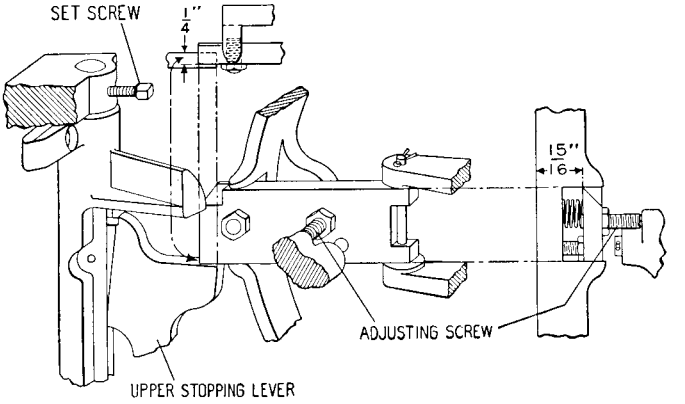


FIG. 88.—View of the stopping mechanism of the machine, showing the distances for adjustment when the machine stops in normal position.

shaft starts to revolve that it should revolve at a regular speed and that the power required to drive it be furnished so that when the cam shaft is revolving the distributor and other parts of the mechanism of the Linotype will not slow down. When this occurs it may cause transpositions in the assembler and bad distribution.

In some cases the machine is driven by a belt connected to a main shaft. When this is the case the shaft should have an independent power. It is not well to have the machine connected to any shaft that drives other mechanism because in this case there may be irregular motion of the cam shaft, resulting in the troubles above mentioned.

THE LOCK-UP

The lock-up of the pot crucible against the mold, and the mold against the matrices, and the matrices in the jaw against the vise cap at the time of casting, have been previously mentioned, but will now be described in

more detail. The smooth working of the machine depends very much upon a good lock-up. A good lock-up requires that the mouthpiece be straight and smooth, and exactly parallel to the mold. At the bottom of the lugs on which the pot crucible is mounted is an adjustment, both vertical and

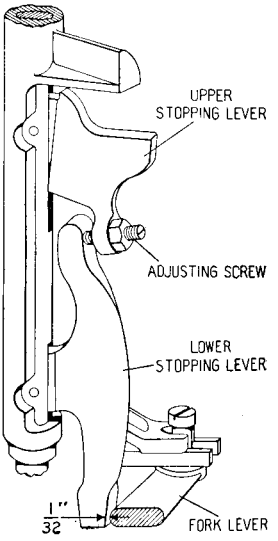


FIG. 89. — Diagram of the starting mechanism, showing also the adjustments and the distances for clearance.

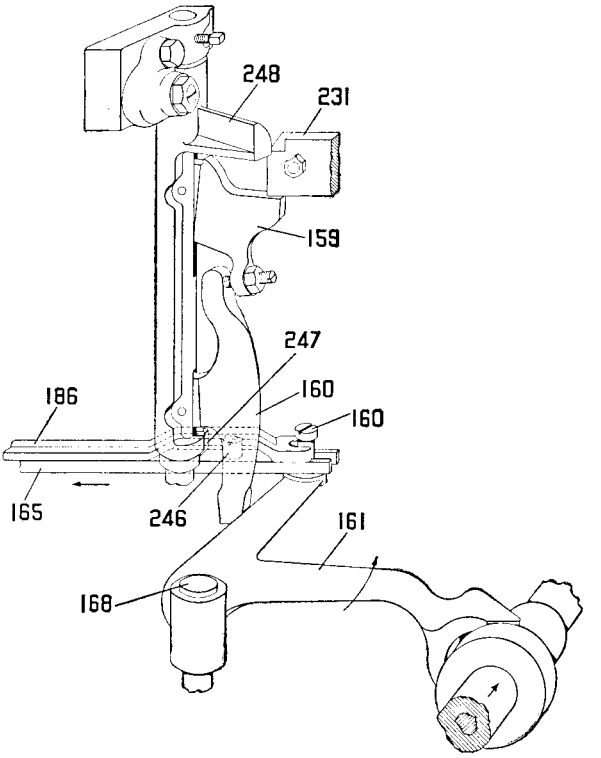


FIG. 90.—Diagram of the starting and stopping pawls, levers, and bell-crank, which act on the driving clutch.

161 is the bell-crank. *160* is the lower lever. *159* is the pawl. *231* is the starting and stopping dog. *248* is the lug on lever which knocks off the automatic stopping pawl when the handle *169*, shown in Fig. 85, operates the lever *186*.

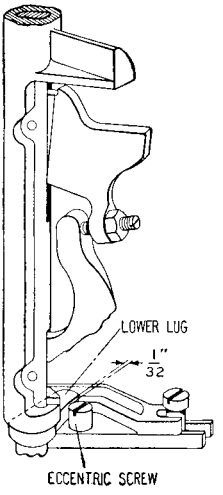


FIG. 91.—Adjustment and distances for the hand-stopping lever.

horizontal, as shown in Fig. 64, by which the pot and the mouthpiece may be adjusted, so as to get this parallelism. The mold is mounted in the mold disk, which is mounted on the mold slide. The mold slide does not fit closely in its guides, and should not do so. There should be a slight looseness in the mold slide sideways, so that the mold can adjust itself to a slight degree when it comes upon the mold-banking pins on the vise frame. The first-elevator jaw, in which the line of matrices is contained, is backed up at the time of casting by the vise cap and the vise frame. Therefore it is necessary that the vise frame and the vise cap should be also exactly parallel to the mold. There is no mechanical adjustment for the vise frame, but a slight change can be made by putting in thin washers in the locks that hold the vise frame to the main frame of the machine.

TESTING THE LOCK-UP

The Linotype machine, as it leaves the factory, has the lock-up in proper relation. In the operation of the machine, however, the heat is suddenly applied to the mold from fifteen hundred to two thousand times a day, and a quick cooling process follows. This very rapid heating and

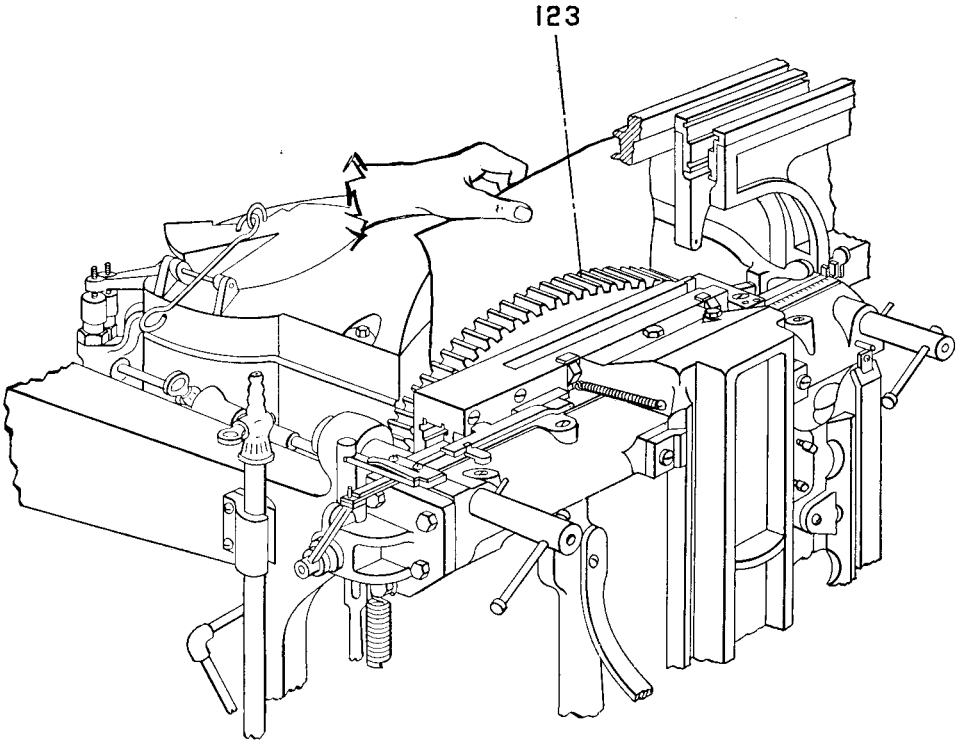


FIG. 92.—View showing the means of inserting a piece of tissue paper between the mouthpiece and the mold in testing the lock-up.

cooling of the mold sometimes causes it to warp slightly. The action of the machine may in time derange the lock-up so that it must be brought back to proper position. The same conditions of heating and cooling make the mouthpiece go out of shape slightly at times. Any derangement of the lock-up permits the escape of the molten metal, which, of course, must be avoided.

It may be generally assumed that the vise cap is in the proper position and the first thing to find out is whether the first-elevator jaw comes back against the vise cap properly. This will always be the case unless

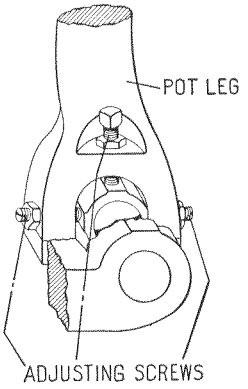


FIG. 93.—View of the bottom of the pot jacket leg, showing three adjustment screws and lock nuts. The adjusting screw at the top is for height and the adjusting screws on the sides for the position from front to rear. By the use of these adjustments the holes in the mouthpiece can be brought into exact line with the mold in the mold-disk.

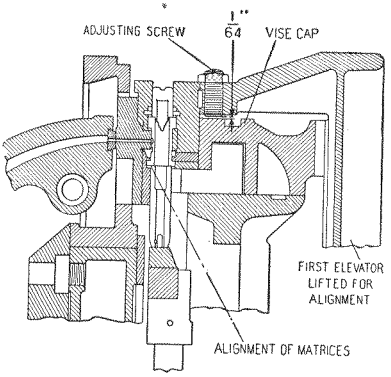


FIG. 94. — This is a small view of the "locker," as it is called, showing the first-elevator jaws, the vise cap, the line of matrices and spacebands, the mold against the same, and the pot crucible against the mold, at the time when the cast takes place.

This view also shows the means by which the alignment takes place through the lifting of the first elevator, bringing the lower lugs of the matrices against the mold.

the first-elevator jaw has been bent or sprung in some way, in which case, of course, it must be straightened. The vise cap must support the first-elevator jaw at the time of the lock-up.

The mold should then be brought against a line of matrices (using a full 30-em line) with a piece of tissue paper between the matrices and the mold. This will show whether the mold is warped on its front side. In making this test care should be taken that the mold is in its proper position in the mold disk and that the screws holding it to the disk are tight.

If a smooth even bearing is obtained along the whole length of the line of matrices a piece of tissue paper should be put in back of the mold disk between the mold and the mouthpiece. The mouthpiece should then be brought up against the mold and the line of matrices. The tissue paper will show whether there is a good bearing along the whole line. Some machinists prefer to use red lead on the mouthpiece instead of using the tissue paper. It is at this point that the lock-up is most likely to be found defective. If there is not a good bearing of the mouthpiece against the mold, the mouthpiece must be trued up and made to fit against the mold. This is an operation requiring some skill in the use of a file and should not be done by any one who has not such skill. If the machinist or operator has never adjusted the lock-up it is better to have an experienced Linotype machinist perform this operation, and he should be carefully watched by the one in charge of the machine. Like many other things, the adjustment of the lock-up is not a very difficult matter if you know how. A good lock-up, however, is absolutely essential to the efficiency of the machine. Much time is lost in cleaning out squirts and it is easy to damage matrices and the machine in such cleaning.

GAS BURNER

The ordinary gas burner using illuminating gas is of the Bunsen type, and contains a device for mixing air and gas in proper proportion, so that the mixture will burn with a blue flame. A subsidiary pipe is carried from the burner underneath the pot to a burner directly underneath the mouthpiece. The control of the gas is by means of an ordinary stop-cock and a device known as a "thermostat governor."

The metal should have a temperature of between five hundred and thirty and five hundred and sixty degrees Fahrenheit. The governors must be adjusted so that when the machine is working regularly the metal will not fall below five hundred and thirty degrees, and when it gets to five hundred and sixty degrees will be partially shut off, so as not to allow the heat to increase beyond that point.

THERMOSTAT GAS GOVERNORS

The action of the Thermostat and the method of regulating it should be thoroughly understood in order to get the best results from the gas burner.

The principle upon which the Thermostat is built, is the difference in expansion of two metals under heat.

That part of the Thermostat which is immersed in the metal, being cast iron and having a hole or pocket in it, in which is a rod of composition metal the upper end of which operates a lever due to the expansion of the rod being greater than the cast iron, and the lower end pushing against the bottom of the hole, or pocket. The lever in turn at its other end operates a valve which closes the gas inlet when the heat from the metal expands the rod, and as it contracts the gas inlet is again opened.

In Fig. 95 *A* represents thermostat casting, *B* expansion rod pushing against lever *C*, which is hinged at *D*. The other end of lever *C* operates valve *E*, through screw *F* and spring *G* with locknuts *H*. Spring *I* raises valve as expansion rod *B* contracts, which opens gas inlet, and also keeps expansion rod pushed to bottom of pocket. Spring *G* is simply a safety spring, and only works when for any reason the gas valve is entirely closed and the expansion rod keeps on expanding. It provides for an overthrow and prevents breaking of other parts. This spring *G* should always be

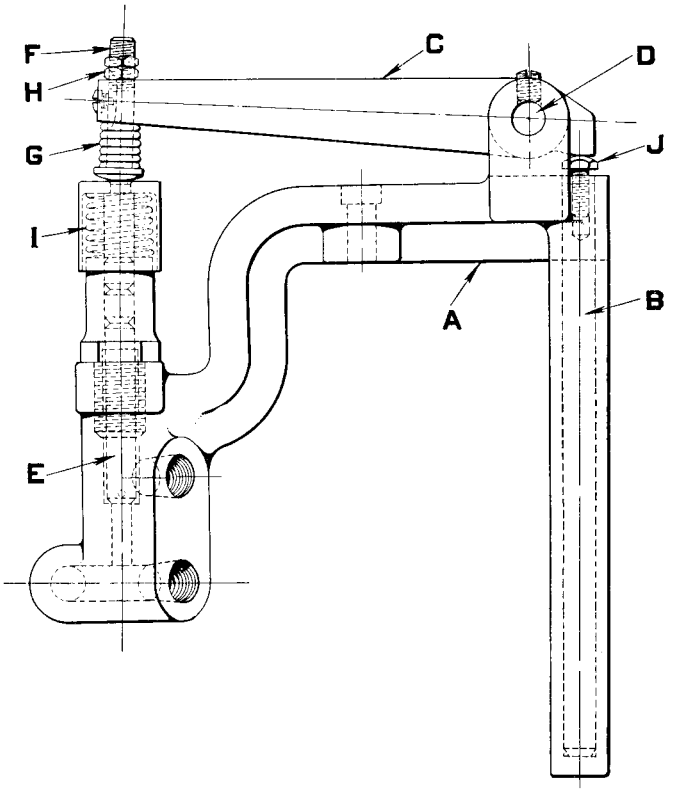


FIG. 95.—*A*, Thermostat Casting; *B*, Expansion Rod; *C*, Lever; *D*, Fulcrum Pin; *E*, Valve; *F*, Adjusting Screw; *G*, Safety Spring; *H*, Locknuts; *I*, Overthrow Spring; *J*, Adjusting Screw.

stronger than spring *I*, but locknuts *H* should never be screwed down far enough to close coils of spring *G* so it will not operate.

To adjust thermostat if metal is not hot enough, screw locknuts *H* farther down, so as to raise screw at *F* in Fig. 95, which makes it necessary for expansion rod *B* to expand farther to close off gas. If metal is too hot, unscrew locknuts *H*, which makes gas valve close quicker.

Do not disturb or adjust screw *J*, unless in making adjustment for too hot metal, locknuts *H* are unscrewed so far as to make spring *G* weaker than spring *I*. If this occurs it will be necessary to unscrew *J* so as to make expansion rod longer and readjust locknuts *H*, until spring *G* is stronger than spring *I*. To adjust screw *J* it will be necessary to take out hinge pin *D*, and take expansion rod *B* out of the casting.

In the lower end of valve *E* is a small hole to prevent the burner going out if valve is entirely closed. *This hole must not be enlarged.*

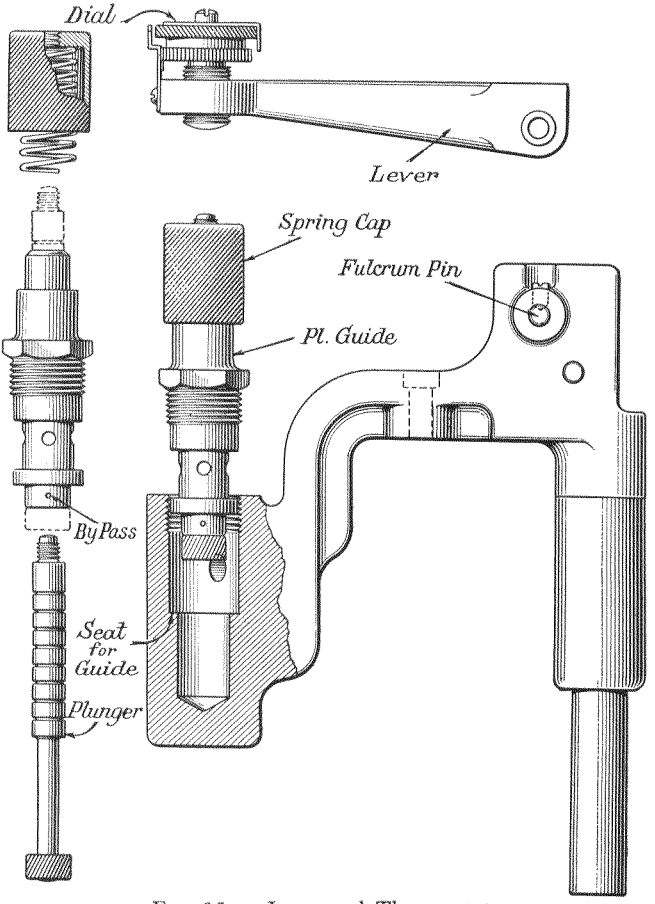


FIG. 95a.—Improved Thermostat.

IMPROVED THERMOSTAT

Above, in Fig. 95a, is shown a greatly improved thermostat which is now applied to all new Linotypes. The basic principle is somewhat similar to that shown in Fig. 95, but its mechanical design and operation permits of greater ease in adjustment and sensitivity in action. This thermostat is

easily disassembled for cleaning if the directions are followed closely. It is extremely sensitive to fluctuation of gas pressure and will control the temperature of metal within close limits. Each thermostat is calibrated and tested under actual working conditions at the factory and adjustments should not be disturbed unless it becomes absolutely necessary.

Disassembling and Cleaning.—The Thermostat shown in Fig. 95a, like similar gas controlling devices, should be taken apart and cleaned occasionally. This can be done quickly and easily if the following instructions are observed and reference made to the accompanying illustration.

Remove fulcrum pin by loosening set screws, and then take out lever. Unscrew and lift out plunger guide. Hold the plunger guide *in your hands,* unscrew the spring cap and remove the plunger. These parts are assembled by hand in the factory. The use of tools or vise may destroy alignment. Clean out by pass, wipe off and rub plunger with graphite.

Reassemble—Do not try to screw plunger guide down to the hexagon head, as it seats on bottom, as shown.

Graphite fulcrum pin—*don't use oil.*

Setting—This thermostat was calibrated and set at the factory, where the gas pressure may vary from yours; therefore, test the thermostat by using a thermometer in the metal pot. When the thermometer registers 550 degrees Fahrenheit, loosen the screw at top of the thermostat and turn the dial plate until it corresponds with the thermometer, thus insuring its future accuracy.

IMPERFECT JUSTIFICATION

After the mold disk comes forward the first time, bringing the mold against the matrices, it should retract a little, about .01 of an inch, so that, during the operations of alignment and justification, the mold will *not be against the matrices.* If the mold does rest against the matrices at this time, the friction of the matrices against the mold will be so great that when the justification levers are driven up they will stop before the line of matrices is completely spread out, or justified, and a "squirt" of metal may result. Whether the mold rests against the matrices can be tested by a strip of paper, as shown in Fig. 92, which is inserted between the mold and the matrices. After the slight retraction of the mold mentioned, it should be possible to pull out this piece of paper. If the paper is still tight, it shows that the mold has advanced too far, or has not retracted enough, and it should be adjusted by the adjustment shown at *152* in Fig. 64.

REMOVING THE MOLD SLIDE

If the operator has occasion to remove the mold slide, as shown in Fig. 96, it is necessary, when it is returned, that the mold-turning pinion should mesh with the proper tooth in the mold wheel. There is a small circular mark made with a punch on a tooth in the mold-turning pinion

and a corresponding mark on a tooth on the mold wheel. When the mold slide is returned to the machine, the mold wheel or pinion should be turned so as to bring these two marks in register. The mold-turning pinion and mold wheel will then be in proper mesh.

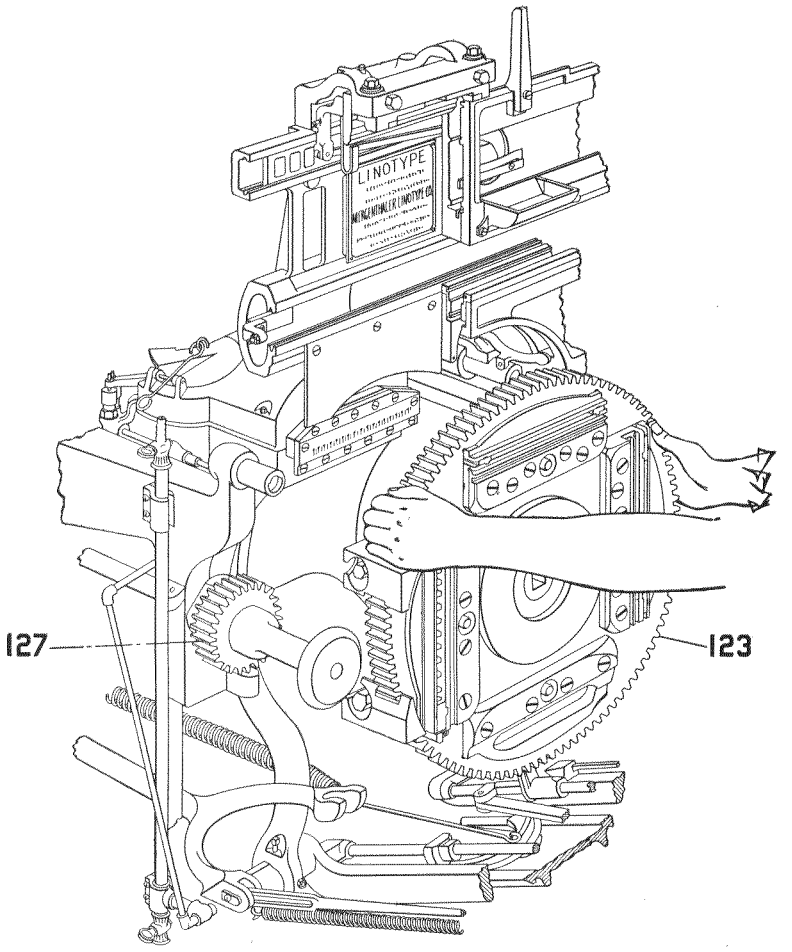


FIG. 96.—View showing the vise lowered and the mold disk and slide being pulled forward.

REMOVING THE WEDGE MOUTHPIECE

It is necessary at somewhat long intervals to remove the mouthpiece and clean out the throat of the pot. This operation requires some skill and care, particularly in connection with the old style wedge mouthpiece, which is no longer standard. The tapered wedge holds the mouthpiece tight in the beveled groove in the forward edge of the pot. To remove the

mouthpiece it is necessary to drive it a short distance to the right, as you stand in front of the machine. This should be done while the mouthpiece is hot, and a pot-mouth drift, or its equivalent, should be used in driving the mouthpiece. A small steel drift is used but care must be taken that it does not burr the end of the mouthpiece. As soon as the mouthpiece has been driven a little to the right, the tapered wedge will be released, and it can be driven in the opposite direction, and the mouthpiece and wedge can then be removed from the crucible, giving access to the front side of the pot. A peculiar tool is used to scrape out the throat of the pot.

In driving the mouthpiece and the tapered wedge a succession of light blows should be tried. If the pot has been run for a long time there forms around the joints, between the pot, the mouthpiece and the wedge, a white oxide of lead. This oxide goes into the cracks in the form of a gas and finally deposits or precipitates, as chemists would say, a white substance that they call "dioxide of lead." This white substance forms a tight joint that makes it quite difficult at times to drive out the wedge and the mouthpiece. This deposit of white powder can be partly prevented if the bearing surfaces of the wedge and mouthpiece are rubbed with a mixture of linseed oil and graphite, or red lead and glycerin. A thin film of this rubbed on the wedge and the mouthpiece diminishes the formation of this white deposit, and will make it very much easier to remove the mouthpiece and the wedge next time.

In replacing the mouthpiece and the wedge, care must be taken not to drive the wedge in too tightly. This may spring the cast-iron mouth so that it takes a permanent "set" and a leakage of the metal will take place. Sometimes the mouthpiece will not leak for a time, but after a while, under the strain, the cast-iron will warp. In this case, when the wedge and mouthpiece are removed, the beveled face of the mouth of the pot must be filed straight. This requires considerable skill and should not be attempted by one who is not an expert with a file. To one who knows his business, however, it is possible to bring the seat for the mouthpiece straight again and fit the mouthpiece to it. If this warping is not very bad, a paste made of litharge and glycerin, painted on the bearing surfaces of the mouthpiece and pot, and allowed to harden before the machine is used, will sometimes cure a leak.

THE MOUTHPIECE

The throat of the pot crucible, where it fronts the mold, is closed by a part called the mouthpiece. This is a strip of metal having beveled edges and tapered to correspond to beveled grooves in the pot-crucible casting. To hold this mouthpiece firmly in position a wedge is used, tapered in the opposite direction from the mouthpiece, and arranged to fit in the casting of the pot crucible, the other part of the wedge bearing against the mouthpiece. When the wedge is driven home it presses the mouthpiece firmly into the beveled grooves in the pot crucible and makes a tight joint, leaving

only the holes in the mouthpiece through which the metal can escape when the pump plunger descends. This mouthpiece is shown on Fig. 96. It is fastened to the pot with screws instead of gib.

To remove it, first use a pot screw loosener. Insert the lip in screw slot; hold the tool firm against the head of screw. With a hammer strike the head of tool several light blows. This jolt will loosen the screw. It is important to have a good screwdriver that fits the slot of screw to unscrew them.

In replacing mouthpiece, be sure to remove all metal, both from the mouthpiece and face of pot. If, for any cause, the face of pot is warped it can be straightened by lapping seat with mouthpiece. This requires some skill and should not be attempted by one who has not had some experience. When replacing the screws, apply a mixture of linseed oil and graphite. This will facilitate the removing of screws.

THE PUMP PLUNGER

At least once a week, better every day, the pump plunger should be removed from the well in the pot, while the metal is hot, and thoroughly cleaned. A wire brush is furnished for this purpose. When using the wire brush in the well, be sure to turn it always to the right, otherwise the bristles may break off and stay in the well. While the pump plunger is out the inside of the well of the pot should be thoroughly cleansed. Various scrapers and cleaners have been invented for the purpose of cleaning the inside of the pump well. These should be used with great caution, as it is very easy with such devices to enlarge the well so that the metal will escape around the plunger as it descends, and a good slug will not be obtained. The two holes in the side of the well should be kept open, using the end of the mouthpiece wiper, which is bent at right angles and pointed. If the pump plunger is clean, the metal in good condition, and the throat cleaned out at intervals, as previously described, there will be no trouble about the passage of the metal.

SUNKEN FACES ON SLUGS

If the pump plunger is dirty, or if the throat of the pot is clogged, there will result sometimes a sinking in of a letter or letters on the slug, and on examining, a hollow or bubble of air will be found beneath these sunken letters.

There is one other cause for the sinking of the letters, which is a lack of proper venting. The vents are little grooves or cuts made alongside or underneath the holes in the mouthpiece through which the metal is forced into the mold. The object of these vents is to allow the air to escape. When the metal is forced into the mold by action of the pump, if the metal flows freely, the most solid part of the slug is directly underneath the letters, and the air that is in the mold is either forced out alongside of the matrices or is driven back toward the bottom of the slug. Part of

the air will escape through these little vents, a small portion of the metal following the air and filling the vents. These little particles of metal in the vents adhere to the bottom of the slug and are shaved off by the back knife.

These vents will need to be more numerous in some machines than in others. The better the lock-up the more vent is needed. It will be plain that if the mold fits tightly against the matrices and the mouthpiece tightly against the mold, everything is parallel and exact in the lock-up, the only chance for the air to escape is through these vents. If the mold should be slightly warped, or the mouthpiece, or there should be any lack of parallelism in the lock-up, the air has a better chance to escape, and the vents do not need to be so large or so many in number. On the other hand, in this case, more metal escapes alongside of the mouthpiece, and the mold and the machine is said to "spit," and a considerable amount of metal will be driven downward, finally lodging upon the floor. This is to be avoided, as with a good lock-up and proper venting, little or no metal will "spit," and the slug will be clean and solid, with a clear, sharp face.

LINOTYPE METAL

To get the *best* results from your Linotype it is absolutely necessary to use the *best grade of Linotype metal.* Anything less than that simply *won't do.* The metal used must be the *best grade obtainable.* And even that *best grade* must be *kept* that way; that is, kept clean and correctly balanced at all times. To keep that good metal good and giving best results at every cast, the following must be observed:

The one doing the remelting must be competent and conscientious.

A good-sized modern remelting furnace must be used.

The molten metal must never be overheated or allowed to stand very long while molten. (600 degrees is about right.)

All foreign matter must be kept out—especially copper, brass and zinc.

The molten metal must be thoroughly and continually stirred, and correctly treated with Reductio before being skimmed and poured.

When the dross has been removed, the metal must be poured quickly and from the bottom of the pot.

On the Linotype itself the temperature of the molten metal must be maintained at from 525 to 550 degrees.

The machine pot must be kept fairly full at all times, with the surface of the molten metal kept above the top of the well.

Cold metal must be introduced gradually—not too much at a time.

Slugs must not be remelted on the Linotype, but in the remelting furnace.

Dross must be removed from the surface of the metal once a day, but seldom oftener, for the dross forms a blanket that helps to retain heat and minimizes oxidation.

The burner of a gas-equipped Linotype must be adjusted to produce a steady blue flame; and the pressure of gas in the supply pipes must be kept as low as possible consistent with the production of such a flame.

That it is a simple task for a competent person to keep good metal clean and up to standard we shall show later on; but first let us consider the chief characteristics of Linotype metal.

"Combination" metal should not be used on the Linotype. By "combination" metal is meant metal alloyed for use not only on the Linotype but in the stereotype department and possibly on other machines. Such metal can be alloyed to work fairly well for both linotyping and stereotyping, but only fairly well. It will not be ideal.

The ideal metal for use on the Linotype must have proper composition, purity, and microstructure. This is attained by the alloying of as nearly pure as possible lead, antimony and tin in proportions of about eighty-five per cent of lead to eleven of antimony and four of tin.

Lead alone is too soft; but the fact that it has a low melting point makes it a good basic metal for use with antimony and tin. Antimony lends both hardness and fluidity to lead (hardness when cold and fluidity when molten), and fills out the mold by expanding just as solidification occurs. Tin, by combining the lead and antimony, holding them together, as it were, lends body to the metal. It also adds considerably to its toughness and gives the resultant characters smooth, even faces. Moreover, by enhancing the fluidity of the alloy, tin permits the use of the metal at a lowered temperature with good results.

Dross.—Dross is the waste substance resulting from oxidation—from the metal absorbing oxygen from the air. The hotter the metal becomes, and the longer it remains molten, the more dross results. Undue agitation of the metal, by continually exposing fresh surfaces to contact with the air, makes for increased dross production. Every bit of dross removed, of course, reduces the original supply of metal, and for that very reason every pound of dross removed should be replaced with a pound of new metal, the new metal being added to the older in the remelting furnace, *and not in the metal pot of the Linotype.* This procedure must apply even when the new metal is received in pig form for use in metal feeders.

Naturally, the metal of lowest melting point oxidizes faster than the others. Tin oxidizes faster than lead, and lead faster than antimony. An alloy which contained originally, say, about eighty-five per cent of lead, eleven per cent of antimony, and four per cent of tin, after many remeltings may have changed to about eighty-four and three-quarters per cent of lead, twelve and one-quarter per cent of antimony, and three per cent of tin. The percentage of antimony rises in proportion as the lead and tin percentages decrease through oxidation.

Undue loss of tin necessitates increased temperature, and makes for poor faces and hollow slugs. Undue loss of antimony causes the alloy to

become too soft to withstand long press runs; an excess of it tends to clog up the crucible throat and the mouthpiece holes.

Dross loss should not amount to more than two per cent, and can and should be kept down to one and one-half per cent. But carelessness may cause a much greater loss.

Remelting.—The important business of remelting must be done by a person (preferably a grown man) thoroughly aware of his responsibilities, and conscientious enough to perform his duties properly. Many alleged "metal troubles" are directly traceable to the fact that the remelting has been entrusted to some mere lad unqualified for the task. Such important work must not be turned over to a boy who may care little whether harmful foreign substances get into the metal, or who, to rush things through, may improperly stir the alloy or skim it too soon, or let it get too hot, or even leave it in a molten state for so long a time that much needless loss of antimony and tin will result. When it is considered that in one hour's time, say, it is possible to pig an entire week's supply of metal for a Linotype, and that any carelessness in pigging taking place in that one hour may affect the output of a machine and operator for a whole week or more, it will readily be appreciated that the remelting must be entrusted only to competent and conscientious persons.

Heat must be applied slowly to the remelting pot (so that the whole mass of metal will become fairly evenly heated and no portions greatly overheated), and gradually increased until a temperature of about 600 degrees has been attained. A thermometer should be used to take the temperature, but in the absence of a thermometer a piece of white uncoated paper may be used with fairly satisfactory results. The paper should be immersed in the molten metal for three seconds. If, upon being withdrawn, the paper is a chestnut brown in color, the temperature is about right. If the color is lighter, the temperature is too low; if scorched, too high.

The molten metal must be thoroughly stirred before the dross is removed or the metal poured. The stirring must be done from the sides of the pot, downward and across. The sides and bottom must be thoroughly scraped, to remove any dross that may be clinging there.

When the stirring is begun, a quantity of Reductio, a special preparation for purifying Linotype metal, and for sale by all agencies of the Company, must be stirred into the metal. Reductio quickly brings impurities to the top, promotes cohesion of the lead, antimony and tin, and, by saving a large percentage of the richer ingredients which usually are skimmed off with the dross, adds considerably to the life of the metal. A one-pound can is sufficient to clean three tons of metal. Full directions for the use of Reductio are carried on each dust-proof covered can.

If, just before the stirring is completed, the metal is given a circular motion, the dross will be attracted to the center of the surface and more readily may be removed.

Skimming must continue until the surface of the molten metal is like a mirror, and then becomes covered with light cobwebby lines.

After the dross has been removed, the metal must be ladled quickly, and from the bottom of the pot, to avoid separation of its elements and to minimize the dross-loss.

Dross should be remelted at least once. When a sufficient quantity has accumulated, it should be placed in the remelting furnace on top of enough regular metal to cover the bottom of the pot. The regular metal on the bottom, by holding the heat, makes it easier to attain the required higher temperature. When the temperature reaches 600 degrees, the contents should be treated with Reductio and then skimmed. The heat should then be increased, another treatment of Reductio given, and additional skimming done. Then the contents should be quickly poured.

Too much emphasis cannot be given the importance of stirring the molten metal well. The three basic elements of the alloy—lead, antimony and tin—are of three different specific gravities and when in a molten state will separate unless stirred thoroughly and constantly. If the metal is not properly stirred, a large percentage of the antimony and tin will rise to the top and may be skimmed off with the dross.

Another important point is the heating of the metal to the proper temperature—about 600 degrees. If the metal is stirred and poured when the temperature is too low, the alloy will be improperly mixed, and much antimony and tin will be removed with the dross. If the temperature is too high, excessive oxidation will result and an undue amount of antimony and tin will be lost.

Some Metal "Poisons."—Some of the things that most often contribute to the contamination of unbalancing of Linotype metal, in addition to dirt, improper stirring and overheating, are copper, brass and zinc. None of these metal "poisons" should be permitted to enter the metal pot.

Even the slightest amount of zinc is bad.

Copper, by unduly hardening the metal, will contribute to mouthpiece stoppage, and will have a bad effect on the trimming knives.

Zinc etchings, brass rules and matrices, battery plates, old lead pipes and foundry type must be debarred.

Electrotype trimmings that accumulate beneath saw trimmers must not be mixed with Linotype metal. If, by mistake, a copper shell gets into the remelting furnace, it will rise to the surface, and must be quickly removed.

Retoning.—Occasionally a proportionate quantity of new metal must be added to the old, the old, of course, having first been freed as much as possible from impurities. The new metal, we repeat, must be thoroughly mixed with the old in the *remelting furnace,* and not placed directly in the metal pot of the Linotype. Unless the old metal has become too impoverished, such treatment usually will serve to keep a metal supply in good working condition.

When Linotype metal has become unbalanced and is causing trouble of any sort, no chances should be taken on retoning the metal haphazardly, but the advice of some competent metal company should be solicited. And be sure to state the exact nature of the trouble.

An approved way to secure representative samples of a metal supply for analysis by a metal company is for some person in a plant to select one slug a day from the regular output of the plant, for from six to ten days. Such slugs will constitute a fairly representative sample, and will enable the metal company to prescribe the proper toning metal.

No single toning formula can be followed in all cases. Each case must be treated as a special problem. Sometimes it is found advisable to replace an old supply of metal with an entirely new one.

It is well to have the metal supply analyzed and retoned at regular intervals.

IV. Distribution

We now come to the third great division of the Linotype mechanism. We have followed the matrix from the magazine to the assembler, and thence to the casting mechanism, and the slug has been produced by the injection of the molten metal by the pump in the pot crucible. The action of the cam shaft now withdraws the pot from the mold, withdraws

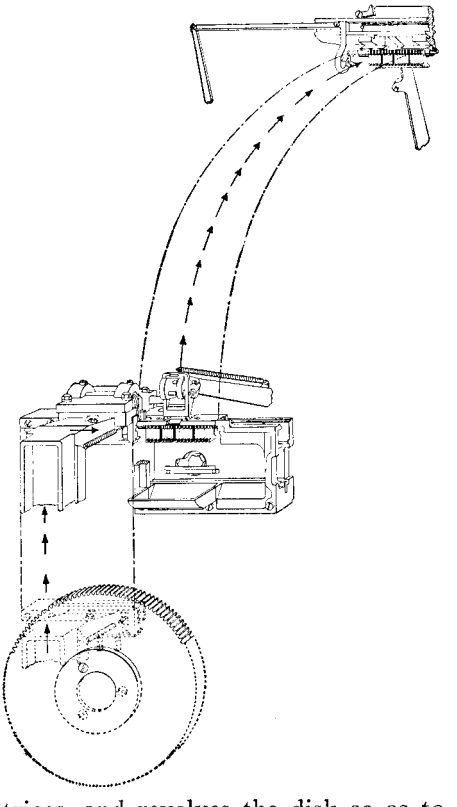


FIG. 97.—Diagrammatic view of the transfer of a line of matrices from the casting point up to the distributor box.

In this view is shown on dotted lines the first-elevator jaw with a line of matrices at the casting point in front of the mold and the mold disk. The arrows indicate the direction of the first-elevator jaw as it rises to the upper transfer channel. Here the first-elevator jaw is shown in full lines. Horizontal arrow indicates the direction of the transfer of the matrices into the transfer channel and a line of matrices assembled on the second-elevator bar.

The arrows indicate the movement of the second-elevator bar upward until it rests against the distributor beam in front of the distributor box ready to be transferred by the distributor shifter.

the mold disk from the line of matrices, and revolves the disk so as to bring the mold in front of the knives, and the slug is ejected into the galley. While this is taking place Cam No. 3 unlocks the line through the action of the wedge, as described in Figs. 47 and 83. The first elevator now rises through the action of cam No. 1 until it comes into register with the intermediate channel.

As the line is now unlocked, while the first elevator rises, the bands of the spaceband wedges usually fall by their own weight. If they do not do this, they strike upon the bar *53* shown in Fig. 98, and are forced downward. On the first elevator there are two levers *51*, shown in Figs. 98 and 99. These two levers have a beveled surface at their upper end

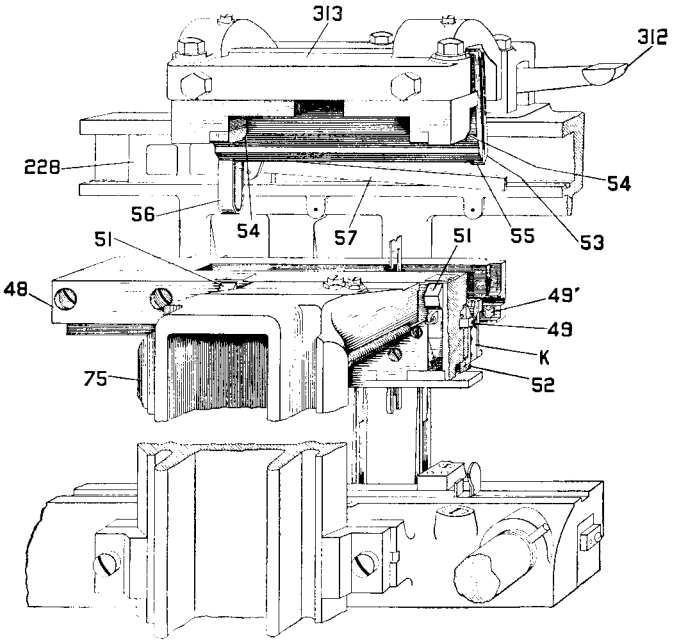


FIG. 98.—View showing the first-elevator jaw rising with the line of matrices and spacebands after the cast has taken place. *53* shows the bar having a beveled edge at its lower side, and this beveled edge is adapted to push down the spacebands in case they do not fall by their own gravity. *54* shows the two beveled edges adapted to engage with the levers *51* which withdraw the shelf *52*, allowing the matrices to fall by gravity to the lower, or roman, level. In case the matrices do not fall by gravity, the beveled edge of the block *53* pushes them down in the same manner as it does the spacebands. The matrices should fall by their own weight and will do so unless the jaw is sprung. *55* is a pawl which is quite thin so that it may pass between the two lower teeth of a matrix. The lower edge of this pawl is exactly on a line with the lower tooth of the second-elevator bar and pushes the wedges of the spacebands to their lowest position so as to clear the second elevator bar. *56* is the pusher operated by the link *57* through a lever and cam not shown in this view. The pusher *56* carries the matrices out of the first-elevator under the pawl *55*, and on to the second-elevator bar. The pusher *56* is called the elevator-transfer slide finger.

which strikes against beveled surfaces, shown at *54* in Fig. 98, and force the upper end of each lever inward, and at the other end the levers move the shelf that supports the matrices in the upper, or italic, position to the front, releasing the matrices in the upper, or italic, position, which fall by their own gravity so that they hang by their upper ears.

In case the matrices do not fall from the italic position by their own weight, they are brought down by the block *53*, which has previously pushed down the spacebands. The matrices are now all in the roman, or lower, position, and their distributing teeth are all in alignment. The

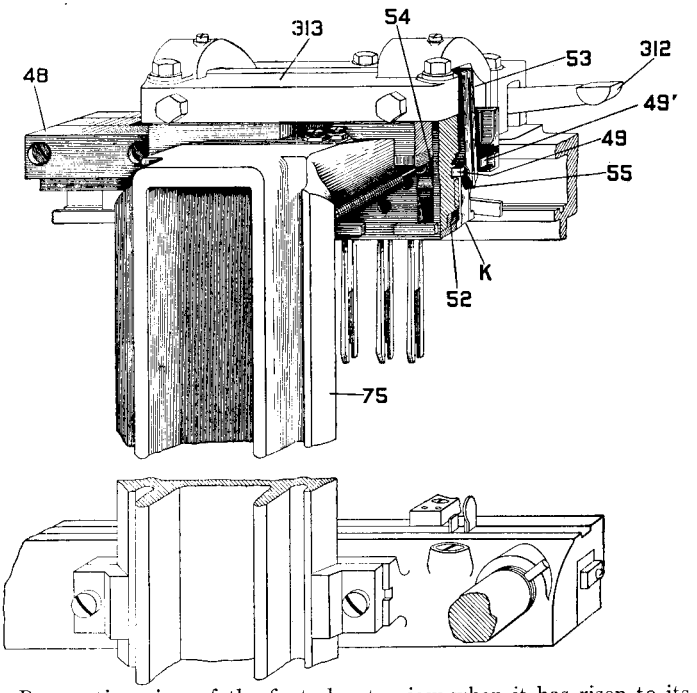


FIG. 99.—Perspective view of the first-elevator jaw when it has risen to its highest position ready for the discharge of the matrices into the upper channel. The bar *53* has pressed the matrices and spacebands down, and the pawl *55*, which is in exact line with the lower tooth of the second-elevator bar, compels the spacebands in their transfer to register with the teeth of the second-elevator bar when they are pushed out of the first-elevator jaw.

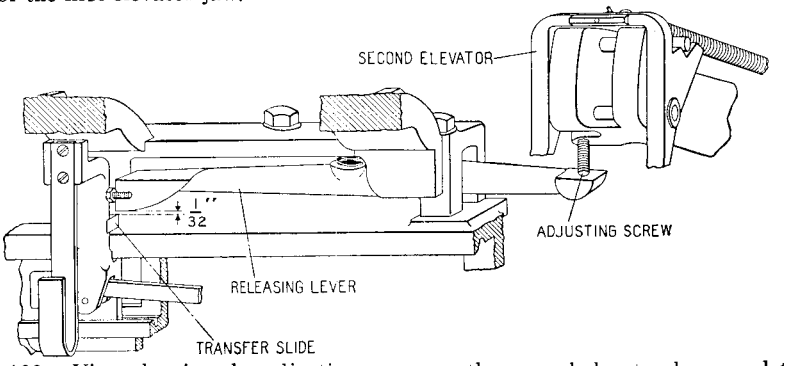


FIG. 100.—View showing the adjusting screw on the second-elevator lever and the distance of the releasing lever from the projection on the transfer slide.

spacebands are also in their normal position. The transfer lever operated by a cam now carries the line of aligned matrices and spacebands out of the first-elevator jaw past the pawls, into the upper transfer channel, as

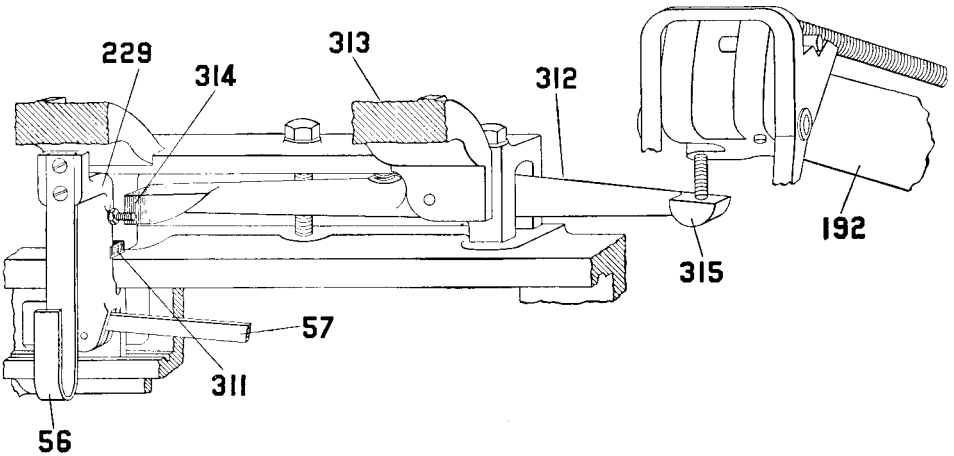


FIG. 101.—Enlarged view showing the method of locking the elevator transfer slide. When the machine is in normal position the lever *312* locks the elevator-transfer slide, but when the second elevator descends a screw strikes on the end of the lever *312* shown at *315*, raises the other end of the lever *312*, unlocking the elevator-transfer slide and allowing the matrices to be transferred upon the second-elevator bar.

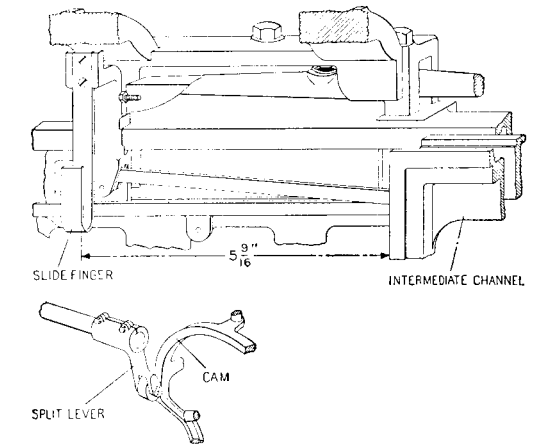


FIG. 102.—Elevator transfer slide ready to push over the line of matrices into the second elevator. The lower part of the figure shows a portion of the lever and cam which operate the elevator transfer slide. The lever has a split bearing and is held on the shaft by two bolts and it is thus possible to set it in any desired position.

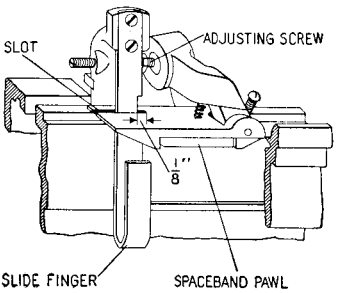


FIG. 103.—The spaceband pawl and the slide finger at their closest position when they have pushed the spacebands together and the pawl has passed by them so as to return them into the spaceband box or magazine.

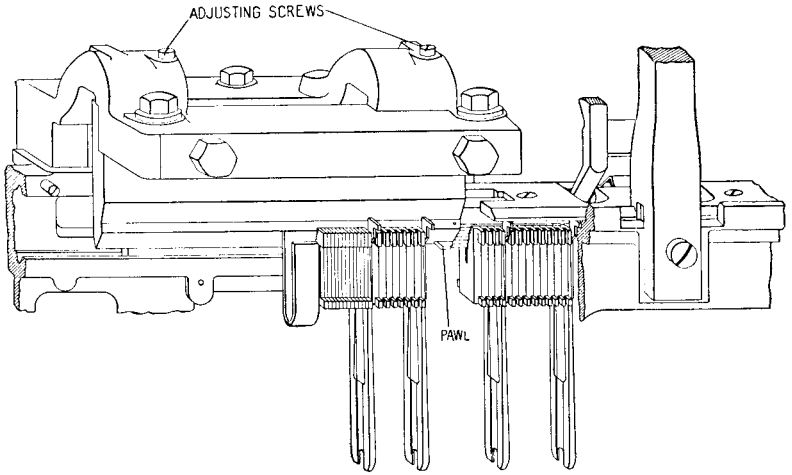


FIG. 104.—View of the line of matrices and spacebands going through what is called "the upper transfer;" that is, the line is passing from the first-elevator jaws in their highest position into the intermediate channel.

shown in Fig. 105. The matrices also pass under a pawl *55* in Figs. 98 and 104 that levels or aligns them exactly, so that the teeth of the matrices will go smoothly onto the teeth of the second-elevator bar and cause the wedges of the spacebands to clear the second elevator bar. It will be noted that this transfer channel has only two rails at the bottom, which support the matrices by their lower ears. The shoulders of the spacebands, being wider than the ears of the matrices, register with and enter a groove in the front part of the intermediate channel as shown in Fig. 27. The notch in the bottom of the spacebands registers with a rail in the bottom of the intermediate channel. This rail prevents the spacebands from twisting in the transfer.

At the time of this transfer, the second elevator *198*, which is mounted on a lever, is in register with the intermediate channel, as shown in Fig. 105. This second elevator, as shown in Fig. 105, consists of a flat surface *198* having mounted beneath it a short section of a distributor bar. This short section of the distributor bar has seven teeth on it, corresponding to the teeth in the matrices. When the transfer, which has been described, has taken place, the teeth of the matrices, engaging with the second-elevator bar, the matrices are all held upon this bar by the teeth of the bar. The spacebands, however, having no distributor teeth, are not held upon this second-elevator bar, and hence, when the second-elevator bar is raised it carries the matrices along with it, while the spacebands are retained by their shoulders in the groove as previously described, and are left behind. The matrices are now carried through the air by the second-elevator lever to a point where the second-elevator bar registers with the distributor box.

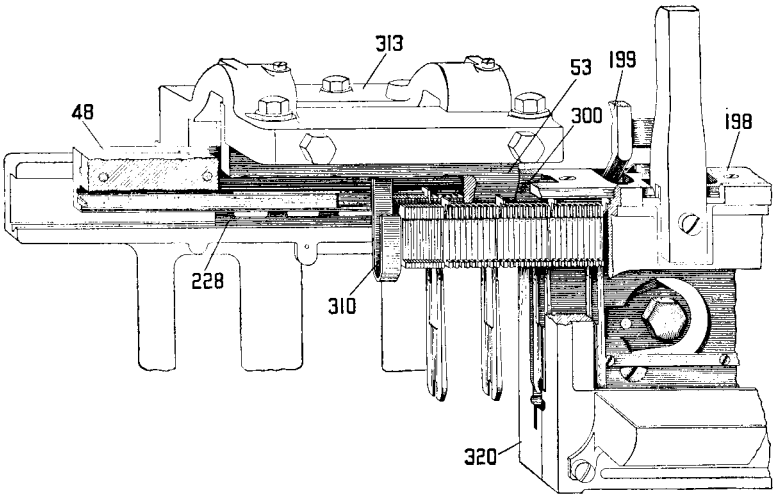


FIG. 105.—Another view showing the line of matrices being transferred into the intermediate channel. A part of the casting *320* is cut away so as to show the line of matrices and spacebands passing on to the second-elevator bar *300*. This is called the "upper transfer."

The teeth of the second-elevator bar *300* must be in exact alignment to receive the teeth of the matrices as they are passed on to the bar.

The first-elevator bar *48* must be adjusted so that as the matrices pass from the jaw they will exactly register with the grooves in the second-elevator bar.

In making this adjustment, the machine should be stopped when the first-elevator jaw *48* has just reached its upper position and before the matrices are transferred. If a few matrices are left in the first-elevator jaw *48*, they can be transferred into the second-elevator bar *300* with the fingers, and the first-elevator jaw should be adjusted up or down by the screw at the lower end of the first-elevator slide until the transfer made with the fingers feels smooth and easy.

The lugs *54*, shown in Fig. 98, are then adjusted so that the first-elevator jaw *48* will be lined up for smooth transfer of matrices. It will be noted that these lugs *54* perform a double function; one, of pushing in a lever to align the matrices, as described on page 108, Fig. 98; the other, to guide the jaw *48* in line with second elevator.

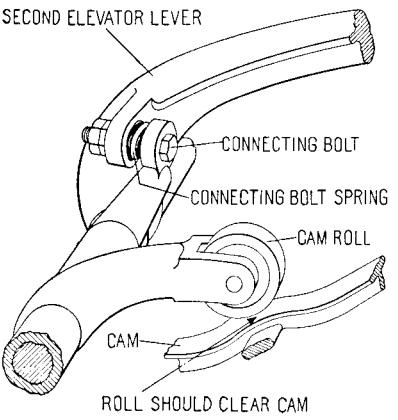
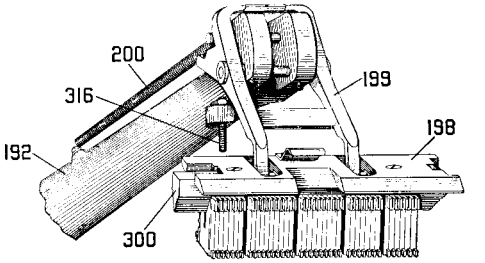


FIG. 106.—View of the second-elevator lever, the safety spring, the short arm carrying the roll, and a small portion of the cam when the machine is in normal position. At this time the cam roll should clear the surface of the cam by the thickness of a piece of cardboard.



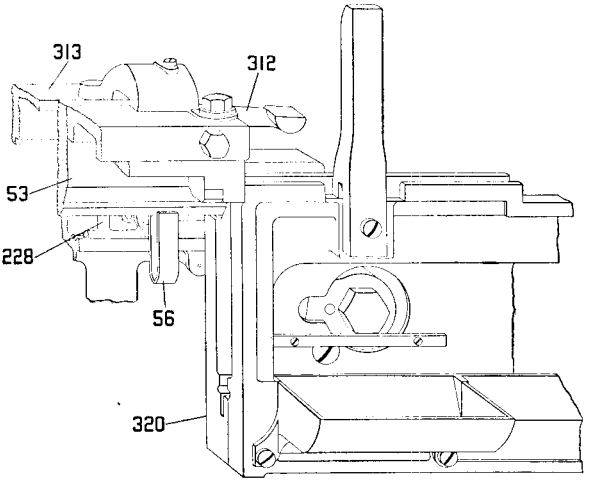


FIG. 107.—View showing the line of matrices on the second elevator starting upward to be transferred to the distributor box. The intermediate channel *320* retains the spacebands.

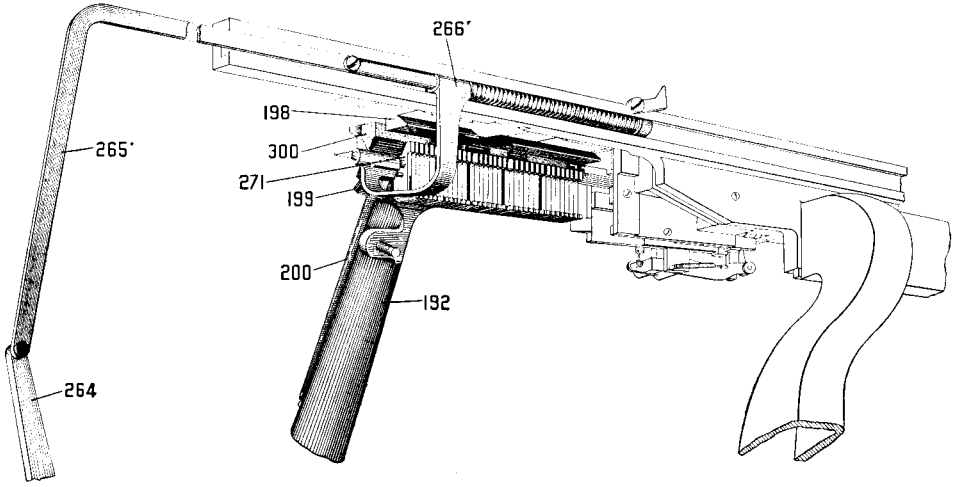


FIG. 108.—Another view of the distributor shifter *266′* and the distributor-shifter link *265′*. This is the form which is used in the Model 9 machine and some other models. In other respects the view shows a line of matrices ready to be pushed into the distributor box off the second-elevator bar *300*. Substantially this arrangement is common to all models.

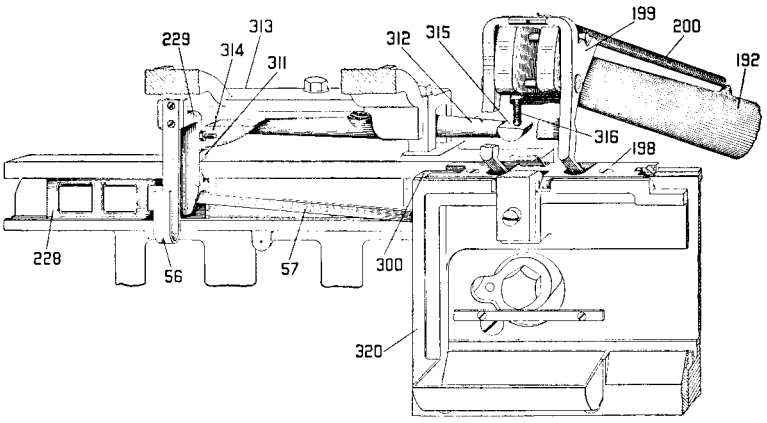


FIG. 109.—Mechanism for transferring the line from the first-elevator jaw into the intermediate channel. *228* is the elevator transfer slide, which is adapted to slide in grooves in the upper part of the face plate.

Attached to the elevator-transfer slide is the elevator-transfer slide finger *56*. The lower part of this finger *56* is curved upward, and is adapted to push the line of matrices out of the first-elevator jaw into the intermediate channel *320*. Pivoted in the first-elevator slide guide *313*, is the elevator-transfer slide releasing lever *312*, which has a projection *314* on the front of its left-hand end. This projection, when the machine is in normal position, locks the elevator-transfer slide stop *311*, which is attached to the elevator-transfer slide *228*, and prevents it going to the right until the second elevator *198*, as it descends to receive the line of matrices in the intermediate channel, unlocks it, by the adjusting screw *316* in the second-elevator lever *192*, striking upon the end of the elevator-transfer slide releasing lever *312* at *315*, raises the other end, which permits the elevator-transfer slide to move to the right.

This screw *316* should be adjusted so that the projection *314* will just clear the elevator-transfer slide stop *311* when the second-elevator bar *300* is fully down in position to receive the line of matrices.

DISTRIBUTION OF SPACEBANDS

The spacebands, as previously described, are left in the intermediate channel. Through the action of the cams *219* and *220* in Fig. 76, the spacebands are pushed together by the transfer lever *234* and the spaceband lever *234*, as shown in Fig. 28. The bunch of spacebands is then transferred to the spaceband box or magazine, by another movement of the spaceband lever *234*. They are prevented from twisting sidewise or falling out of the grooves by a slot in the bottom of the spaceband which engages with a rail in the bottom of the upper transfer channel.

The spacebands are pulled by the pawl of the spaceband lever beyond the incline shown at *341*, Fig. 28, so that the spacebands slide down this incline by gravity and pile up in the spaceband box, or magazine, in a position to be assembled again. The pawl of the spaceband lever must be set to perform this action surely and smoothly.

SECOND ELEVATOR LEVER AND BAR

The second elevator lever carries the second elevator, upon which the matrices are hanging by the teeth, from the intermediate channel to the distributor, where they align with the distributor box bar, so that they can be transferred into the distributor box. The second elevator is attached to the lever, by the second-elevator link, which permits it to take its proper position in both the upper and lower positions.

In the front of the second-elevator bar plate *198*, is a slot which engages with the post on the front plate of the intermediate channel, and positions the second elevator endwise as it descends, while it takes its position front and back, from a projecting lip on the top edge of the front plate of the intermediate channel, which brings the second-elevator bar in the center of the intermediate channel, parallel with it, and in proper position to receive the line of matrices as it is transferred from the first-elevator jaw.

Near the end of the second-elevator lever is a screw *316* that strikes upon the elevator transfer slide releasing lever *315*, Fig. 109. This releasing lever normally holds the elevator-transfer slide *229* from moving, and its motion is only allowed when the releasing lever has been tripped by the screw *316*. At the upper end of its motion, the second elevator fits into recesses in the distributor shifter slide guide, which is fastened to the distributor beam. In this upper position the second elevator is positioned endwise, by the slot in second-elevator lever *192*, Fig. 107.

The object of the parts just described is to bring the second elevator (which carries the matrices by their teeth) into exact alignment with another small bar having teeth upon it, and known as the distributor box bar. This distributor box bar is not fastened solidly in the distributor box, but is pivoted, so as to have a slight motion, and there is a small projection on its end which fits between the second-elevator bar and the second-elevator bar plate, and causes the teeth of the two bars to align exactly so that the matrices can transfer from one to the other.

THE DISTRIBUTOR BOX

The distributor box is that part of the mechanism through which the matrices pass in going from the second elevator on to the distributor bar. It consists of a bracket, having a notch on the upper side by which it may be attached to the distributor beam by a bolt and handle, mounted on the beam, so that it can be readily taken off and put on the machine. In a slot in the lower edge of this bracket is pivoted the distributor box bar, along which the matrices slide as they are transferred through the box. Fastened to the sides of the bracket are two plates, one on the front and one on the back, and attached to these plates are the distributor box rails *370* and *371*, Figs. 111 and 112. Pivoted in a lug on the back plate are two levers, the distributor box matrix lift lever *353* and the cam lever *357*.

The distributor box matrix lift lever operates the matrix lift *362*, which lifts the matrices into the distributor screws. The distributor box matrix lift lever is operated by a cam *360*, mounted on the distributor screw, by the cam lever *357*. When the matrices are transferred from the second elevator into the distributor box they are carried by their teeth on to the distributor box bar, until they reach the right-hand end, when they leave the teeth and are supported by their upper ears, on the upper rails, and are pushed against the vertical shoulders of the upper and lower rails,

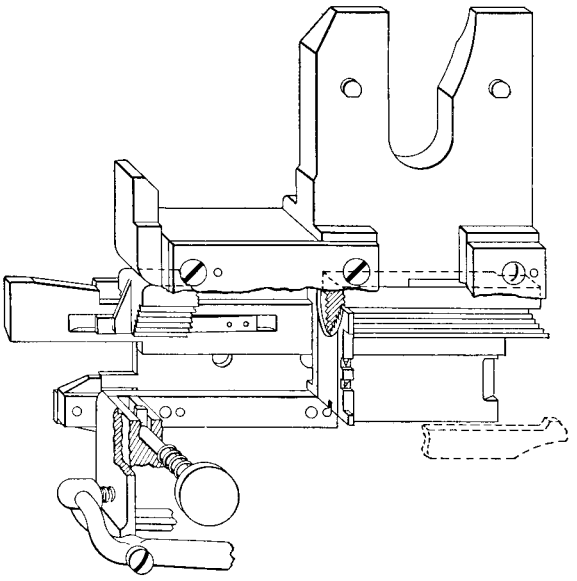


FIG. 110.—A matrix traversing the inside of the distributor box along the toothed bar, the back side of the distributor box being partly cut away for purposes of illustration.

in which position they are ready to be lifted into the distributor screws. At the left-hand end of the distributor box are two lower tilting rails, with a projection on them, against which the matrices strike. At the right-hand end of this section of the distributor bar is a thin blade which is let into the distributor bar, and is called the distributor-box bar point. This point is about one thirty-second of an inch thick.

The rails, previously mentioned, end in two upwardly projecting shoulders, as shown in Figs. 111 and 112. In the right-hand end of the distributor box there are two lower rails having similar shoulders, as shown in the same figures, so that when the matrix comes to the extreme end of the distributor box, the upper ears of the matrix, as shown in Fig. 112, rest against the shoulders *370* and the lower ears against the shoulders *371*. The distributor blade, previously mentioned, engages with a notch

which is found in all matrices except the thinnest. The front end of this blade is about thirty thousandths of an inch back of the shoulders. As the matrix is lifted by the action of the lift the distributor blade enters the notch in the matrices and prevents a second matrix from rising, on account

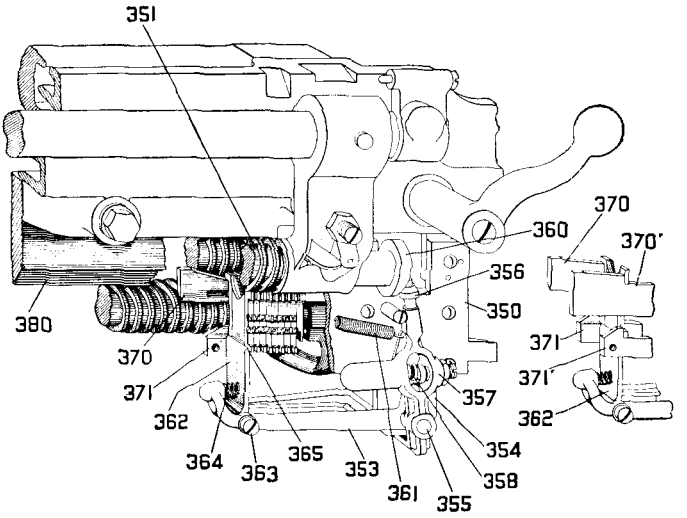


FIG. 111.—Enlarged view of the distributor lift and its action.

In the small view at the right hand are two rails, *370* and *370'*. These rails are mounted on the inside of the distributor box, and project forward in between the distributor screws. These rails have vertical shoulders about three sixteenths of an inch high, against which the ears of the matrices rest.

The lower ears of the matrices come against the shoulders in another pair of rails, *371* and *371'*.

In the large view, the lift *362* is shown just ready to lift a matrix. The upper part of the lift has a very narrow shelf upon it, *365*. This shelf goes under the lower edge of the matrix, and when the cam *360* revolves, the distributor box matrix lift lever *353* is raised, carrying up the lift *362*, raising the matrix up into the distributor screws.

of friction with the matrix being lifted. This arrangement of the distributor-bar blade and the notches milled in the matrices is equivalent to making all matrices at this point of the same thickness.

On a lug, or projection, of the back side of the distributor box is mounted the distributor lever and lift. The distributor lever is shown at *353* in Fig. 111 and the lift at *362* in the same figure. The distributor lever is operated by a vertical lever *357* having upon its side a small roller. This roller engages with a small cam that is mounted on the end of one of the distributor screws, as shown at *360* in Fig. 111. The operation of the cam *360* through the vertical stud *357* and the distributor lever *353* causes the distributor lift to rise and fall at a certain time with reference to the distributor screws.

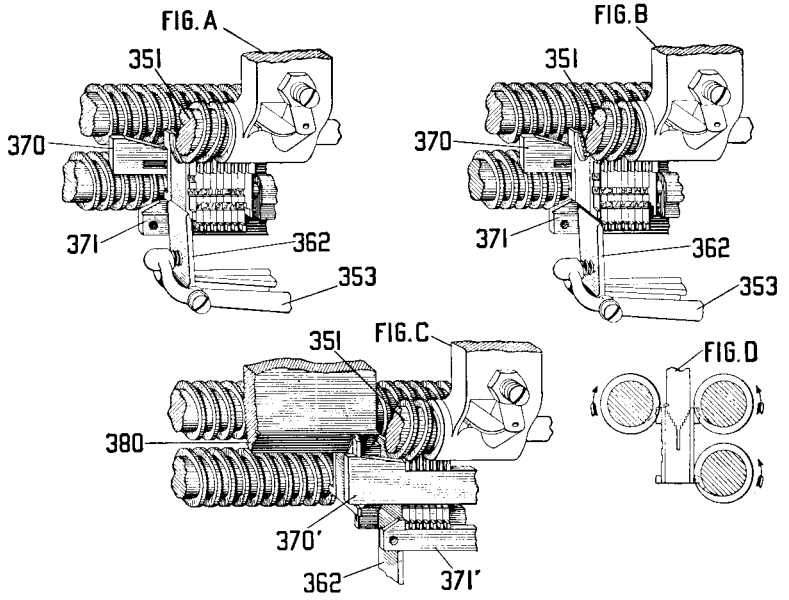


FIG. 112.—Several views showing the action of the lift. Figure A shows the matrix just lifted over the shoulders of the rails *370* and *371*. The front rail in this view is cut away, and a part of the distributor box, to make the illustration more clear.

Figure B shows the matrix lifted entirely over the shoulders into the threads of the distributor screws, and the distributor lift *362* leaving the matrix and going down to its original position.

Figure C shows the matrix being carried forward up the inclined part of the rails *370* and just ready to go on to the distributor bar. The top of the rail *370* is parallel with the bottom of the rail for a short distance, and is of such a height as to bring the teeth of the matrix opposite the grooves in the distributor bar *380*.

The further revolution of the distributor screws carries the matrix onto the distributor bar *380*, and the bar sustains the matrices by the teeth as they are being carried along on the distributor bar until such time as the combination in the teeth of the matrix comes to the combination in the distributor bar which is cut away; whereupon the matrix, being no longer sustained, drops off the distributor bar into the channel entrance.

Figure D is a sectional view of the three distributor screws, the distributor bar, and the matrix hanging thereon, showing the engagement of the threads of the distributor screws with the ears of the matrix.

The lift is timed so that it will raise the matrix between the threads of the screws and hold it there until the threads of the screws have pushed the matrix forward upon the rails.

DISTRIBUTOR BOX MATRIX LIFT CAM

The distributor box matrix lift cam is fastened to the end of the distributor back screw by a taper pin. The cam cannot be adjusted, and should not be taken off unless it is worn, and should be replaced by a new one. To apply a new one drive out the taper pin and take off the cam,

placing the new one on the distributor screw in such a position that the hole in the cam will match the hole in the distributor screw. To hold it in position use an 8 x 32 headless screw in the tapped hole in the hub of the cam. Place a thick matrix with full-size ears in the distributor box, and see that the distributor box matrix lift is adjusted so that when the cam roll is on the high part of the cam the upper ears of the matrix will be raised about one thirty-second of an inch above the shoulder of the distributor box upper rails. After this adjustment is made use the same matrix and turn the distributor screws by hand. As the lift starts to raise the matrix between the threads of the screws, the front or side of the matrix opposite the distributor pusher should be about one thirty-second of an inch back of the threads of the screws. If it is not, loosen the small screw and turn the cam, so that when the matrix starts to raise it will clear the threads of the screws by about one thirty-second of an inch. This provides for any wear on the shoulders of the rails and still permits the matrix to be raised without striking the threads of the screws. Fasten the cam securely with the small screw and run a few lines through to be sure the cam is set right. If it is, ream out the hole through both the cam and distributor screw and drive in a taper pin. The small screw can then be removed. Before applying a new matrix lift cam be sure that the distributor box rails, both upper and lower, are not worn on the shoulders. If they are, put on new rails before applying the new cams. The replacing of the cam is not often necessary.

BENDING OF MATRICES

It occasionally happens that the thin matrices are bent in the distributor box. In general the box gives little trouble in its operation, but like all mechanical devices, parts become worn and it is necessary at times to replace them. These parts are illustrated in exaggerated form shown in Fig. 113. Any of the following causes will bend matrices:

First, the wear on the shoulders of the rails *370* should never be permitted to exceed .050″ between the bar point and shoulders of rails *370*. Nearly all the distributor box trouble is due to worn rails, causing a space between the shoulders of the rails and the bar point large enough to allow two thin matrices to be lifted at one time, damaging the ears of the thin matrices, and permitting the thick matrices to become twisted.

Second, distributor box lift not raising matrix high enough to clear the shoulders of rails *370*, Figs. 111 and 112. The lift *362*, Fig. 111, should be adjusted to raise the matrix ears one thirty-second of an inch above the shoulders of distributor box rails *370*, Figs. 111 and 112.

Third, distributor bar point or blade, Figs. 110 and 124, worn or damaged.

Fourth, the distributor-shifter buffer shown at *271* in Fig. 108 may be gummy or sticky, and if it happens that the matrix is being lifted just as the distributor shifter goes back for the next line, the matrix may slip

off the shelf on the lift after it has been partly raised. This is shown in Fig. 113.

Fifth, the shelf on the distributor lift, after long use, becomes rounded so that it does not hold with a firm grip underneath the matrix, and the matrix may slip off the lift after it has been partly raised.

Sixth, the little spring that holds the distributor lift against the matrix may become stretched and weak and not hold the distributor lift firmly

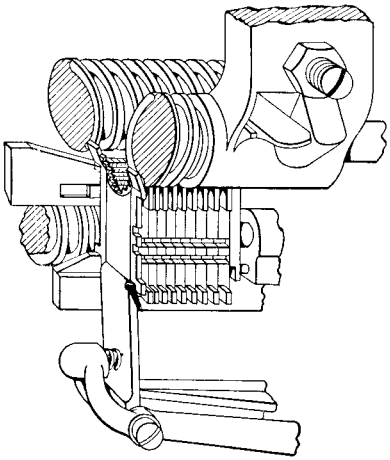


FIG. 113.—View showing a thin matrix bent by the action of the screws because the lift has not raised it above the shoulders and the rails of the distributor box.

against the matrix, so that the matrix may slip off the shelf after it has been partly raised. These last two points may combine to make trouble.

Each of the six points above mentioned should then be carefully looked into. In all these cases, when the screws bend or bruise the matrices as mentioned above, they must be repaired before using.

THE DISTRIBUTOR SCREWS

The two upper distributor screws run in fixed bearings, as do all the distributor screws on the Model 9. Upon all the models where there is a single distributor, comprising three screws, the lower distributor screw is pivoted, so as to swing outward and upward, as shown in Fig. 114. This is done to give access to the matrix on the distributor bar. When this is done, the small gear at the left-hand side of the machine which drives the lower distributor screw comes out of mesh. In order that it may always be in the proper time there is in this distributor screw what is called a "hunting tooth;" that is, in one gear there is a pin inserted between the teeth, and there is a corresponding hole in the gear teeth with which it meshes. The gears cannot be meshed unless the hunting tooth is in proper position.

The distributor screws have a thread upon them with one-quarter of an inch pitch; that is, the matrix is carried along the distributor bar one-quarter of an inch for every revolution of the distributor screw. In most of the models the distributor screws are about one inch in outside diameter. In the Model 9, and some of the other models, the diameter of these screws is reduced to three-quarters of an inch. In the later models the distributor screws, instead of having a pitch of one quarter of an inch, have a pitch of one-third or one-half inch. That is to say, every revolution

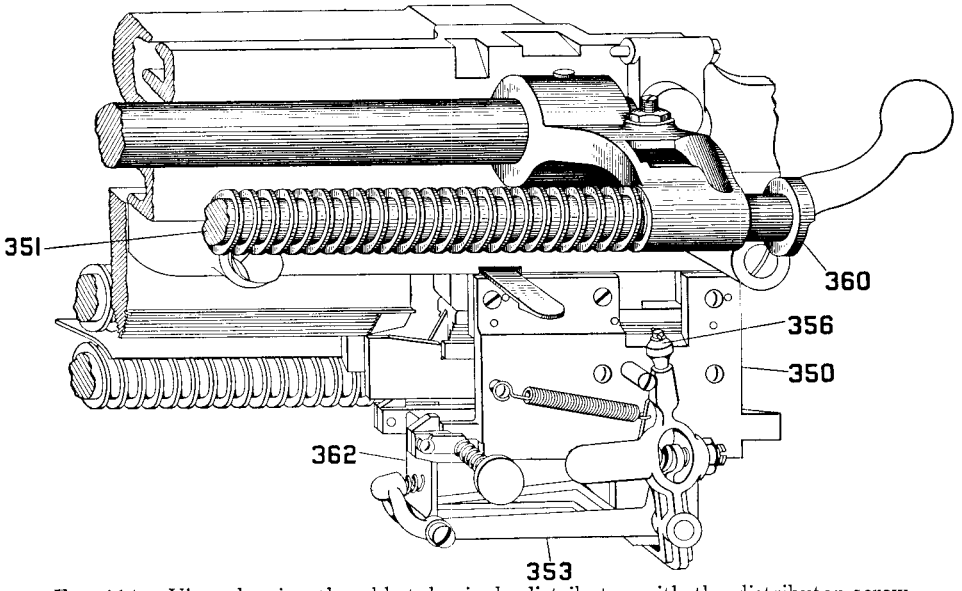


FIG. 114.—View showing the old-style single distributor with the distributor screw thrown out so as to remove matrices from the bar.

of the distributor screw carries the matrix along the distributor bar a distance of one third, or, in some cases, one half of an inch. This carries the matrices along the bar much more rapidly and moves the matrices away from the distributor box much more quickly, leaving a greater space between each successive matrix, so that, although the matrices are traveling more rapidly along the bar, there is less chance for interference by the succeeding matrix striking against a preceding matrix as it is falling from the distributor bar.

DRIVING MECHANISM AND CLUTCH OF THE DISTRIBUTOR

The distributor is operated by a friction clutch which slips if anything stops the distributor screws. This is shown in Figs. 115 and 116. The clutch consists of a disk *460* mounted on a sleeve *459* which has a spline, and a spring *461* presses this disk against the face of the driving pulley *462*. The shaft that carries the friction disk has upon it a gear that meshes

with the gears of the distributor screws. Mounted on the sleeve *459* is a collar *458* which has cams or teeth in its side. Just below this is a distributor clutch lever *456*, having a tooth *457* in its end which engages with one of the cams of the collar *458* and forces the sleeve *459* away from the distributor clutch pulley, thereby stopping the motion of the distributor screws.

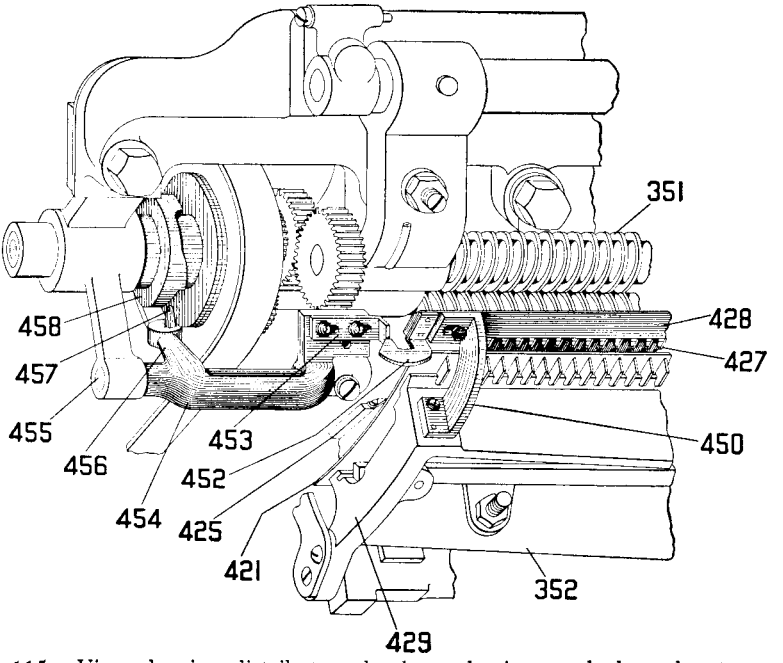


FIG. 115.—View showing distributor clutch mechanism, and channel entrance in normal position and the method of stopping the distributor when the matrices clog and fail to go through the channel entrance into the magazine.

351 is the distributor screw, and *352* is the channel entrance. Mounted on the channel-entrance casting are two brackets *450*. These two brackets carry a toothed bar *427*. At the end of this bar there is a small catch *452*. This catch normally stands in contact with a bracket *453*. The bracket *453* is mounted on a casting *454*, which in turn is mounted on a short shaft *455*. This casting *454* has a lever on it *456* through which passes a screw having a tooth, or pin, *457*.

The casting *454* is free to swing on the shaft *455*, and the pin *457* is urged upward by a spring not shown in this view. So long as the catch *452* rests against the bracket *453*, the tooth *457* is held in position out of the path of the cam *458*, but when the catch *452* is moved endwise, the projecting part of the bracket *453* drops into the notch in the catch *452*, allowing the tooth *457* to move up and engage a tooth of the cam *458*, which throws out the clutch and stops the distributor screw, as will be more fully shown in another view.

DISTRIBUTOR AUTOMATIC STOP

In most of the Linotype machines now in use the distributor automatic stop is constructed as follows: Fig. 116 shows a view of the partitions in the channel entrance. The upper part of these partitions is flexible,

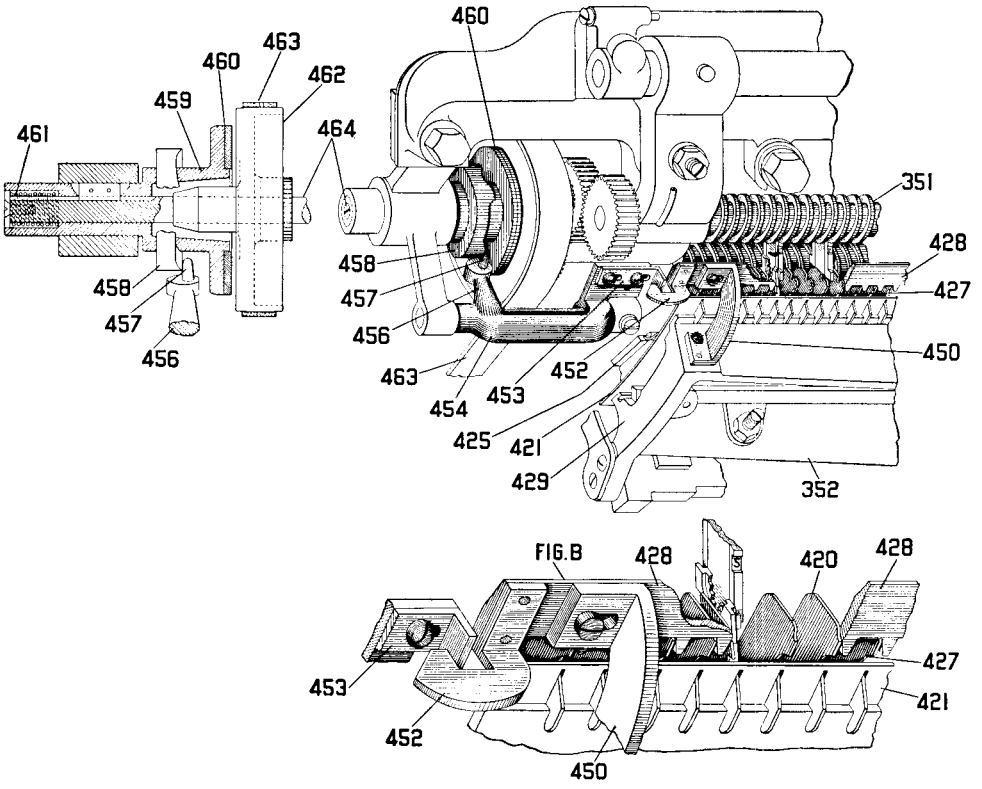


FIG. 116.—View of the means for stopping the distributor when the matrices clog. This view shows a matrix in the channel entrance which has failed to get out of the way of the following matrix.

The view shows the matrix on the distributor bar pressing against the matrix partly in the channel entrance and pressing against the partition. This flexible partition moves the toothed bar *428* to the left, as you stand behind the machine, allowing the bracket *453* to enter the notch of the catch *452*, permitting the casting *454* to swing back and throw the tooth *457* upward into the cam *458*. This is shown in an enlarged view just below in Fig. B. This causes the sleeve *459* to move slightly to the left, releasing the clutch *460* so that the drive of the distributor screws is released and the motion of the distributor screws stops. The clutch disk *460* is held in action by the spring *461*.

After the channel entrance is open and the clogging matrix removed, upon closing the channel entrance, the bracket *452* strikes against the bracket *453*, drawing the tooth *457* downward and out of engagement, whereupon the spring *461* brings the clutch *460* into engagement and the distributor screws revolve normally.

The motion of the distributor screws is communicated to them by the pulley *462* and by the belt *463*, which is driven by the intermediate shaft, not shown in this view. The clutch *460* is made of a leather or fiber washer, which presses against the smooth surface of the pulley when the clutch is in action. The sleeve *459* is splined into the shaft *464*, and attached to the right of this shaft is a small gear, which meshes in the distributor screw gears, and drives the screws.

and is made of spring brass. These partitions at their rear edge engage with small notches in a long bar. This bar, at its left-hand end (as you stand behind the machine), engages with a little catch *452*, shown in Fig. 115. When the machine is in normal position, the little catch *452* rests upon this bracket *453* and holds the lever *456* (previously described) out of contact with the cam-shaped collar.

It will be manifest that if the bar *428* is moved to the left (as you stand behind the machine) the bracket *453* will drop into the notch in the catch *452*, allowing the lever *456* to swing upward, and the tooth *457* will make contact with the cam shaped collar, throwing it to the left, disengaging the clutch and stopping the motion of the distributor screws.

The movement of the bar *428* to the left is caused by the pressure of a matrix under the impulse of the screws against the flexible channel entrance partition, and the movement of the partition, which moves the bar *428* so as to operate the automatic stop, as previously described. This stop does not work so long as a matrix falls into the channel entrance and gets out of the way of the distributor screws. The distributor automatic stop only works when, for any cause, the matrix fails to fall into the channel entrance and go on its way.

There is an adjustment on the small bracket *453* that enables the operator to set the automatic so that it will trip and stop the distributor screws by greater or less left-hand movement of the bar *428*. The left-hand movement of the bar *428* should not be more than about one thirty-second of an inch to trip. The views 115 and 116 are taken from the rear of the machine.

This automatic stop has proved to be very efficient and satisfactory, and is now running in many thousands of machines all over the world. It requires, however, a little care and attention. The bar *428* should move very freely. It should not be allowed to become sticky with gum, or its action in any way hindered. Its left-hand movement, as previously mentioned, should not be more than one thirty-second of an inch. If it is more than this, the spring partitions are bent too far, and after being so bent a number of times the brass partition *420* in Figs. 116 and 122 loses is elasticity, and the partition "sets". The partition must then be bent backward into its proper position with a pair of pliers. When a partition has entirely lost its elasticity it is necessary to remove it and replace it by another. This will seldom occur if the automatic is properly set and the motion of the spring partition is not too great.

TO REMOVE THE DISTRIBUTOR BOX

To remove the distributor box, turn the machine back until the second elevator descends a few inches from the distributor beam, withdraw distributor-shifter and lock it, then unscrew the locking screw of the distributor box to the right as far as it will go without forcing. The box can then be removed in a downward direction.

ADJUSTMENT OF THE LOWER DISTRIBUTOR BOX

Place the distributor box in the machine and turn the distributor screw, until the distributor box lower escapement cam roll rides on the lower point of the cam. Adjust the escapement cam lever adjusting screw until the point of escapement pawl clears the bottom of the slot in the matrix about one sixty-fourth of an inch. See that the male pawl point

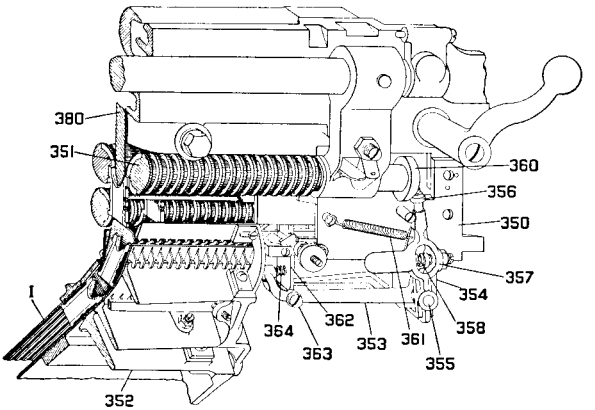


FIG. 117.—View showing the distributor box *350* in its relation to the distributor screws *351* and to the channel entrance *352* and the magazine.

The distributor box *350* is composed of two plates fastened together at the top and open at the bottom. There is a lug, or projection, on the bottom of the distributor box, in which is mounted a pivot *355*. On this pivot there is mounted a lever called the "matrix lift lever" *354*.

This lever is operated by a second vertical lever *357*. Between the lever *357* and the lever *354* is interposed a spring *358*. This acts as a safety device so that if a matrix gets caught, or there is anything to prevent the upward movement of the lever *353*, the spring will contract so that nothing is broken.

Mounted at the top of the lever *357* is a small roll *356*. This roll works against the surface of a cam *360*. This cam *360* is mounted on a bearing shaft for the distributor screws *351*. The shape of the cam *360* is such as to cause it to raise the lever *353*, hold it in position a certain length of time, and then allow it to return to normal position. The return is caused by the spring *361*. Mounted at the outer end of the lever *353* is a small vertical lever *362*. This lever *362* is mounted upon a pivot *363*.

A small spring *364* presses the lever *362* toward the left of the machine, as you stand in front of it. This lever *362* is called the distributor "lift," as it is used to raise the matrices so that their ears engage the threads of the distributor screws that carry the matrices along the distributor bar.

does not become bent. This point should admit a thin matrix only between both pawls. The female pawl must have a retaining hold on the matrix of at least one thirty-second of an inch when the male pawl is adjusted, to allow the matrix to clear the bottom of the slot.

In the Model 9 machine the matrices pass from the second-elevator bar into the primary distributor, where they are separated and delivered to any one of the four distributors as pre-determined. This is accomplished

by using four bridges, and a series of notches in the lower end of the matrix. These notches are arranged in combinations, using three notches by which arrangement it is possible to get 41 different combinations. The primary distributor consists of a distributor box in which the matrices are raised into the screws and carried on to a short distributor bar. On this distributor bar the teeth are cut away at certain places, and directly underneath where the teeth are cut away is a bridge. As the matrices pass over the bar they will ride on the bridge where the teeth are cut away, unless the combination of notches in the lower end corresponds with the bridge combination, in which case the matrix falls so that the teeth will not re-engage the teeth on the distributor primary bar, and as the matrix is carried across the bridge it falls through a chute into the lower distributor box of the predetermined distributor.

If the combination of notches in the matrix does not correspond with the combination of the bridge, the matrix will be carried forward and on to the teeth of the distributor bar again. In this way each matrix tries the different bridges until it finds the one where the notches and bridge combinations correspond. By this device the matrices are distributed into any one of the four distributors, which in turn carry them along their distributor bar until they drop into the channel entrance. This upper distributor box, although of somewhat different shape, acts exactly as the ordinary distributor box.

MULTIPLE DISTRIBUTORS

In this form of distribution the matrices pass from the second-elevator bar into an upper distributor box and stop against the distributor-box rails. They are then raised over the rails by the matrix lift. There is a device called a "bridge" mounted on the lower side of the upper distributor box on which the matrices for the upper magazine ride until the teeth of the matrix catch on the distributor bar. The matrices for the lower magazine *have a notch in the bottom* so that they do not ride on the bridge as they are carried forward, but drop so that the teeth of the

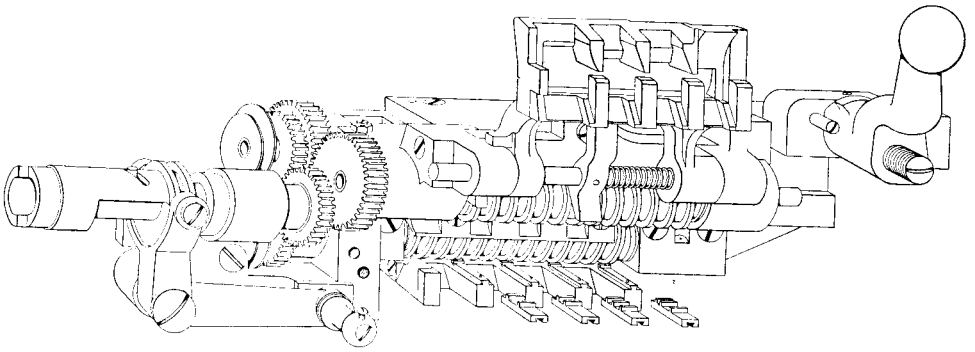


FIG. 117a.—Distributing mechanism; primary distributor assembled.

matrices do not engage the distributor bar, and they are then carried off the end of the rails, falling from the upper distributor box through a tube into the lower distributor box, where they are separated by an escapement and delivered to the lower distributor rail and screws.

It is very important to keep these distributor screws, the distributor bar, and the distributor box absolutely free from oil. Never permit oil to flow beyond the bearings of these parts.

Care should be taken to see that the escapements in the lower distributor boxes work freely at all times. If dirt is allowed to accumulate the escapements will not work freely; the matrices will be prevented from separating, and cause clogs in the distributor box. By removing the hinge screw and the small jam nut, the escapement can be readily removed and cleaned. Benzine must *not* be used to clean the escapements. They should be wiped off well with a dry rag or a piece of waste. Dry graphite or the best clock oil may be used, preferably the former, but care should be taken that no loose graphite remains. It is a good plan to remove and clean the lower distributor box at least once a day. Kerosene oil has been successfully used as a lubricant for the separating pawls.

DISTRIBUTOR-BOX RAILS—MODEL 9

Distributor-box rails, if allowed to become worn, will damage the lugs of thin matrices, permit thick matrices to become twisted as they enter the screws, and otherwise cause damage and trouble. *Nearly all distributor-box troubles can be traced to worn rails or cam.* One set will last at least a year, generally much longer, and they are inexpensive to renew. In ordering be careful to specify the model and serial number of the Linotype, as well as the part number of the rails.

TO RUN IN UPPER MAGAZINE MATRICES CUT FOR LOWER

There is a device that can be used on the matrix bridge (part G-649) to prevent matrices cut for the lower magazine from straddling the bridge and dropping into the lower distributor box. When this device is in place the matrices cut for the lower magazine will be distributed into the upper magazine. This is of use only on Models 2 and 4.

THE CHANNEL ENTRANCE

The partitions, shown in Figs. 116 and 122 form channels through which the matrices, as they fall off the distributor bar, are conducted into the entrance of the magazine. The upper ends of these channel-entrance partitions have been described. At the lower end the partitions are crimped, as shown in Fig. 122, or two lugs are used to guide the matrices by the ears. The object of the crimping at the lower end of the partition, or the lugs, is to compel the matrices to enter between the points of the magazine channels, and to prevent the thinner matrices from falling

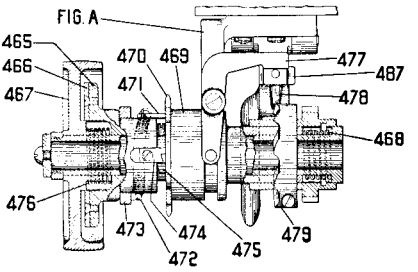
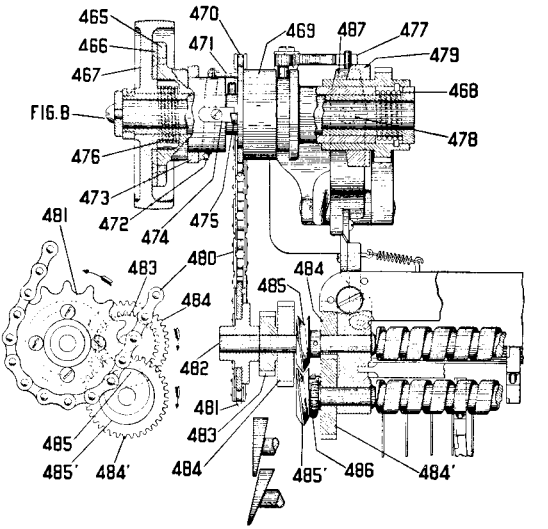


FIG. 118.—Views of another form of distributor stop. This form of distributor stop was used first on the Model 9 machine, but has since been adopted for all models. In this form of distributor stop the partitions are not flexible, but are fixed, as shown in Fig. C. It is possible, therefore, to make these partitions much thinner than the flexible partitions, allowing larger matrices to drop into the channel entrance.

The distributor is stopped by the friction of a clogged matrix upon the lower distributor screw, causing it to lag behind the upper distributor screws and get out of time with them, which brings the stopping mechanism into action.

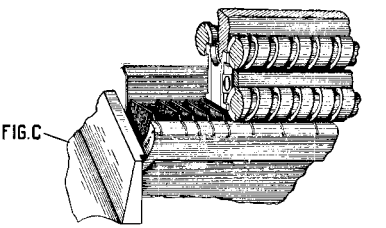
In Fig. A, *465* is a clutch sleeve having upon its surface a leather or fiber washer *466*. This clutch is shown here out of engagement with the pulley *467*. The clutch is urged inward against the pulley *467* by a spring *468*.

Mounted on the sleeve *465* is a pawl *474*. This pawl has a notch in it adapted to engage with a pawl *475* mounted on the collar *469*. These two pawls, *474* and *475* are held normally in mesh with each other by the spring *476*. In this view the clutch is shown out of engagement and the pawls are not in mesh, and are held in position by the spring *472*.



In the collar *469* there is a groove, and in this groove a pin is mounted upon a bell-crank lever *477*. This bell-crank lever works against another lever *487*, in which there is a tooth *478*. This tooth *478* engages with a cam *479*, which pulls the sleeve *465* away from the pulley *466*, fast on the bearing of the screw and the distributor screws stop. This view shows the mechanism as it would appear to one standing on a high stool and looking down upon it from above.

Fig. B shows the same mechanism with the clutch engaged and with the pawls *474* and *475* in mesh. This is a rear view and is shown as it would appear to one standing



on the floor back of the machine. The sprocket wheel *470* drives through a chain *480* another small sprocket *481*. This sprocket is fast upon a shaft *482*, which is an extension of the upper distributor screw. Mounted on this shaft are small gears *483* and *484*, and also a small portion of a screw thread *485*. These screw threads are so arranged that the thin part of the thread on the upper screw is opposite the thick part of the thread on the lower distributor screw. The small pinion *484* is pinned to the shaft; the corresponding pinion *488* is not fast upon the shaft, but is fast to the screw thread *485*. The lower distributor screw is pulled along by a small spring partly wrapped around the shaft *486* and fast to the screw thread. These screw threads are shown in diagram in the small view at the left.

So long as the distributor screws are in exact time, that is to say, so long as the thin part of the screw *485* is opposite the thick part of its mate *485'*, the screws will revolve regularly. If, however, from any cause the lower distributor screw is caused to slow up or change its relation, the two surfaces on the screw threads *485* lock against each other and stop the motion of the screws.

This puts a strain upon the distributor chain *480*, which overcomes the spring *476*, throwing the pawls *474* and *475* out of mesh and throwing the tooth *478* into the cam *479*, which pushes the sleeve *465* away from the pulley *466*, allowing it to run free and the whole distributor mechanism stops.

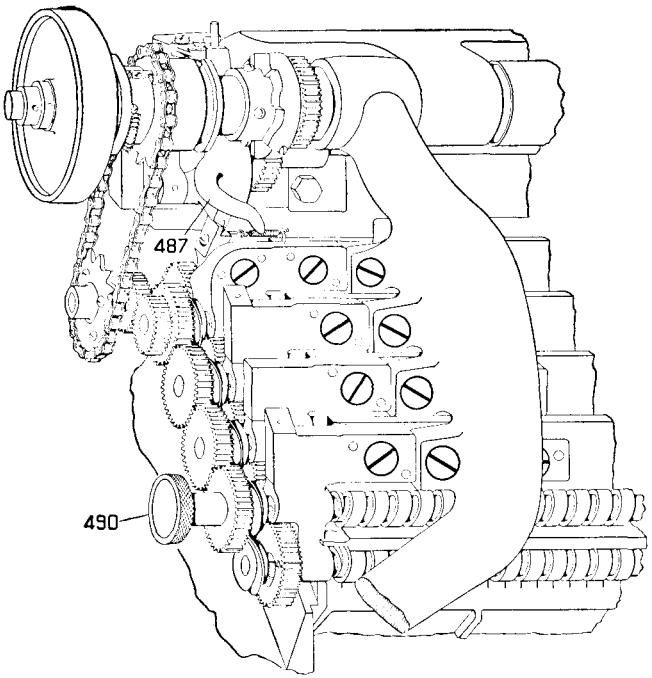


FIG. 119.—Diagram, on the rear of the machine, of the multiple distributor as used in the Model 9.

This multiple distributor is of the same general form as that shown in Fig. 116, except that there are four sets of distributor screws.

Beginning at the top of the view, the lower distributor screw of the highest set of three distributor screws forms one of the upper two of the second set of distributor screws, and so on down to the lowest. By this arrangement nine distributor screws form four sets of three distributor screws each.

sideways so that they will not enter the magazine at all. The crimping is of different thickness on the partitions.

The upper side of the magazine channel entrance, Fig. 122, is composed of two parts one of them a strip which is perforated and through these perforations the lugs on the partitions project and a wire is run through to

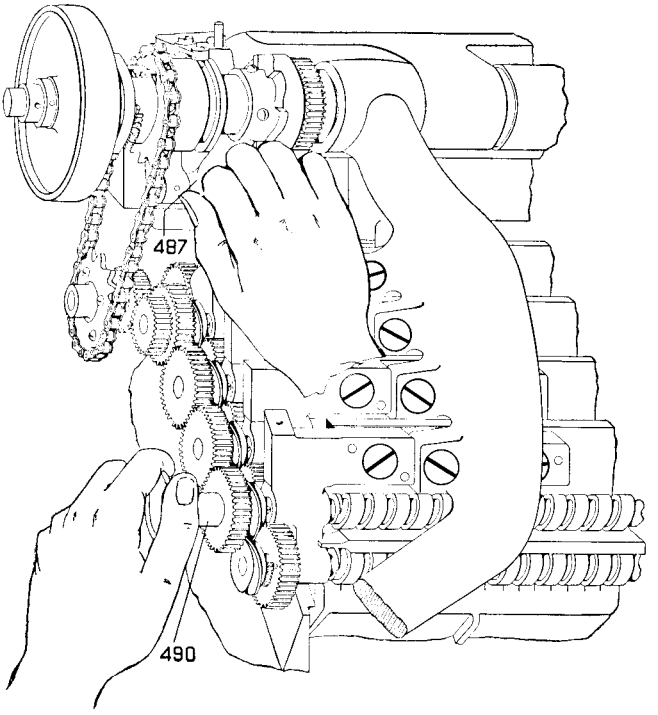


FIG. 120.—Another view of the rear of the Model 9 set of distributor screws. The view shows the method of starting the distributor screws after a clogged matrix has been removed.

In the view the right hand is shown raising the hand lever *487*, which throws in the clutch against the driving pulley. With the left hand the little hand wheel *490* is revolved backward a short distance to disengage the lock of the screw threads, which stops the distributor screws.

A short turn backward of the hand wheel *490* and raising the hand lever *487*, which throws in the clutch, permits the distributor screws to revolve normally.

hold them. The lower part of the upper side of the channel entrance is hinged and can be raised if necessary to remove matrices and to prevent injury when the channel entrance is opened if a matrix is partly in the magazine and partly in the channel entrance. The lower side of the magazine channel entrance is formed of one curved piece of brass. The lower edge of this brass plate running along the magazine should be a little above

the lower plate of the magazine. This distance should not exceed fifteen thousandths of an inch. This is for the purpose of preventing the matrix from hitting an obstruction and compelling it to rise in order to enter the magazine. The upper side of the channel entrance is composed of two pieces. Just above the crimp in the partitions above described there is a flap, or door, *425*, extending the entire length of the channel entrance, which can be raised up so that access can be had to the matrices, and to prevent damage when the matrices are fast in the magazine, and it is necessary to open the channel entrance. This is shown in Fig. 122.

SPIRAL AUTOMATIC DISTRIBUTOR STOP

Recently another form of distributor stop has been adopted for all models. This distributor stop was first used on the Model 9, and was found to work so well that it has been adopted to all machines.

In this form of automatic stop the channel-entrance partitions are not elastic, but are fixed, as shown in Fig. 118, Fig. C. This allows them to be made about one-half the thickness of the elastic channel-entrance partitions. This gives an opportunity for larger matrices to be used.

In this form of automatic distributor stop the front upper distributor screw and the lower distributor screw have upon them two rotary wedges. These wedges are fastened to the screws. These wedges are so set that the thin edge of one wedge is opposite the thicker portion on the other distributor screw. So long as the distributor screws are in a certain relation to each other the threads of these screws pass one another, and the distributor screws will revolve, as shown in Fig. 118. The screw thread on the lower distributor screw is fastened to the screw shaft and the gear is not fast on the shaft, but is loose thereon, and is attached to the screw thread by a spiral spring. As the gear with the spiral spring revolves, it pulls the screw around with it, and so long as the lower distributor screw does not get out of time with the upper distributor screw the screws revolve freely. If, however, any friction is placed upon the lower screw it gets out of time with the upper screw. The threads are not now in position to pass one another, and they lock together, stopping the distributor screws. At the same time the lever *477*, shown in Fig. 118, is tripped a little to the right (as you stand in front of the machine). This throws out the clutch, as shown in Fig. 122.

The friction that puts the lower distributor screw out of time with the upper one is caused by the pressure against a matrix that fails to fall into the channel entrance. As soon as the matrix rubs against the distributor screw, the screw is retarded, the little spiral spring stretches; the screw threads are now out of time, and in a very small portion of a revolution they interfere with one another and a lock occurs, stopping the distributor, as above described. The spring at proper tension should not bind the ears or lugs of matrices when they drag the lower screw. If tension is too strong thin matrices will be damaged.

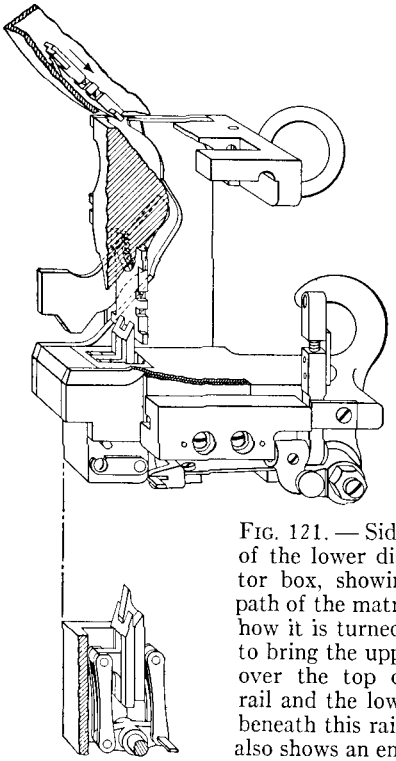


FIG. 121. — Side view of the lower distributor box, showing the path of the matrix and how it is turned so as to bring the upper ear over the top of one rail and the lower ear beneath this rail. This also shows an enlarged view of the pawls.

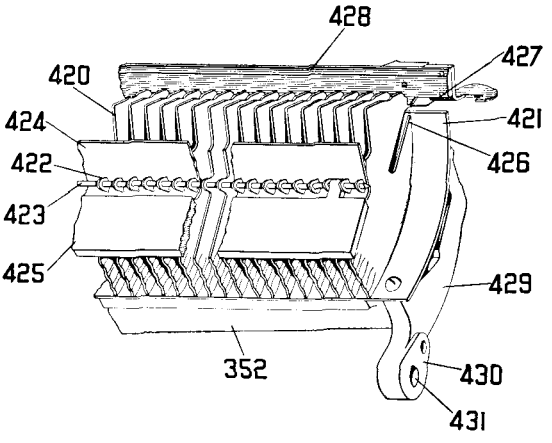


FIG. 122.—An enlarged view of a portion of the channel entrance. The channel entrance is the device which guides the matrices when they drop off the distributor bar into the channels, or grooves, in the magazine. The channel entrance consists of a number of thin partitions *420*. These partitions are secured in a grooved brass plate *421*. The partitions *420* have shoulders at their upper and lower extremities which fit over the top of the plate *421* and into slots cut in the bottom of the brass plate *421*.

There is a third projection in the channel-entrance partitions *420* which has a hole in it, and through these projections *422* is threaded a wire *423* to hold them in position. The top of the channel entrance consists of two plates, one of which is fixed, *424*, and the other pivoted to swing like a door, *425*. This door, or flap, *425* can be raised in order to get at the matrices in the channel-entrance partitions.

The channel-entrance partitions have a slot cut in their upper part at an angle *426* which makes the upper part of the partition flexible. In this flexible part there is a small projection *427* which is adapted to register with notches in a bar *428*, the use of which has been described.

The plate *421* and all the mechanisms above described in this figure are mounted upon a cast-iron frame *429*, the width of which is equal to the width of the magazine. At the bottom of this casting there are two lugs *430* having pivoted holes *431* so that the channel entrance can be mounted on the magazine frame or the upper part of the distributor bracket in such a way that the whole channel entrance can be opened or closed by revolving around the pins which fit in the pivot holes *431*.

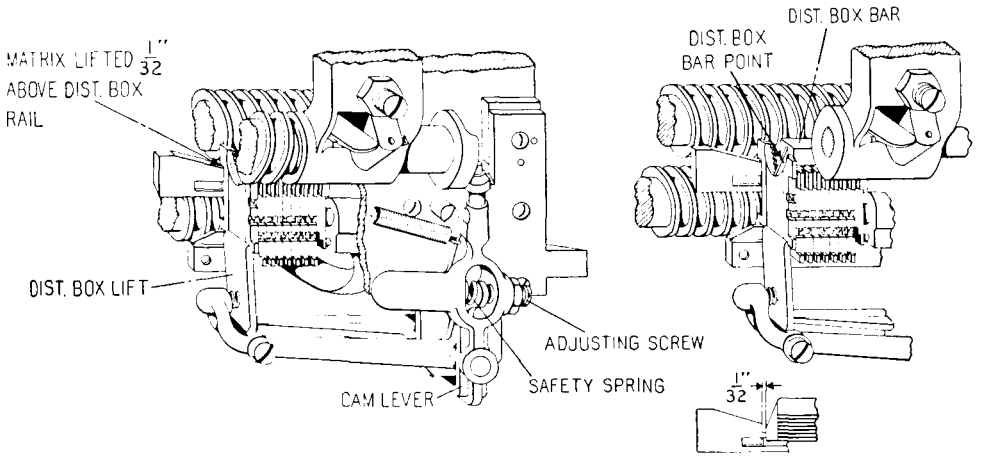


FIG. 124.—View showing the matrix being lifted over the shoulders of the distributor-box rails and shows the adjusting screw for setting the lift so as to raise the matrix one thirty-second of an inch above the shoulder of the rail.

Assembled on the distributor clutch pulley washer clutch flange are two distributor clutch stops. These are called left-hand stops. Fastened to the distributor clutch flange are two distributor clutch stops, called right-hand stops. When the distributor is operated the right hand stops are held on the left hand stops by two spiral springs. One end of each spring is fastened to an adjustable spring collar that slips over the distributor clutch flange; the other ends are fastened to the pulley washer clutch flange. These stops force the pulley washer flange against the driving pulley, operating the distributor. The tension of these two spiral springs should be just tight enough to hold the stops together. When the spiral locks, the tension of the springs should permit the right hand stops to leave the left hand, releasing the pressure on the driving pulley. Too much spring tension will have a tendency to bend the matrices or prevent the proper operation of the distributor screws.

To start the distributor, it is only necessary to remove the matrix that has caused the stoppage, turn the lower distributor screw slightly

backward with the little hand wheel; the screw threads are now in time, and by lifting up the latch, the clutch is released and the distributor is free to go on.

THE MAGAZINE

The magazine consists of two brass plates of a trapezoidal shape, fastened together by screws passing through separating pieces. The inside surfaces of these brass plates have ninety-two grooves, one sixteenth of an inch deep. These grooves are called "channels", and are adapted to receive and guide the ears of the matrices and form a storage for them. At the upper end of the magazine, the space between the channels laterally is uniformly one quarter of an inch. The space between the channels at this

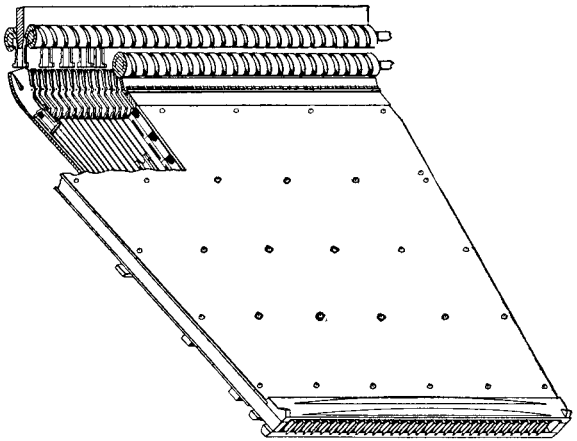


FIG. 125.—Perspective view showing the magazine, the distributor screws, the channel entrance, and the matrices passing along the distributor bar and ready to fall off into the partitions of the channel entrance and ready to pass down into the channels of the magazine.

The upper left-hand corner of the magazine is cut away to show the entrance of the matrices into the magazine.

point is milled away so that the channel is at its upper end V-shaped, and is approximately one quarter of an inch in width at the top. The grooves, or channels, in the magazine are not parallel, but converge toward the front so that at the front end of the magazine the matrices are brought as near together as possible without actually touching. There are nine different widths to these channels, which correspond to the thickness of the ears of the matrices. The channel is ten thousandths of an inch wider than the ear of the matrices, so that the matrices can ride along freely and at the same time can be guided by the channel, so that there is very little sidewise motion.

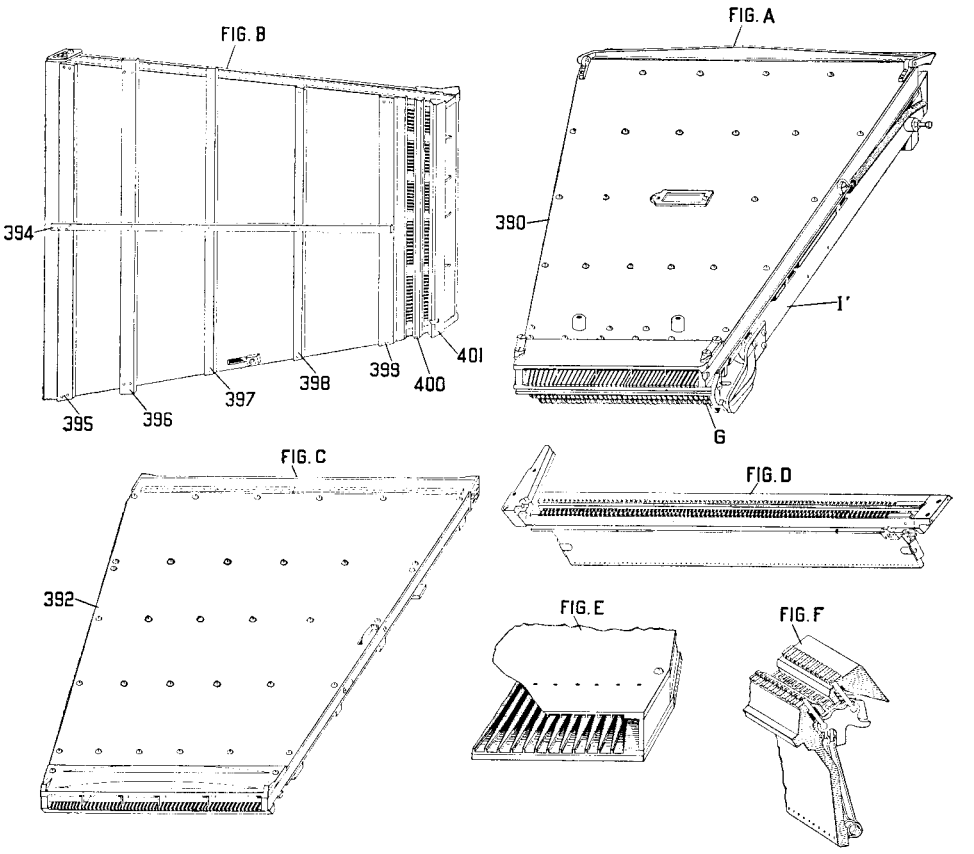


FIG. 126.—Views of the magazine. Fig. A shows a perspective view of the magazine *390* and the cast-iron frame which supports it *I'*. The type of magazine shown in this view is the one originally used, and is called the "Model 1 magazine." In this form the escapements *G* are attached to the magazine, and the magazine *390* and the frame *I'* are fastened together and are removed and replaced on the machine together and form a unit.

Fig. C shows a perspective view of the magazine which is most used in the different models of the Linotype, and is known as the "Model 5 magazine," being first used on this model, but afterward on others. In this type of magazine the escapements are not fastened to the magazine, but are carried separately in a frame called the "escapement bar," shown in another view.

Fig. B shows a view of the under side of this magazine, with a light frame composed of a central bar *394* and crossbars *395*, *396*, *397*, *398*, and *399*. All of these bars are made of steel. There are also two crossbars of brass, *400* and *401*.

Fig. D is a plan view of the escapement bar.

Fig. E is a view of the upper part of the magazine with a portion cut away so as to show the channels made in V-shape at the top. This form is common to all magazines.

Fig. F is a side view of the escapement bar. This bar remains on the machine and registers with and delivers the matrices from the magazines, which can be removed and replaced.

AUXILIARY MAGAZINES

On the Models 14, 17 and 19, there is used an auxiliary magazine. This is illustrated in Fig. 127. This magazine has parallel channels, twenty-eight in number. The magazine proper is not the full length of the ordinary magazine but the lower part *60* is made so that it is easily removable from the machine, while the upper part *59* remains permanently upon the machine. The channels of the short magazine *60* hold only ten matrices. The use of this magazine is confined to special char-

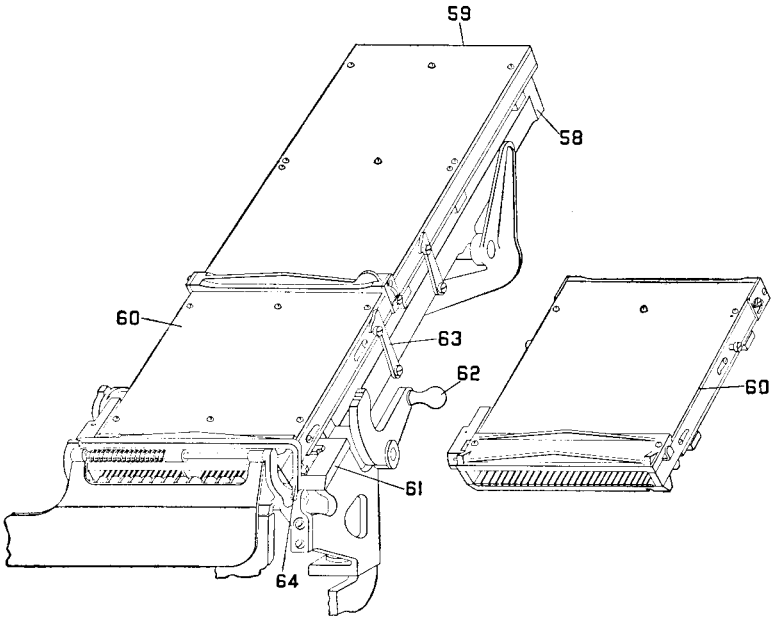


FIG. 127.—View of the supplementary, or auxiliary, magazine. This magazine is used in the Models 14, 17, and 19. The mechanism consists of a frame *58*, which is mounted on the machine, and extends to the right-hand side of the main magazine. The magazine is divided into two parts the upper part *59* and the lower part *60*. A view of the lower part of the magazine *60* is shown at the right of the main figure.

In this mechanism the escapement bar *61* carries the escapements which are separate from the magazine, as in the Model 5 magazine. The magazine *60* has a locking bar, and when the locking bar is in position the magazine can be removed and replaced by other magazines. In the supplementary, or auxiliary, magazine, each channel of the magazine *60* contains not more than ten matrices, and the magazine *60*, as a whole, has only twenty-eight channels, which are parallel, and not at different angles as in the large magazines. The auxiliary magazine is intended to contain only a limited number of characters.

62 is a handle with a cam arrangement for throwing up the magazine *60*, so that it may be more easily removed; *63*, latches which hold down the upper part of the magazine in place after it is upon the machine. The front end of the magazine is held by a bail *64*, similar to the one used in the Model 5 magazine. The matrices are released from the magazine by keyboard.

acters where the full number of matrices in the channel is not needed. The matrices are discharged by a manually operated keyboard and the matrices fall upon an extension of the assembler belt and are delivered by this belt into the regular assembler.

THE ESCAPEMENT

The ordinary escapement has been described previously in Fig. 7. This form of escapement was used in the original Model 1 Linotype, and in this machine the escapement mechanism is fastened to the lower end of the magazine and forms an integral part of it.

In the Model 5 machine the escapement is of the same general character, but it is mounted in a separate frame that registers with corresponding slots in the magazine in the same manner as magazine 60, as shown in Fig. 127. When the matrices are fastened in the magazine by the locking bar, the magazine can be raised and removed from the escapement. This allows one escapement to answer for a large number of magazines. It is desirable that there should be a magazine for every font of matrices that is used frequently. The construction described above saves the expense of the escapement mechanism on each magazine. The magazines are also somewhat lighter. When the magazines are on the machine they rest upon a frame, and when off the machine, if they are hung vertically, they need no support. This does away with the weight of the cast-iron frame, which is fastened to and forms a part of the magazine on the earlier models of the Linotype. With the form of magazine above described the magazines *should not be piled upon one another or left resting against the wall,* but should be hung vertically, either in a frame or supported on the wall by two hooks.

Model 9 Escapement.—In the Model 9 machine there is a somewhat different form of escapement. This escapement consists of a single piece, as shown in Fig. 9, and the action of the matrices is shown in Fig. 23. In this form of escapement the whole set of escapements is attached to the magazine in a manner similar to that described in the Model 1 magazine. These magazines, however, have only a light frame, similar to that used on the Model 5 magazine, and are supported in the machine in side plates.

MULTIPLE MAGAZINE LINOTYPES

The original Linotype machine had only one magazine, which was removable and could be replaced by magazines containing another font of matrices. These first magazines used in the Model 1 machine had a heavy cast-iron frame, so that it required two men to remove and replace one of the magazines. As the art advanced it was necessary to use more than one magazine upon the machine, and the Model 2 was designed.

This had two magazines, the lower one of which, however, was not supposed to be removed from the machine. This proved satisfactory for a time, and a large number of these machines were manufactured and a

considerable number of them are still in use. It soon, however, became apparent that the removal and replacement of magazines was a serious loss of time, and although in the Model 5 machine the magazine was made much lighter and more easily removed, it was still found that it was desirable to have a greater number of magazines permanently upon the machine with some means of transferring the use of one magazine or another without removing it from the machine. This brought in the use of the Model 8 and the Model 9 machines.

In the Model 8 machine there are three magazines mounted upon a frame which in turn is mounted on a barrel containing a screw by which the frame can be raised or lowered at will of the operator, as illustrated in Fig. 128. The screw in the barrel is revolved by a handle at the right.

A screw *518* is caused to revolve by means of a handle *510* through the shafts *520* and *513* and beveled gears *514* and *515*. Turning the handle *510* causes the screw *518* to revolve, raising or lowering the frame containing the magazines. The magazines are locked in place by means of two side bars which are operated by a lever *511* working through lever and link connections, by which these bars are thrown out of locking position by pushing the handle *510* directly inward. In operating position the magazines should rest on the locking bars.

The raising and lowering of the magazines on the Model 8 as just described brings any one of the three magazines into register with the assembler front and the distributor screws.

The Model 8, on the whole, has been a most popular and useful machine, and there are a great many thousands of them in use. On almost all small newspapers at least three sizes of type are used, such as 5½ point, 6 point and 8 point; or 6, 8 and 10 point. It is, therefore, a very great convenience to have these magazines with the proper fonts, which can be quickly brought into register and use.

On the larger newspapers it has been found advantageous to have a display font in one of the three magazines. Ordinarily only two of the magazines would be used on the news part of the paper, but when a pressure of "ads" comes in the extra magazine containing the display font can be used to help out the "ad" alley.

This machine uses the same magazines as are used on the Model 5 and the Model 14. These magazines can be readily removed from the machine and others put in their place, but the use of three magazines to a considerable extent obviates the necessity of change of magazines.

In book and job work it is also found convenient to have at least three sizes ready for use on one machine. Many books, pamphlets, circulars and work of this sort require at least three sizes of type, and in this work the Model 8 has proved to be very advantageous.

It is this "flexibility" which has caused the very large sale and use of this machine.

In book and job offices a considerable number of extra magazines are usually required. This is because the varied work of such offices requires a considerable number of different faces.

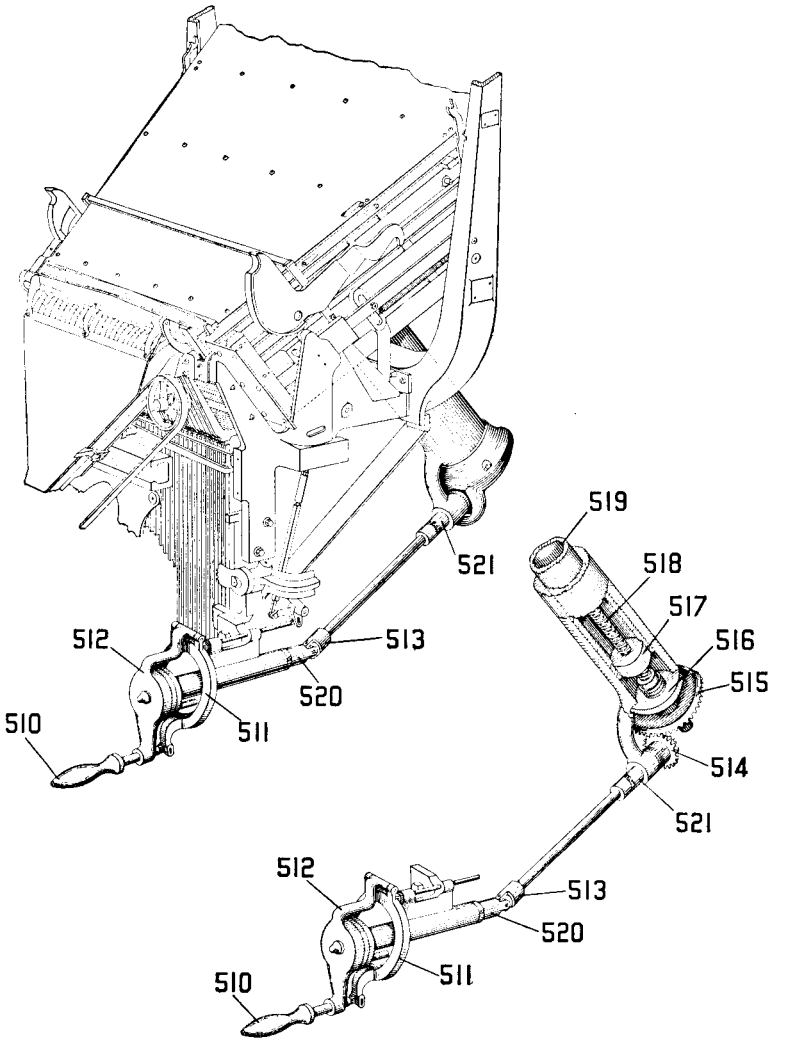


FIG. 128.—View of the magazine-elevating mechanism as used on the Models 8 and 14 machines.

510 is a handle; *511* is a lever hinged at the top. When the handle *510* is pressed inward it operates through a series of levers to unlock the bars which hold the magazines in position. When the handle *510* is revolved through the universal joint and the shaft *513*, a beveled pinion *514* is caused to revolve, which operates on a corresponding gear *515*, which causes the screw *518* to revolve, carrying the tubular slide *519* up or down, thereby raising or lowering the magazines.

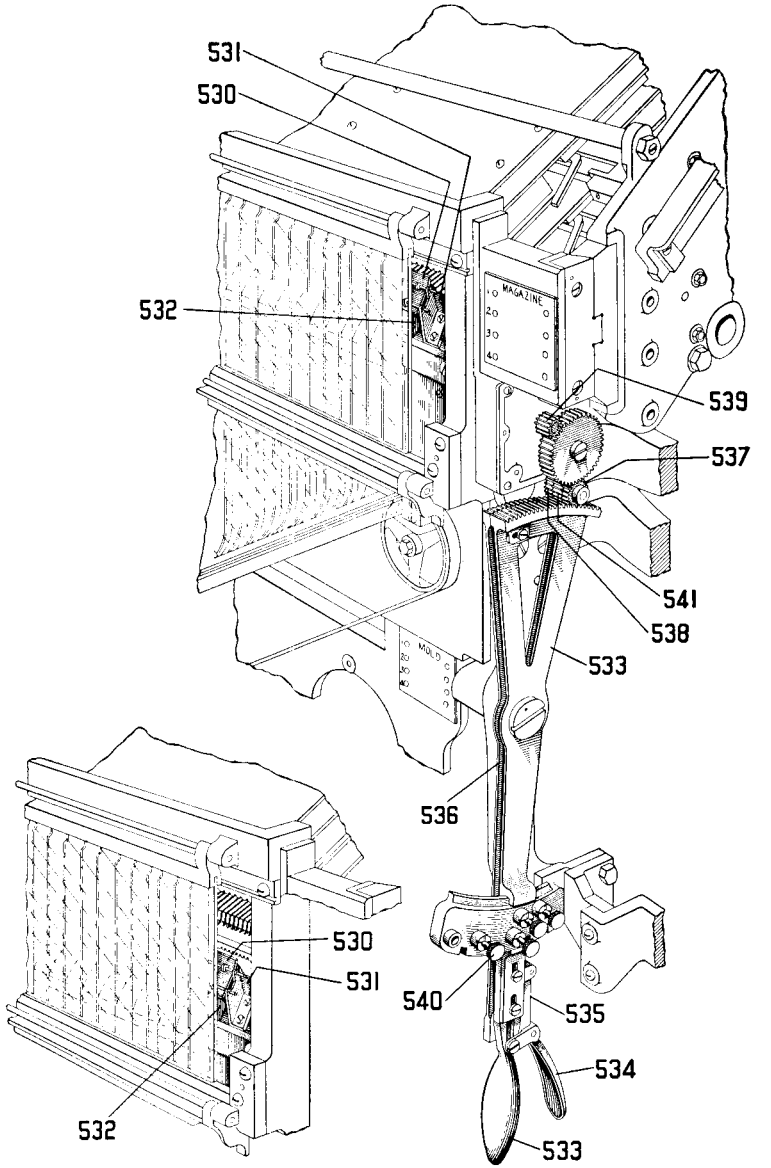


FIG. 129.—View showing operation of raising and lowering of the front on Model 9 Linotype. By pressing handle *534* against handle *533*, pinion *538* is caused to revolve, bringing reeds *532* front, and out of register with the escapements of the magazines. By moving handle *533* forward or back, the pinion *541* operating through an idler gear on pinion *539* raises or lowers the front until the proper position is reached, when the part *535* snaps into one of four notches on the sector, thus holding the front in position. When handle *534* is released, pinion *538* is caused to revolve by a spring, which is not shown in the drawing, thereby bringing the subsidiary reeds under the escapements in the Model 9 magazines and the machine is ready to operate.

It is best, wherever possible, to have sets of matrices stored in magazines so that these magazines can be quickly placed on the machine with their fonts of matrices. Separate fonts of matrices to be run in and out of magazines have not been found advantageous as a general rule. It is so easy to get fonts mixed up in such cases.

Proper receptacles should be made for these magazines. The Linotype Company makes some of these magazine holders. As these magazines are somewhat expensive, care should be taken that they are not damaged when off the machine or when being replaced upon the machine. Magazines should never be left standing against the wall on the floor and they should always be protected if possible from the dust and dirt of the room. From a magazine which is full of dust and dirt the matrices will not run properly, and much time will be lost on this account.

Of late years "split magazines" containing small fonts have proved to be quite useful in special work not requiring a full font of matrices. These magazines and small fonts are cheaper than the regular magazines and fonts, and can, therefore, be used to advantage and with considerable economy. These magazines also should have proper racks or receptacles, and where there is room, the regular rack made by the Linotype Company is preferable.

A change of magazines requires a certain amount of lost time. This lost time may become a very serious loss to the office if the precautions above mentioned are not taken. The successful printing offices are those where proper equipment and system reduce lost time to lowest terms.

We have now followed the course of a matrix through the machine. Beginning with the touch of the finger on the keyboard keybutton, which trips the cam yoke trigger, allowing the keyboard cam to fall upon the revolving rubber roll, causing the cam to revolve and raise the keyboard rod, thereby operating the escapement pawls and permitting the matrix to come out of the magazine and fall through the assembler guides upon the assembler belt, and be carried thereby over the assembler star into the assembling elevator. When the line is assembled the line of matrices is raised in the assembling elevator, transferred through the delivery channel into the first-elevator jaw, which carries it downward between the vise jaws, where the operations of justification and alignment take place, whereupon the mold comes forward against the line of matrices, the pot comes against the mold, the pump plunger is forced down, and the metal is driven into the mold against the matrices, forming the slug. The pot then retracts and the mold disk revolves (trimming the bottom of the slug) to the ejecting position, where the slug is ejected between the knives (which trim the sides) into the galley.

While the mold disk is revolving to the ejecting point, the first-elevator jaw is raised to the intermediate channel, the line of matrices and spacebands is transferred into the intermediate channel, the matrices

engaging with the second-elevator bar, which is raised to the distributor box; the matrices are transferred from the second-elevator bar into the distributor box, are lifted one at a time into the screws, and are carried along by the screws until they reach the point where the combination on the distributor bar corresponding to the teeth of the matrix is cut away, whereupon the matrix falls into the channel entrance and is guided by the channel entrance into the magazine, thus completing the cycle of operation; meanwhile the spacebands have been transferred by their levers into the spaceband box, or magazine.

V. Machine Actions

A LINE of matrices is assembled in the assembler elevator and the elevator is then raised by hand between the fingers of the line-delivery carriage. The line delivery or transfer carriage is released by the tripping of the latch and carries the line of matrices to the first elevator, thereby automatically starting the main cam shaft. The following actions then take place:

1. The first elevator descends to present a line of matrices in front of the mold. During this action the first-justification lever descends, at the same time the slug lever is carried to the right, and the knife wiper rises.

2. The vise jaw on the left-hand side is closed, making the distance between the vise jaws a little less than the proper length of line before the line descends between them.

3. During actions 1 and 2 the mold disk turns one quarter of a revolution to the left, carrying the mold from the vertical or ejecting position to the horizontal or casting position.

4. The mold slide carrying the mold disk moves forward toward the matrices, leaving one hundredth of an inch space between the vise jaws and the matrices, and the face of the mold.

5. The vise-closing lever rises, allowing the vise jaw wedge spring to raise the wedge, moving the vise jaw outward to make the proper distance between the vise jaws for the line of matrices, after the line is justified.

6. The justification levers rise, causing the spaceband block to rise in an inclined position and push the spacebands upward through the line successively, spreading the line until the friction on the bands stops the action of the justification spring. This is called the first justification. During the actions 2 to 6 the transfer carriage returns ready to receive the next line from the assembling elevator.

7. The justification levers descend, relieving the spacebands from the upward pressure.

8. The vise-closing lever descends, relaxing the vise jaw, and slightly relieving the matrix line from the pressure, to allow the vertical alignment of the matrices.

9. The first elevator rises, lifting the matrices so that their lower ears bear against the aligning shoulders in the mold for vertical alignment.

10. The metal pot advances and pushes the mold forward against the line of matrices, pressing them back against the jaw, to complete the alignment facewise.

11. The metal pot recedes, relieving the matrix line from the pressure of the mold.

12. The vise-closing lever rises, allowing the wedge spring to raise the wedge to its proper height and moving the vise jaw inward to the exact length of the line.

13. The justification and vise-closing levers rise simultaneously, causing the justification block to rise horizontally and push the spacebands upward through the line of matrices to complete the justification.

14. The metal pot closes against the mold, forcing the mold against the aligned and justified matrices, making the "lockup."

15. The pump lever descends, and plunger delivers metal into mold from metal pot to form the slug, after which plunger rises again.

16. The upward pressure on the first elevator, due to action 9, is relieved, releasing the lower matrix ears from the strain. The justification lever and vise-closing lever descend, releasing the pressure on the line, and the metal pot and the mold slide carrying the mold then move backward, drawing the face of the slug out of the matrices.

17. The mold slide stops and the pot continues to retreat, separating the mouth of the pot from the base of the slug.

18. The mold disk revolves three-quarters, carrying the base of the slug in the mold past the back knife, thereby trimming the base of the slug to the proper height, and presents the slug in a vertical position in front of the two trimming knives, in position to be ejected. During this action the first elevator rises, lifting the matrix line to the intermediate channel, where it is transferred to the second elevator, at the same time the first elevator rises. The knife wiper descends to normal.

19. The elevator transfer slide lever now moves the matrix line on to second elevator. The transfer lever slide and spaceband pawl now move back, allowing the second elevator to lift the matrices out of the intermediate channel, leaving the spacebands. The transfer slide and spaceband pawl now move toward each other, pushing the bands together and then returning them to spaceband box.

20. The ejector blade moves forward and pushes slug out of mold between trimming knives and into galley at front of the machine.

21. During operation 20 the first elevator is lowered to its normal position ready to receive another line. At the same time the second elevator rises to register with the bar in the distributor box.

22. While the second elevator is rising the distributor shifter is moved outward to be in position to shift the line into the distributor box.

23. The distributor shifter moves inward pushing the line of matrices into the distributor box. At the same time the justification lever rises slightly and actuates the slug lever, assembling the slugs in the machine galley. At the same time the ejector retreats to its normal position.

This completes the actions for one revolution of the cam shaft.

VI. Molds and Liners

UNIVERSAL ADJUSTABLE MOLD

THE universal adjustable mold is adjustable for any measure from 4 to 30 ems pica and from 5 to 14 points in body thickness. The body portion of the mold is screwed firmly to the disk. The mold cap overlying the body is held at each end by upright mold cap guides insuring position adjustment, front and back, of cap and body.

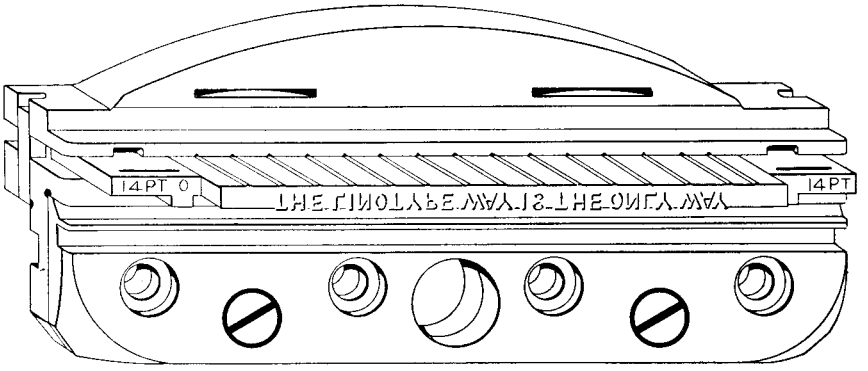


FIG. 129a.—Universal adjustable mold.

The right- and left-hand liners are held firmly between the cap and body by the pressure of the mold cap screws, and at right-angles with the mold slot by keys on bottom of liners, which fit in mold body, insuring rigidity and accuracy in length.

A change of measure and body does not affect the general relation of the mold to the trimming knives. Therefore, the molds and knives, when properly adjusted, will maintain their corresponding position indefinitely, thus insuring slugs of equal height and thickness.

The mold disk opening or pocket is of a curved form on the outer side, with three set screws through the rim from the outside which hold the mold cap liners securely in place.

In order to change the length of the line, it is only necessary to loosen the screws so that the left-hand liner may be withdrawn easily and one of the proper length inserted. The mold cap can be raised by inserting a screwdriver in the slots which will be found in either end of the cap. Never

pry the cap open by inserting screwdriver in the mold slot. This will eventually ruin the mold. Use a piece of brass.

If a change of body is required, the screws are loosened at both ends, and both liners (right-hand and left-hand) withdrawn and the proper ones inserted. When tightening the screws, use only a moderate pressure. There is no need of binding.

Liners can be supplied for all measures in even ems or half ems up to 30 ems pica, and in all bodies from 5 to 14 point, inclusive. It is convenient to have an assortment on hand.

The universal adjustable mold can be changed for any lengths of line or thickness of body in a very short time.

RECESSED MOLD

In order to reduce the quantity of metal in large slugs and to improve the face on large characters—10 to 14 point, inclusive—this mold is provided with a cap having projecting portions that form large cavities, or recesses, in the slug, as shown in the illustration, thus reducing the weight of each Linotype slug about one third.

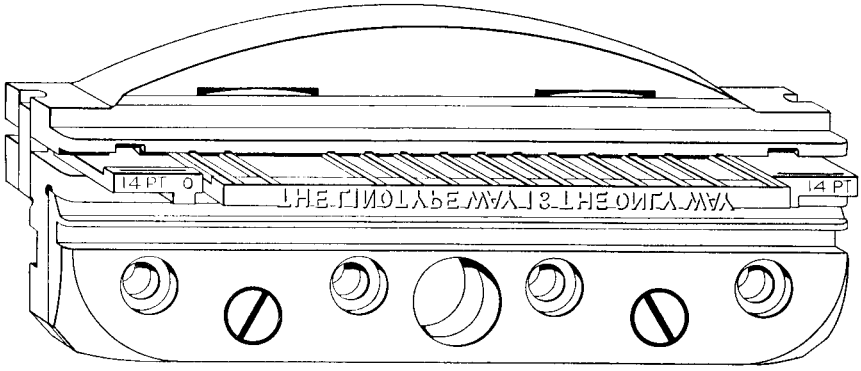


FIG. 129b.—Recessed mold.

The slug has a solid face, as usual, and ribs at the side to sustain the face, so that it stands up solidly under the pressure of stereotyping, electrotyping, or printing from the slugs direct.

The recessed mold is, in general construction, similar to the universal adjustable mold. The right-hand liner is precisely the same as that used in the universal adjustable mold, but the left-hand liner, which is used in changing from one measure to another, *is special, and can be used only in a recessed mold.*

The mold can be applied to any machine having a universal adjustable mold disk, without altering or fitting the parts, and may be used in

connection with the ordinary ejector blades, *but the ejector blade must be five points thinner than the body being cast, on account of the recessed cap.*

The slugs being much lighter than when cast solid, the saving in metal reduces the expense of keeping matter standing. As the air to be displaced from the mold is less than that from the Universal Adjustable mold, more perfect slugs are secured, especially on the larger sizes.

Recessed molds may be specified on all new Linotypes, except Models K and 15, without extra charge.

UNIVERSAL ADJUSTABLE LOW MOLD

This mold is used for casting low slugs without ribs from 5 to 14 points in thickness and any ordinary length of line. Both right- and left-hand liners used in this mold are special. The ordinary matrix slide blocks may be used with this mold but the slide is special, being extra thick in order to make up for the difference between the height of this mold and the ordinary mold. The universal adjustable low mold is only .754″ high.

ROGERS TABULAR MOLD

This mold can be used for casting blank slugs on a machine equipped with the Rogers tabular attachment. The mold is .731″ high and used only with the tabular attachment. Matrix slides are not made for use with the Rogers tabular mold.

FUDGE MOLD

This mold is used to produce a slug with a taper from top to bottom, so that a number of them when assembled will fit the curved surface of the plate cylinder of a rotary newspaper press. A fudge is a number of these slugs so fastened to the cylinder that, if desired, it may be printed in a different color from the rest of the plate of that particular page, or may be inserted in a stereotype plate.

This mold cannot be used to cast any measure or body except the one for which it is built. To make these, the factory must have the following information:

1. An accurate drawing of the cylinder, showing its total diameter, and the radius from center to the face of the type.
2. Exact length of slug at face of type.
3. State whether the two ends of the slugs are to be brought to an angle, or left flat or square, same as the regular slugs.
4. Height of slug from bottom to the beginning of the angle on the two ends. Also what the angle on ends is to be; whether forty-five degrees, or some other angle.
5. Size of face.
6. Size of body on which the face is to be cast.
7. Show how slugs are to be held in position.

In supplying a Fudge mold there are some extra parts necessary to be applied to the machine, and an order should always state (unless you already have one of our fudge molds and only desire to replace it) that the necessary parts should be supplied.

If you have one fudge mold and desire to put another in the other side of the mold disk, it is only necessary to purchase the mold itself.

Regular ejector blades are used with fudge molds. *The liners, however, are special, and are not adjustable,* for a fudge mold can be used for only one specified body and one measure.

DISPLAY OR HEAD-LETTER MOLD

The display mold, used to cast the larger bodies, is similar to the recessed mold, the recess being proportionately deeper to accommodate the increased size of slug. This style of mold requires a pocket or opening in

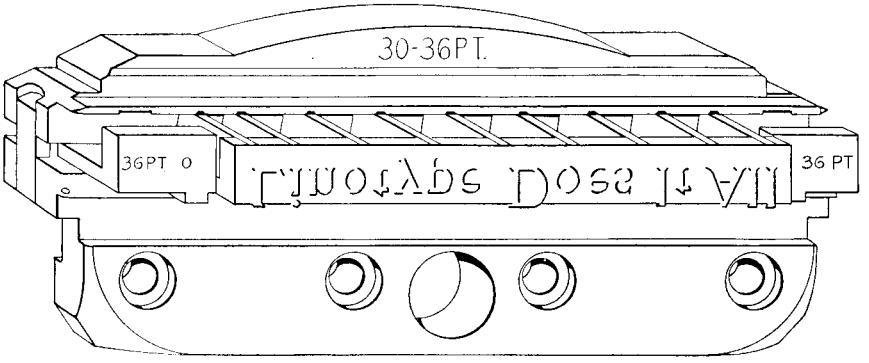


FIG. 129c.—Display or head-letter mold.

the mold disk somewhat larger than that required for other styles of molds. This mold is adjustable for body size as well as length of line and is used in the same general manner as other molds.

ADVERTISING-FIGURE MOLD

This mold is made for the purpose of casting large figures for price figures or other display characters on a slug of smaller size than the face of the type. It permits of casting a character that overhangs the slugs below. There is a wide lip on the cap, against which the overhanging portion of the character is cast, and the ribs are parallel, instead of tapered as usual. This mold will cast overhanging faces up to 24 point in face, and it is adjustable in body from 5 to 12 point.

In special cases this mold will be adapted to accommodate 14- or 15-point liners so that certain 30-point display faces can be cast overhanging. When 14- or 15-point liners are so used, the two-letter attachment must be used to prevent the mold cap lip from striking the first elevator back jaw.

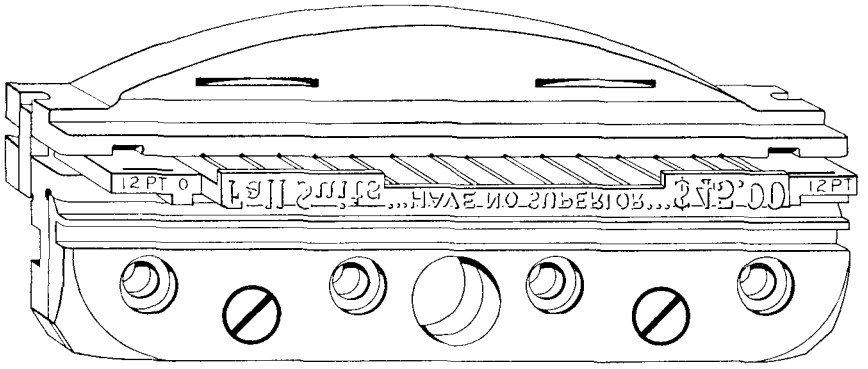


FIG. 129d.—Advertising-figure mold.

Fig. 129d shows the advertising-figure mold with slug bearing overhanging characters. This style of composition is frequently required in newspaper and job work, and is easily and quickly accomplished by the use of this type of mold.

SPECIAL ADVERTISING MOLD

For Use with Matrices in the Auxiliary Position.—This mold is for use with extra large figures and display faces. It is a one-letter mold for use only with matrices punched in the auxiliary position, and will cast large advertising figures up to and including 42 points. Thus, its scope is much larger, due to an extra wide lip on the mold cap to provide for the overhang, than the regular advertising mold. Regular universal adjustable mold liners from 5 to 12 points, inclusive, can be used with this mold. The largest overhang that can be cast against the face of the mold cap is 27 points.

MOLD LINERS

Universal Adjustable Mold Liners.—Universal adjustable mold liners are made in point sizes from 5- to 14-points, inclusive, and, in length, to produce a slug by ems or half ems from 4 to 30 ems, inclusive. When ordering liners the body as well as the length of line to be cast should be stated.

CHANGING MOLD LINERS

To change the liners in a universal adjustable mold from one thickness to another, or from one length to another, lower the vise and revolve the mold disk to a convenient position where the mold will be accessible, as shown in Fig. 60. Loosen the screws in the mold disk above the mold cap, remove the liners, and insert those you desire to use, then tighten the screws. Be sure to change the ejector blade before changing the liners if you have reduced the length or thickness of the slug. The mold must be turned to the ejecting position after the change. Do not remove the keeper from the mold for any reason, except an injury. If it is necessary to remove

it, care must be taken in replacing it to see that there is no dirt on it and that its upper edge is brought up to its proper seat, as this controls the alignment of the matrices. Set the vise jaws by the gauge attached to the vise, close the vise, and set the side trimming knife, the assembler slide and delivery slide, and the first-elevator jaw line stop one eighth of an inch longer than the length of the line after it is justified.

Caution: In order to change the left-hand mold liner in a 36-em mold, it is necessary to take the mold from the mold disk, after which the cap can be removed and the liner taken out. The liner is held in position by the mold cap guide and cannot be changed while the mold is in the mold disk, as the universal adjustable mold liner is changed. Be sure that the mold body and cap are perfectly clean, and that there is no metal adhering to them when changing liners.

Left-hand liners made for 30-em molds cannot be used in 36-em molds, and *vice versa.*

VII. Miscellaneous

EJECTOR BLADES

EJECTOR blades are of different thickness and width, to accommodate the different sizes of bodies and lengths of slug, 5, 5½, 6, 7, 8, 10 and 11 point body sizes, and in width, for all lengths of slug from 4 to 30 ems, inclusive, varying by one em. Eight point ejector blade is used for ejecting 9 point slugs, as there are no 9 point ejector blades made. Eleven point ejector blade is the thickest and is used for all slugs 11 point and larger. When ordering ejector blades, the body and length of line must be given. For instance, 6 point, 12 ems.

Ejector blades used with recessed molds must be at least 5 points thinner than the slug to be cast, 5 point blade used with 10 point recessed mold, 6 point blade used with 11 point recessed mold, 7 point blade used with 12 point recessed mold, 8 point blade used with 13 and 14 point recessed mold.

Ejector blades used with head-letter molds start at 5 point with the thinnest liner used in the mold, as, for instance, a 15 to 19 point mold would take a 5 point ejector blade with 15 point liners, or a 32 to 36 point mold would take a 5 point ejector blade with 32 point liners, and the blades increase in thickness as the liners increase.

CHANGING EJECTOR BLADES

To change an ejector blade, open vise; if machine is fitted with mold ejector safety lever, push ejector lever back by hand; turn the mold disk until the slot is in the front of the blade; turn the machine backward until the second elevator falls to the safety hook; remove the ejector blade, and insert the proper size of blade to be used. Place the machine in its normal position. *Care should be taken that an ejector blade wider or of greater thickness than the slug to be cast is not put in the machine.* Liners or molds will be damaged if this important point is overlooked. Never deviate from the rule of *always changing the ejector blade before changing mold liners.* A good plan is always to *try* the ejector blade by hand *after* changing liners.

See page 68 for description of the universal ejector blade.

KNIFE WIPER

On the old style knife wiper operated by the first-elevator lever the knife-wiper bar should work freely in its guides and the tension of the knife-wiper bar spring should be just strong enough to balance the

weight of the knife wiper. A drop of oil should be placed on the working surface of the bar once a day and the lower guide should be kept free from trimmings of side knives. This form of knife wiper is now obsolete.

NEW STYLE KNIFE WIPER

The knife wiper in use on all later Linotypes is shown in Fig. 44. It is more compact and rigid in its construction and is not so liable to be bent. The new style is strongly recommended for replacement.

POT CRUCIBLES

We have had occasional complaint that the crucible of the metal pot becomes cracked, causing the metal pot to leak. To prevent this the gas should be turned on about half way for twenty minutes when starting to melt the metal, or until the metal becomes warm and expanded, after which the gas may be turned on full. When the gas is turned on full at first, the metal in the bottom of the pot melts sooner than the metal at the top, and the rapid expansion on account of the heat forces the molten metal through the minute pores in the crucible, and sometimes cracks it.

HOW TO PACK A POT JACKET

Mix the asbestos meal with water until a paste is formed; coat the pot jacket about one half inch thick on the inside, except in front, where the burners are located; place the crucible in the jacket, and pack the asbestos between the jacket and the crucible, filling in all the spaces around the crucible. *Asbestos must not be allowed to get into the well.* Stop up the well with a piece of rag, or waste, while packing the crucible. Care should be taken that the crucible fits in position firmly; then put on the cover and fasten it down. Turn on the heat about half force, and let the moisture dry out slowly; take three or four hours for this.

VIII. Power

POWER FOR DRIVING THE LINOTYPE

THE Linotype may be driven from any source of power having a uniform speed such as a line shaft, electric motor, gas engine, or water motors, and requires approximately one-quarter horsepower. The driving pulley on the Linotype is 14½ inches in diameter and has a 2½-inch face. Its speed should be seventy revolutions per minute, which will give approximately six and one third lines per minute, as the Linotype is geared so that eleven revolutions of the driving shaft will make one revolution of the cam shaft. To ascertain the size of pulley required to drive the Linotype, multiply the diameter of the driving pulley on the Linotype, 14½ inches, by the number of revolutions, 70, and divide the product by the number of revolutions of the line shaft, and the quotient will be the diameter of the pulley required on the line shaft.

ELECTRIC MOTORS

The individual electric motor provides the most convenient and efficient drive for a Linotype. Turning a snap switch, located within easy reach of the operator's working position, starts or stops the machine, and there is no power consumed except when the machine is running.

We have adopted as standard product an electric motor specially designed and built to our order by a prominent and successful manufacturer of small motors. This motor has given universal satisfaction for many years. It is mounted on the frame of the Linotype and becomes an integral part of the machine. This locates the motor within the lines of the Linotype where it is free from floor dirt and within easy reach for oiling. These motors are wound for any desired commercial electric light or power circuit, both direct current and alternating current. They show exceptional electrical efficiency which tends toward low operating cost, and their slow speed insures long life and low maintenance expenses.

The driving pinion is of the helical type, which insures noiseless operation, maximum efficiency and economy in power transmission.

Every motor is tested at the factory, under full load and overload, with accurate instruments. The rating assigned to each motor is not a nominal rating based on the performance of a few motors, but is the actual brake load successfully carried by the individual motor during a prolonged test. They have a large overload capacity and are designed with a liberal factor of safety.

These motors are carried in stock for immediate shipment wound for 115-volt and 230-volt direct current, and 110-volt and 220-volt, single-phase, 60-cycle, alternating current. The direct-current motors will operate satisfactorily on a circuit within ten per cent. of these voltages. The alternating-current motors will operate satisfactorily on a circuit within ten per cent. of these voltages and frequencies. These single-phase motors will operate entirely satisfactorily on a two-phase or a three-phase circuit. We are prepared to furnish them wound for other voltages or frequencies or for two-phase or three-phase circuits, on special order, but we advise the use of single-phase motors wherever possible.

An electric motor equipment for the Linotype consists of the motor and pinion, a gear wheel which is to replace the tight and loose belt drive pulleys, snap switch, cable, and attaching screws. The motor is shipped with a suitable pinion to drive the shaft on the Linotype at about 70 r.p.m. when motor is operated at its rated voltage. This speed permits of casting approximately six and one-third lines per minute. If it is desired to increase or decrease this speed the motor pinion may be changed. Substituting a pinion with one having one more tooth will increase the casting speed about one-third line per minute.

ORDERING MOTORS

In ordering direct-current motors it is only necessary to state the voltage. We do not supply, nor do we advise the use of, a 500-volt direct-current individual motor on the Linotype.

In ordering an alternating-current motor it is necessary to give the voltage, frequency, and phase. When motors are installed, we wish particularly to call attention to the necessity of having the work done by competent electricians.

ELECTRICAL NOTES

746 watts equals 1 horsepower.

1 horsepower is equal to raising 33,000 pounds one foot in one minute, or 550 pounds one foot in one second.

1 kilowatt equals 1,000 watts.

The alternating-current motor, 110 volts, 133 cycles, consumes about 350 watts an hour.

The direct-current motor, 115 volts, 2.2 amperes, consumes about 253 watts an hour.

IX. Adjustments

MAIN DRIVING CLUTCH

THE main driving clutch is where the power to drive the machine is applied, and should always be kept clean. If the leathers on each end of the friction shoes become dirty, or oil is allowed to accumulate, they will slip, and the machine will not eject the slug.

1. *Main Driving Clutch.*—The clutch should be adjusted so as to allow fifteen thirty-seconds of an inch between the collar on the driving shaft and the driving shaft bearings. Should the clutch for any reason bear against the rim of the pulley unevenly either sandpaper off the thicker leather or pack under the thinner one with hard paper as may be necessary to secure the fifteen thirty-seconds of an inch distance referred to above.

The spring that expands the clutch should be adjusted to a tension of sixteen pounds. This gives about the right friction to carry the machine through all its operations with a steady motion when everything is working properly, but if anything sticks or makes the machine run hard, the clutch will slip. This avoids damaging the machine. To find tension: shut off the power, and open the starting rod in front, then turn the cams back a little, so the stopping pawl is clear of the stopping lever. Take an ordinary spring balance and catch the hook in the toggle joint of the clutch and pull out. The tension should be taken just when the clutch rod begins to move.

If the clutch fails to let go properly, it is generally because the leathers are sticky with a mixture of oil and dirt. Rub them off with a piece of sandpaper, or wash in benzine.

Do not use rosin, belt grease, printers' ink, or any other preparation to give the clutch greater driving power when it slips, but follow the suggestions given above, and *keep inside of pulley and faces of clutch leathers perfectly clean.*

Before applying new leathers to a friction clutch, the starting lever should be opened, the machine backed free from the stopping pawl. If there is clearance between the lower vertical lever and the forked lever, adjust as above by packing underneath the leathers; see that the pulleys are clean and the leathers clean, and the brass screws holding the leathers not bearing on inside of driving wheel.

2. *Automatic Stopping Pawls.* Set pawl fifteen sixteenths of an inch from the edges of the cam (Fig. 88), when the cam shaft is in normal

position. Use adjusting screw in automatic pawls; that is, the screw that goes through the pawl and strikes the lug of the cam.

The stop pawl brings the machine to rest after the main cam shaft has made one revolution.

The automatic safety pawl is to stop the machine if, for any reason, the line has not transferred.

3. *Automatic Stop Lever.* Set so that the lever bears one quarter of an inch on upper stopping lever (Figs. 88 and 90). Use set screw in top of vertical lever for this adjustment. This lever is for stopping machine in normal position. The action is to push down on the upper stopping lever, forcing the lower stopping lever against the forked lever, which in turn pushes on the collar that is fastened to the clutch rod, the other end of which is connected to the clutch rod. In doing this the clutch is thrown out of action and the machine is stopped.

4. *Automatic Stopping Lever Lower* (Fig. 89). Allow one thirty-second of an inch between the lower stopping lever and forked lever. Use adjusting screw in the upper stopping lever. This lever forms the connection between the upper stopping lever and the forked lever to get a horizontal motion from a vertical action.

5. *Vertical Lever* (Fig. 90). This lever is only in action when starting lever is pulled by hand. Eccentric screw on starting lever rod is pulled against the lower lug of vertical lever and draws the upper lug *248* around one sixteenth of an inch. Use adjusting screw in the upper vertical bearing. Lug *248* forces automatic pawl *231* off stopping lever *159*, which releases clutch, causing the cam shaft to revolve. The vertical lever is returned by a spring located in the upper vertical lever bearing and stops against an adjusting screw inside of column. This screw should be adjusted to allow the upper lug *248* to clear automatic safety pawl *231* one sixty-fourth of an inch when back in normal position.

6. *Vertical Lever.* Allow one sixty-fourth of an inch between upper lug and automatic stop pawl. Use adjusting screw inside of column. This lever is returned by a spring and stops against the adjusting screw, and should move freely.

7. *Starting Lever* (Fig. 91). Allow one thirty-second of an inch between eccentric screw and vertical-lever lower lug. This lever controls machine. When part way out and standing free, the machine is in operative position. When pulled all the way out it will start the machine. When pushed in it acts on the clutch and stops the machine.

8. *First Elevator Connecting Link* (Fig. 40). Adjust eyebolt so that it is three quarters of an inch at the top and thirteen sixteenths of an inch at the bottom from holes to shoulders. This link has a spring inside of it that compresses when the alignment is made. It is also used to align the first elevator with the delivery channels and the intermediate channels, which is manifestly important.

9. *First Elevator Slide.* To clear the transfer and delivery channels in its vertical movement, adjust gibs on vise frame.

10. *Delivery Channel.* To align the first elevator jaw with the delivery channel use the first elevator connecting link. When in position the rails of the first elevator should be very little below the rails of the delivery channel, about the thickness of a sheet of paper.

11. *Intermediate Channel.* The first elevator jaw should align with the intermediate channel so that the matrices will pass freely on to the second elevator. Adjust with screw on the bottom of the first-elevator slide on the right side.

12. *First Elevator Slide* (Fig. 42). When the first elevator slide is raised, bringing the ears of the matrices against the mold for alignment, there should be one sixty-fourth of an inch space between the adjusting screw and the top of the vise cap. Adjust with center screw in top of first elevator slide.

13. *First Elevator Slide Guide* (Fig. 100). Releasing lever should clear transfer slide one thirty-second of an inch when matrices are transferring. Adjust by screw in second elevator. This lever is to keep the matrices from transferring in case the second elevator does not come down into position.

14. *First-Elevator Intermediate Bar.* When the intermediate bar pawl is raised it should be flush with the lower tooth of second-elevator bar. Adjust with two screws in top of cap. This pawl is to push down the spacebands when transferring.

15. *First Elevator Line Stop* (Fig. 41). Should set one eighth of an inch from line, after line is justified. Clamp by screw in first-elevator jaw. This jaw is to keep the matrices from falling out of the elevator and to prevent them from twisting when elevator is carrying them up or down.

16. *Assembling Elevator.* There is a small wire on the assembling elevator. This wire should be set to release the transfer carriage just as the latch of the assembling elevator catches. Adjust by screws under the starting wire. This wire starts the cam shaft by releasing the transfer carriage which is carried to the first elevator. The lever that makes the transfer carries a roller at its lower end which comes in contact with the automatic stop pawl, forcing the pawl off the upper stopping lever, allowing the main driving clutch to come into action and start the cam shaft.

17. *Assembling Elevator.* To be returned by its own weight. Adjust with counter-balance-spring screw hook in keyboard frame. This is to make the elevator fall easily by balancing it so that it will just fall into position. Always see that front and back buffers are in good condition, to insure proper assembling of matrices.

18. *Assembler.* The assembler chute spring of old style should be set to throw the bottom of the matrices toward the assembler star, allowing sufficient space for the cap "W" to go between it and the rails. Adjust

by bending the spring. The present style of assembler chute finger is of the proper shape, and only requires adjusting for the cap "W" of the different fonts of matrices. This adjustment is made with the knurled assembler chute finger adjuster. The assembler star should stop on tight lines. Adjust the assembler star pinion friction spring. The assembler matrix catch spring is to prevent the top of the matrix from falling backward. Adjust by bending the spring so it will be flush with the casting when pushed forward by the matrices.

19. *Elevator Transfer Lever* (Fig. 102). The elevator transfer slide finger should be five and nine-sixteenths of an inch from the intermediate channel. Adjust by moving elevator transfer cam roll lever on shaft, to proper dimension and then clamp lever to shaft with clamping screws in hub of lever. The elevator transfer lever transfers the line of matrices from the first elevator jaw to the second elevator. It also operates the spaceband lever through a link.

20. *Spaceband Lever.* The spaceband pawl should pass by the point of the spaceband-box rails. Adjust with the turnbuckle which connects with the transfer lever. This lever returns the spacebands to the box.

21. *Elevator Transfer Slide* (Figs. 28 and 103). Allow one eighth of an inch between slide finger and the bottom of slot in spaceband pawl. Adjust the screw in transfer slide. This slide and finger push the spacebands under the pawl so that the pawl can return them to the box.

22. *Automatic Safety Pawl* (Fig. 76). When line transfers to second elevator the cut in slide finger should come flush with second-elevator bar plate, adjusted by screw in safety pawl *231*, which regulates the automatic safety pawl buffer *237*, on which the cam roller *236* works, forcing safety pawl *231* clear of stopping lever *159* when there is no cause for stopping.

23. *Spaceband Box* (Fig. 29). The spaceband box pawls should stand one thirty-second of an inch below the upper edge of the box rails. Adjust with screw in the spaceband box pawl lever. These pawls lift the spacebands over the rails, allowing them to fall into the assembler. See that the pawls are equal in height.

24. *Line Delivery Slide.* The delivery carriage in returning after a line is delivered should go far enough to the right so that the short finger will catch in the second tooth of the pawl (Figs. 35 and 36). Adjust by moving the delivery lever *156*, Fig. 78, cam roll arm on shaft and then clamping the arm to the shaft with the clamping screws in hub of the arm. This should bring the transfer carriage back so that when the line is raised in the assembling elevator it will not strike the short finger.

25. *Line Delivery Slide* (Fig. 38). The inside of short finger, next to the matrices, should stop thirteen thirty-seconds of an inch inside of first elevator. On all machines over 6282, by stop screw on face plate. This adjustment is to carry the matrices inside the first-elevator jaw retaining springs, which keeps them from falling out.

26. *Mold-turning Cam* (Figs. 55 and 93). The steel shoes are to hold shaft in position when the pinion is not in mesh. Adjust by screw bushings in cam. This is to position the mold disk in casting and ejecting points so locking pins will enter bushings.

27. *Vise Jaw* (Fig. 50). To bring face of type .01 of an inch from each end of the slug. Adjust screw in top of knife block for short jaw, locking screw in vise-closing arm for long jaw. This is to position the type on slug so there will be no shoulder sticking over either end of the slug.

28. *Mold Slide* (Fig. 68). The mold slide should be adjusted to bring the face of the mold ten thousandths of an inch from the face of the line of matrices or the back of the vise jaw. The mold should be in this position at the time of alignment. Adjust with eccentric pin in the mold cam lever before the pot comes against the mold. To test this adjustment; turn the casting mechanism until the first elevator jaws are resting on the vise cap; place a pig of metal under the head of the slide and on top of the vise automatic stop rod; fold three thicknesses of newspaper, which measure about ten thousandths of an inch; close the vise jaws; place the paper between the mold and the vise jaws; turn the machine forward by hand until the metal pot is just ready to move forward; pull up on the paper, which should bind a trifle as it is being withdrawn. If the paper does not bind or binds too tight it would show that the slide is out of adjustment. The mold disk locking pins should enter the bushings smoothly as the mold slide comes forward. Adjust with screw under the mold disk guide.

29. *First Elevator Slide, Vise Stopping Rod, and Mold Disk Dog* (Figs. 42 and 43). This adjustment should be made when the first elevator slide is down and resting on the vise cap, the first elevator auxiliary lever cam-roller at the lower part of the first elevator cam. Bring the mold disk forward by hand, so that the ears of the matrices will be in the mold alignment groove. Adjust with center screw *79* in the top of first-elevator slide, bringing the ears of the matrices one sixty-fourth of an inch from the alignment point, or in other words, the top of the alignment groove in the mold should clear the ears of the matrices when the mold advances one sixty-fourth of an inch. With the elevator slide in this position adjust the vise automatic stopping rod and mold disk dog (Fig. 43). This should be adjusted so that when the first elevator slide descends to the vise cap and the mold advances to the line of matrices the vise automatic stop rod pawl should just clear the mold disk dog. Adjust with screw *77* at the top of the first-elevator slide, right-hand side. This adjustment is very important. It will stop the machine if the first elevator slide does not come down to its proper position to align the matrix ears with the alignment groove in the mold, to prevent danger to matrix ears and possible squirts.

30. *Mold-disk Brake* (Fig. 54). To take up lost motion in the mold disk. Adjust screw in brake. This is to keep the disk from running past the locking pins on account of momentum of disk.

31. *Distributor-box Lift* (Fig. 111). Should lift matrices one thirty-second of an inch above the shoulders of the rails in the distributor box. Adjust screw in cam lever. This lift raises the matrices into the screws, one at a time. The screws carry them along the rails until the bar is reached, when they transfer to the bar.

The distributor-box bar point is located at the inner end of the distributor-box bar. Its purpose is to hold the second matrix down while the first one is being lifted. This condition should be constantly maintained.

32. *Distributor Clutch and Stop* (Fig. 116). The bar having a notch in it should be adjusted so that the channel entrance will rest upon the bar one thirty-second of an inch. Adjust the plate by loosening the screws and moving it to proper position.

33. *Ejector Blade.* When the ejector blade advances to its farthest point forward, the end of the blade should be one thirty-second of an inch in front of the incline on the lower knife block liner of the inclined galley, and one thirty-second of an inch forward of the front face of the chase bracket of the vertical chase. Adjust with the screw in the ejector lever adjustable pawl (Fig. 67).

34. *Metal Pot* (Fig. 64). The metal pot should be adjusted vertically so that the lower edge of the holes in the mouthpiece is just above the mold body. Adjust with the upper screws *144* in the pot legs. The pot mouth must be square with the mold in order to get a perfect lock-up. Adjust with the front and back screws in the pot legs *143.*

35. *Pump Stop* (Figs. 72 and 73). When the line is fully justified there should be one thirty-second of an inch between the stop lever and stop. Adjust by the screw in the pump stop operating lever, Fig. 172, *133.*

36. *Second Elevator.* When the second elevator rests on the intermediate channel in position for the line of matrices to transfer, the second elevator cam roll should be clear of the cam. Adjust by the connecting bolt which connects the second elevator cam with the second elevator cam lever.

37. *Matrix Delivery Belt.* The belt should be kept fairly tight. Adjust by loosening nut, pulling idler pulley back and tightening nut. This belt carries the matrices when dropping over the assembler front from the magazine into the assembler elevator.

38. *Pot Lever Eyebolt* (Fig. 62). The pot lever eyebolt should be adjusted so that the front nut is five thirty-seconds of an inch from the sleeve, and the back nut so that there will be a space of one sixteenth to one eighth of an inch between it and the lever, when the pot is forward in the locked-up position. This is to insure the spring being under compression when the pot is locked up.

39. *Back Knife* (Fig. 59). Should be set square and press lightly against mold. Adjust by two square-head screws back of knife. The slug passes by this knife, which trims it to type height.

40. *Stay Bolt* (Fig. 77). Should have head bear lightly against bracket. Held by screw. This bolt takes the strain when pot locks up.

41. *Assembler-slide Brake* (Fig. 164). Should release just before the line-delivery carriage starts. Adjust by screw in operating lever. This brake holds slide when it is being assembled and releases to bring slide back into position. The outer end of operating lever is forced up by the assembler elevator when it is raised and releases the brake, allowing the slide to go back to the starwheel. When the elevator descends the lever is forced down, setting the brake for another line.

42. *Spaceband Box Center Bar* (Fig. 31). The spaceband box center bar should be set so as to allow only one spaceband to be raised at a time. Adjust by the screws in the spaceband bar bracket, which has an elongated hole to permit such adjustment.

JUSTIFICATION SPRINGS

It is important that care should be taken of the justification springs. It does not require the same tension to justify a 10- or 13-em line as it does a 30-em line. The amount of tension on the springs that would justify a line with only two or three spacebands in it would not justify a line with eighteen or twenty in it, and if the same tension is left on the spring which justifies a long line when the machine is running on a short line, with from five to eight spacebands in it, there is an unnecessary strain on the spacebands, matrices, vise jaws, and other parts connected with the justifying mechanism. When changing from a short to a long line, increase the tension, and diminish when changing from a long to a short line. When constant changes are to be made use full tension.

If for any reason justification springs are removed, care should be taken that they are *not transposed* when being replaced. One spring is slightly larger in thickness of wire, as it is intended to exert a greater pressure than the other. The pump stop should be properly set so that the pump will not operate unless the line is fully justified.

LOWERING THE VISE

To lower the vise (Fig. 96) first shut the power off by pushing back the starting and stopping lever. See that the first elevator jaw registers with the delivery channel and that the mold disk is not forward upon the locking pins. Turn the vise locking screws and lower the vise. To lower the vise to the second, or lower, position, which is necessary only when the mold slide is to be removed, turn the machine by hand until the first-elevator jaw rests on the vise cap and stop the machine before the mold slide has come forward, or the vise closing lever has started to raise. Remove the inclined galley, lower the vise, pulling out the vise frame rest to permit the vise to go to the lower position, and pulling upward on the first-elevator slide as the vise is lowered, to avoid breaking or bending the first-elevator lever link.

VISE AUTOMATIC

Care should be taken that the vise automatic is always in working order. It is intended to stop the machine when the operator sends in a tight line. If it is not adjusted properly the machine will not stop if the first elevator does not descend to its proper position, and the matrix ears, or lugs, will be damaged by mold, causing bad alignment, and sometimes causing a bad squirt of metal.

To adjust the vise automatic, turn the machine ahead until the elevator slide descends and rests on the top of the vise. Select two perfect matrices, and with the vise open in the first position, place one matrix in the elevator jaws just inside the pawls, and another at the other end, or about thirty picas away; then close the vise, and lock securely. Disconnect the mold-slide lever, and pull the mold disk ahead on locking pins by hand. With the left hand raise the elevator until the ears of the matrices bank firmly in the aligning groove in the mold.

Holding the slide in this position turn the screw *79* in Fig. 42 down until it banks on the top of the vise cap. The other screw *77* should now be turned down to force the automatic stop rod down just far enough to allow the blade on the rod to pass under the plunger. The ears of the matrices at this time should be about one sixty-fourth of an inch below the aligning point of the mold. Lock the screw with the nut. The screw *79* should now be back one quarter of a turn and locked with the nut which completes the adjustment.

VISE JAW LEFT-HAND ADJUSTING BAR

The vise jaw left-hand adjusting bar registers with a scale on the vise cap by which the left-hand vise jaw can be set for any length of line. This can also be used for casting blank ends on slugs, to allow for the insertion of cuts or initials, the blank end casting against the vise jaw and afterwards cut off by a lead cutter or saw.

SECOND ELEVATOR

If the second elevator fails to descend at the proper time usually because the line of matrices has not distributed, the second elevator is caught by a safety pawl *202*, Fig. 81. In this case the spaceband lever pawl should be locked and then the matrices may be distributed. At this time it is sometimes necessary to pull back the second-elevator lever by hand so that the shifter lever may push the matrices into the distributor box. Then the second elevator may be lowered by hand after releasing the safety pawl *202*, Fig. 81. Never attempt to lower the second elevator by hand without first locking the spaceband lever pawl. On the later models of machines which are equipped with the spaceband lever operating lever it is not necessary to lock the spaceband lever pawl as the second-elevator lever can be held with the right hand and the spaceband lever operating lever with the left hand, controlling the spaceband lever and allowing the

line to come over smoothly after the second elevator is lowered to position. On machines other than recent models the locking of the spaceband lever is necessary.

MAGAZINE—MODELS 1 AND 3

Stroke of Verges.—For Models 1 and 3 machines, throw off keyboard belts, touch lower case "e" and em-dash keys. Turn the rolls until the keyrods reach highest point. The keyrod should be raised off verge at least one thirty-second of an inch. Adjust by the large screws beneath magazine.

MOLD DISK—WATER-COOLED

The mold disk (Fig. 57) revolves on a large stud which is hollow, and so constructed that a continuous stream of water may be circulated through it, keeping the mold disk and molds cool, with the result that solid and accurate slugs are assured. In making the water connections be sure to connect the inlet and outlet as shown in Fig. 57. The water must enter at the bottom and go out at the top. Do not circulate the water through the stud under pressure. Open the valve only enough to keep up a moderate circulation.

MOLD-BANKING BLOCKS

Attached to the back of the vise frame, one above and the other below the side knives, are the mold banking blocks upper and lower. These blocks are to prevent the mold from coming in contact with the knives, and hold the mold disk rigid when ejecting the slug, so that the knives will trim the slug parallel, and support the mold cap and liners against the thrust of the ejector blade.

EJECTOR SLIDE

The improved ejector slide does away with the necessity of turning backward the cam shaft to release the slide. This device is illustrated in Fig. 69. To change the ejector blade, reach back in by the ejector slide, as in making the change with the old-style slide. The lever will be found projecting forward alongside of the slide. Press down on this lever and draw the slide forward. The change of blade can then be made in the usual manner. Push the slide back into position and the operation is completed. When the slide is pushed into position again the link is connected to the slide automatically.

UNIVERSAL EJECTOR

The Universal ejector consists of a series of blades, the lower section of which is for four ems, and the others two ems wide. These sections are arranged edge to edge and are connected to the ejector slide by links. On the front of the machine, just under the starting and stopping lever and within easy reach of the operator, is a controlling lever and a notched segment, by means of which any desired number of blades may be brought

into operation, thus varying the width of the blade to correspond with the length of the slug cast. At the same time that the controlling lever is moved it automatically shows a figure in the back plate of the delivery channel, which represents the number of ems for which the blade is set. Universal ejector blades are only made on one thickness which is thin enough for a 5-point slug, and is supported so rigidly, that it will eject slugs of any thickness within the range of the machine.

X. Care and Operation

OILING AND CLEANING

OILING and *cleaning* of the machine are among the most important of the duties of a Linotype machinist. A good quality of oil should be used, and that sparingly, though regularly, applied. Use two sizes of oil can, a long-spout oiler and a smaller one, and put the oil in the holes or cups, not all over the frame of the machine.

In oiling the Linotype judgment should be exercised as to the amount of oil to be used. It is not necessary to flood the machine in any part. The slow moving parts should be oiled on a new machine once a day, the fast moving parts twice a day. As the machine grows older and the parts become smoother they will not need oiling so often. One important point which should always be borne in mind is, that in oiling any part of the machine which comes in contact with the matrices, no oil must be allowed to accumulate where it is liable to find its way on to the matrices. If it is allowed to get on the matrices it will soon interfere with the proper working of the escapements and the matrices will not respond to the touch of the keybutton. *Always,* when oiling these parts of the machine, carry a piece of waste in your hand and after oiling the parts wipe off any surplus that may be on the outside. This is very important and should never be neglected. Do not use cheap vegetable or mineral oil. Use a high grade machine oil that will not gum. Be careful to remove all surplus oil, particularly around the assembling and distributing mechanism, so as to keep the matrices absolutely free from oil. The following is a list of places which require oiling. Faithful performance is most essential.

1. *Base.*

   Bearings for ejector lever shaft, one at each end.

2. *Column.*

   Bearings for elevator transfer lever shaft, one at each end.
   Bearings for delivery lever shaft, one at each end.
   Bearings for spaceband lever shaft, one at each end.
   Bearing for mold slide, a grease cup.

3. *Cam Shaft Brackets (Right-hand).*

   Bearing for cam shaft, a grease cup.
   Bearing for driving shaft, a grease cup.
   Bearing for justification and vise closing lever shaft.
   Bearing for second elevator lever shaft.

3. *Cam Shaft Brackets (Left-hand)—Continued.*

Bearing for cam shaft, a grease cup.
Bearing for justification and vise closing lever shaft.
Bearing for second elevator lever shaft.
Bearing for mold driving pinion, one at each end.
Bearing for mold turning square block shaft, one at each end.
Bearing for distributor shifter lever shaft, one at each end.

4. *Driving Shaft.*

Bearing for left-hand end, a grease cup.
Driving shaft loose pulley, a grease cup.
Driving shaft motor gear, a grease cup.
Driving shaft clutch rod.
Driving shaft friction shoe rods and pins.

5. *Rollers.*

First elevator cam roll, oil hole in the stud.
Justification cam roll, oil at side of roll.
Vise closing cam roll, oil at side of roll.
Pot cam roll, oil at side of roll.
Elevator transfer cam roll, oil at side of roll.
Delivery cam roll, oil at side of roll.
Mold cam roll, oil at side of roll.
Mold cam lever roll, oil at side of roll.
Second elevator cam roll, oil grooves in lever at side of roll.
Pot pump cam roll, oil hole in lever.

6. *Levers.*

Vise closing lever, oil hole on top of spring rod.
Justification lever, oil hole on top of spring rod.
Justification lever, two oil holes in hub.
Mold cam lever, two oil holes in hub.
Mold cam lever handle, two oil holes in hub.
Pot lever, two oil holes in hub.
Pot return cam shoe.
Ejector lever, two oil holes in hub.
Ejector lever adjusting pawl.
Ejecting lever adjusting pawl plate.
Ejector lever shoe.
Second elevator safety pawl.
Pot pump lever, stop lever, operating lever, oil hole in the stud.
Starting and stopping lever hinge pin.

7. *Cams.*

Ejector cam.
Pot return cam.
Vise closing and mold turning cam, on side where square block slides.
Mold turning bevel pinion, on sides of square block.
Mold turning cam shoes.
Delivery and elevator transfer cam, on spot for second elevator safety pawl.
Distributor shifter cam.
Distributor shifter cam rider, end and hinge pin.
Automatic safety pawl, end and hinge pin.
Automatic stopping pawl, end and hinge pin.
Delivery cam shoe.

GENERAL DIRECTIONS FOR OPERATING MACHINES

Fingering of the Keyboard.—The touch of the key necessary to operate the escapement is exceedingly light on the Linotype machine, very much lighter than on a typewriter. The depression by the finger on the keybutton is only about three sixteenths of an inch, while on a typewriter it is nearly an inch. The arrangement of the Linotype keyboard is based on the relative use of the letters of the alphabet in the English language. The letter "e" (lower case), being used far more than any other letter, is placed in the channel at the extreme left of the magazine, so that when released by the escapement this matrix drops almost directly upon the star wheel. The lower-case "t," which has the next largest use in words, is placed next to the "e" channel in the magazine, and so on across the magazine, the least-used characters being at the extreme right in the magazine and keyboard. In other languages than English, the keyboard is based on the relative use of the letters in the language in a similar manner. The spaceband key is not in the keyboard proper but is placed a little to the left, and is extended in such a way that it can be touched with the little finger of the left hand when the hand is in different positions over the keyboard.

Various rules for fingering have been devised. There are three systems which have been published, each of which is declared by its author to be the best and giving the highest possible speed in composition with the least amount of muscular effort. It is probable that any of these methods is good.

The great object of everyone who is learning to operate the keyboard should be to cultivate a regular movement of the fingers so that there is exactly the same interval of time between the touch of a key and the succeeding one. There are certain combinations which come so often that the fingers can operate them much more rapidly than other combinations of letters; for example, the word "the," the syllables "tion," "sion," "ough," and the like, occur very frequently. There is a temptation on the part of operators to finger these combinations much more rapidly than the letters or syllables used less often. Operators should be on their guard against acquiring this habit. It is productive of transpositions and clogs of matrices in the assembling.

Any one who watches a rapid operator is struck by the fact that the movements of his fingers *seem* to be slow. As a matter of fact, the "swift" learns to make a perfectly even interval of time between the successive touches of the keys, so that the matrices come into the assembler elevator with perfect regularity.

A correct style of fingering, and this evenly timed touch of the successive keys are two great secrets of rapid operation of the Linotype.

Timing of the Spacebands.—The matrices of the Linotype machine are all of the same general shape and vary only in thickness. The space-

band, however, is a very different thing, being heavier than the ordinary matrix, and about four inches long, instead of an inch and a quarter. Its fall is also vertical, directly upon the star wheel, instead of at an angle upon the assembler belt, as is the case with the matrix.

A matrix is released from the magazine by the first upward movement of the keyboard cam, while the spaceband is released on the return movement of the keyboard cam. There is also a certain amount of lost motion left in the connections to the keyboard rod which operates the spaceband lever. The object of this arrangement is to give the matrix a little advantage in the time of release over the spaceband if a finger key and the spaceband key are both touched at the same time because there is a general tendency for the spaceband to drop in front of the final letter of a word, as before the letter "e" in the word "the," instead of in its proper place. The operator should see to it that the escapement of the spaceband is working properly, that the points which lift the spaceband over the retaining shoulders are sharp and of equal length, that the shoulders are square and not worn, and, finally, that the lost motion in the key rod that operates the spacebands is just enough to give a matrix, such as the lower-case "e," the proper advantage in the time of its travel to the assembler elevator.

The forègoing adjustment is of very great importance in the rapid operation of a Linotype machine. This will be seen when it is noted that the matrices and spacebands may be falling into the assembler stick at the rate of from five to ten a second. It would seem as though it were impossible to time two pieces of metal of such different size, weight, and path to be traversed as a matrix and a spaceband so that they will come into their places successively in the exceedingly small interval of time that can be allowed. As a matter of fact, however, this difficulty is more theoretical than real. A little experience and care will make it possible to pour the matrices and spacebands into the assembler stick in a shower, and yet they will find their proper places to form the characters of the composed line.

The best operators learn what is called the "touch system;" that is, they learn the positions of the keys so that they can finger the keyboard while reading the copy, and the eyes do not have to follow the fingers in their movements. The best operators also train their ears so that they hear the fall of each matrix into the assembler stick, although they are not conscious of the fact. Many operators will, without conscious attention, instantly detect the failure of a matrix or of a spaceband to drop into position properly.

This training of the hand and ear will contribute very greatly to the speed of the operator. It will prevent frequent corrections by hand in the assembler stick. These corrections in the assembler stick cause a great loss of time, and they break up what an operator calls his "movement."

This training of the eye, ear, and hand to work automatically and in cooperation cannot be gained in a short time, and some are so constituted that they can never attain it. It is far better, however, for one learning to operate, to understand these things at the beginning, and to make slow, but steady, progress rather than to acquire bad habits that are very difficult to overcome.

Keeping the Metal at the Right Temperature.—The operator should get into the habit of regularly dropping in a pig of metal at a certain interval. This interval varies with the speed of different operators, but on the average a pig should be dropped in about once in twenty minutes. If the metal is replenished at about this rate, there will be little trouble with the governor. On the other hand, if the operator allows the metal to run down so that he has to put in two or three pigs at a time, it is almost certain to cause trouble. This regulation of the metal does not require any *great* amount of attention or care, but the necessary things above mentioned *must not be neglected,* and this care will add greatly to the "string" which an operator will hang up at the end of a day.

Distributor Stops.—If there should be a number of distributor stops the system of distribution should be gone over carefully, as explained on pages 123 and Fig. 116. The distributor lift should be examined. If the flexible partitions are used, it should be noted whether these are bent, and in that case they should be straightened back with a pair of pliers, and, if necessary, the adjustments shown on page 120, Fig. 116, should be reset. The latter, however, seldom happens.

TO TAKE A KEYBOARD APART

Whenever it is necessary to take the keyboard apart to clean, it should be removed from the machine in the following manner: Remove the keyboard cam frames. Disconnect the assembling elevator lever. Procure a strip of wood furniture fifteen inches long, which is the proper length to just pass inside of the frame posts, fasten a strong cord to each end of the wood strip, take off the keyboard locking bar, place the strip of wood along the back of the keybars, bring the string inside of the side posts to the front of the keyboard. Draw the two ends of the string tight, so that the strip can not move, and fasten it to the keylevers. Take out the two keyboard side plate bracket screws (on each side at the rear of the keyboard frame). Take out the four keyboard front plate screws. Remove the two screws which hold the keybar banking bar to the posts and pull the bar off the dowel pins. Pull the frame toward the front of the machine and lift it out. Place the frame on a bench on table in a slightly inclined position with the rear end the higher. Take out the lower row of keylevers by removing the fulcrum rod. Take off the keybars, keeping them in their regular order. Take out the remaining keylevers by removing the fulcrum rods. Wash the keylevers in denatured alcohol or gasoline; brushing vigorously with a jeweler's brush the parts that come in contact with the frame.

If there is any corrosion left, polish the levers with metal polish; wipe them dry with a clean rag. The keybars should be cleaned in a like manner, but rub each side of each keybar on a graphite board instead of using metal polish. Wash the frame of the keyboard thoroughly, and wipe dry. If an air hose is available, blow all the parts dry with the air.

When reassembling the keyboard, work upward. Place the lower row of keylevers in first, run the fulcrum rod through the holes; then assemble the next rows, using the same procedure for each row. This method makes it easy to assemble the keylevers.

After the board has been assembled, test out each key to see that it is working freely, before replacing the strip of wood.

When replacing the banking bar the slot in the keybars must fit over the bar; raise up on all the keybars with the plate extending underneath them until the banking bar dowel pins fit into the dowel pin holes.

It is usually necessary to clean the entire keyboard only once or twice a year unless the shop conditions around the machine are very dirty.

TO REMOVE THE KEYBOARD CAM FRAMES—ALL MODELS

Removal of keyboard cam frames can be accomplished in the same general manner. The cam covers and belts are taken off, the screws in the rubber-roll shaft brackets are removed, and the frame drawn out. In the various models a slight difference may be observed in the shape of the brackets, and in some cases the interferences differ; but a close examination of the parts should show what to do first. Where possible use the same screws where they were taken out.

TO REMOVE AN INDIVIDUAL KEYBOARD CAM

To remove an individual keyboard cam from keyboard of Model 1: 1. Throw off belt. 2. Remove cam frame covers. 3. Locate cam by touch of key. 4. Withdraw cam yoke pivot wire as far as the cam yoke wanted; lift out cam yoke. Reverse operation for replacement.

Models 2, 3, 4, 5, 6, and 7, use the same operation, except that the belt need not be thrown off the pulley. For Models 8, 9, and 10, proceed as follows: 1. Remove keyboard cam frame covers. 2. Push up cam yoke spring bar latch and swing out the spring bar. 3. Lift out the cam yoke. When putting in a cam reverse the operation, being sure the spring bar latch is locked.

TO REMOVE A MAGAZINE FROM THE MODEL 9

Open the assembling entrance cover and the assembler cover; remove the matrix delivery belt from the upper pulley, and belt from the pi stacker pulley; unlock and swing open the entrance; place the right and left magazine supporting arms on the proper lugs on the sides of the magazine supports; place the left hand in front of the magazine to support it, and draw out the magazine locating bar with the right hand. The magazine can then be slid forward upon the supporting arms and be re-

moved. When replacing push the magazine up full distance, push in the locating bar and lower the magazine slightly to position. Reverse the other operations to complete the change. This change is quickly and easily accomplished.

TO REMOVE A CHANNEL ENTRANCE—MODELS 1, 2, 3, 4, 5, K, L

1. Place a mark on the lower edge of the partition plate and frame. This is a guide for the return of the plate to proper position. 2. Remove channel-entrance frame spring. 3. Remove the two frame hinge screws and take the frame to a work bench. 4. Remove the guide bar brackets. This will allow the guide bar and the automatic stopping bar to be taken off. 5. Drive or pull out the locking-strip rod; remove the strip. 6. Remove the screw in the slotted hole in each end of the partition plate. 7. Fasten the frame in the jaws of large vise and take a hammer and a block of wood and drive the partition plate in the direction of the partition that is to be removed. 8. When the plate has moved far enough withdraw the partition and put in new one. In driving the plate back to place, be careful that the lugs of the partitions do not catch on the frame. When the marks coincide that were previously made on the edge of the partition plate and frame, put in the screws in the slotted holes. Finish by replacing the other parts.

TO REMOVE ASSEMBLER STAR WHEEL

1. Take the two screws out of the small holder bracket. 2. Take screw out of the assembler rails. 3. Draw off the star. This operation is practically the same on all models.

TO REMOVE MATRIX DELIVERY CHUTE—MODELS 2 AND 4

If matrices catch in the matrix delivery chute and cannot be dislodged with the fingers or a bodkin, the chute must be removed. To do so, shut off the starting and stopping lever; release delivery slide and permit it to go to the left. A screwdriver can then be put through the face plate, where the delivery slide was, and the screw holding the chute released. The chute can then be drawn downward and out. When replacing it, the tongue of the matrix guide must be placed inside the chute and properly adjusted to its position inside the chute before tightening the screw to insure its proper operation.

TO REMOVE THE SPACEBAND BOX

Shut off the starting and stopping lever, and turn the cam shaft backward until the spaceband lever pawl has moved into the intermediate channel. Remove the electric light or bracket screw from the spaceband box, and swing the bracket clear of the spaceband box. Remove the screw in center of spaceband box, which holds it to the face plate, and the spaceband box can then be taken off. When replacing the spaceband box hold the pawl levers up so that the screws on the back lever will rest on top

of the spaceband keylever, see that the dowels are in the holes properly, and that the spaceband chute is properly located alongside of the assembling elevator gib.

TO REMOVE LINE-DELIVERY SLIDE—MODEL I

1. Push in controlling lever and open vise. 2. Release the slide and allow it to move to the left its full distance. 3. Take out the delivery link screw and the flat spring that holds the link knob in the delivery lever, then draw out the slide. On rebuilt Models 1 and 3 machines, the first two steps should be taken as before, but the third operation consists in removing the slide stop, and by raising the catch from above the knob, the slide is free to be drawn out. The plan applies to Model 10 also.

On Models 2, 4, 5, 8, 9, the first two steps are followed as mentioned above. The third step is to remove the slide stop, and the fourth is to raise the delivery-lever link spring, after which the slide may be drawn out.

TO REMOVE DRIVING SHAFT FRICTION CLUTCH

To remove the driving shaft friction clutch shut off the power; if a motor, turn off the current; if a belt on the loose pulley, remove the belt. Do not attempt to take the clutch off with the power on the machine. Take off the nut on the clutch rod. If the machine is of a later model, remove the screw from the driving shaft friction link collar. Remove the clutch arm key screw. The clutch can then be removed. If the driving shaft is to be removed take off the pulleys or the gear, if motor driven; remove the driving shaft clutch flange screw; drive out the taper pins which hold the driving shaft pinion into the shaft, and the pinion collar on to the pinion. The shaft and pinion can then be removed. In putting the pinion and shaft together again care must be taken that the taper hole for the pin exactly aligns before driving in the taper pin.

TO REMOVE SECOND-ELEVATOR STARTING SPRING

1. Pull out controlling lever, and when second elevator descends, push in lever. 2. Take out the screw in end of spring rod, withdraw rod, and remove spring. In putting on a new spring have the adjusting nut turned up to the shoulder of the bolt cap. When the screw is put in, turn the adjusting nut to give a slight compression to the spring. Keep the rod oiled.

TO REMOVE THE MOLD SLIDE

On machines having the universal ejector blade, start the machine, and when the first elevator has reached the lowest position, stop the machine by pushing back the starting and stopping lever. Open the vise to first position; raise the first-elevator slide by hand, and lower the vise to a horizontal position and rest it on a block or other support; remove the ejector lever link; lower the mold cam lever handle; set the ejector blade scale bar at 12; remove the ejector blade controller link rod, and the con-

troller can be removed; detach the hose from the mold disk stud, first turn ink off the water, and the mold slide can now be removed. On machines equipped with the old style ejector slide it is necessary to remove the first-elevator back jaw guard, and hold the mold slide when taking it out, so the ejector slide will not fall out. Otherwise all the operations are entirely the same except that there is no ejector blade controller and controller link rod to be removed.

TO REMOVE AN EJECTOR-LEVER PAWL

1. Push in controlling lever. 2. Remove lock nut from screw. 3. Turn the screw out until it touches the gear wheel, then turn the cam shaft back, and move the ejector lever forward. The pawl can then be removed. In replacing, reverse the operations.

TO REMOVE THE MOLD DISK

On machines having the water-cooled mold disk, shut off the starting and stopping lever; disconnect the ejector lever link; lower the mold slide handle and draw out the mold slide, until the mold disk is clear of the mold disk pinion; remove the mold disk guides; take out the three screws in the mold disk plate, and lift the mold disk off the stud. In removing the mold disk from the old style stud, proceed as above, except that instead of taking out the three screws from the mold disk plate, remove the nut from the mold disk stud. In loosening the nut use a piece of brass and a hammer. Do not use a steel drift. Push the stud back and lift off the disk. Before replacing, be sure that the front and back ends of the mold stud bearing, as well as the shoulders of the mold stud, are perfectly clean. Screw the nut up tight, and the stud and disk should revolve freely, and be very sure that the mold disk does not bind when the guides are replaced in position.

SETTING THE MOLD DISK TO CAST IN PROPER MOLD

See that the mark on the mold disk exactly matches the one on the mold disk pinion. If it does not, draw the mold slide forward until the disk is clear of the pinion, and turn the disk until the marks coincide. Then push the slide back so that the teeth in the disk and pinion are in mesh. With the machine standing in normal stopping position, pull the mold disk pinion forward off its locking pin, and turn the disk until the mold required is in the ejecting position, when the pinion can be pushed back on to its locking pin, and the mold required will be in the proper position.

TO REMEDY A MOUTHPIECE LEAK

When the mouthpiece leaks: if the mouthpiece is of the old style fastened with a gib or wedge, drive out the wedge, remove the mouthpiece and fit it to the mouthpiece bearing, using a little Prussian blue. The fitting must be done with a fine file or scraper until there is a perfect joint. Then

replace the mouthpiece and wedge. If the mouthpiece is of the new style, where the mouthpiece is fastened to the crucible by screws, remove the mouthpiece and fit the face of the crucible to the cast iron of the metal pot in the same manner. This operation requires some skill and should not be attempted by one who does not understand the use of file and scraper.

TO REPLACE MOLD TURNING BEVEL PINION IN PROPER POSITION

If the mold turning bevel pinion has been removed for any reason, in order to replace it in proper position, bring the machine to normal stopping position and mold required in ejecting position. The square block on the mold turning bevel pinion should then stand with the set screw up.

TO REMOVE SLUG STUCK IN THE MOLD

1. Push in controlling lever. 2. Take hold of cam and turn back cam shaft sufficiently to allow the ejector pawl to be raised. 3. Draw back the ejector lever until the pawl clears the cam. Then pound the slug out by a series of gentle strokes.

TO REMOVE THE PUMP LEVER OLD STYLE SPRING

Place a short rod in the hole in the spring rod just above the spring washer; remove the pump locking pin; start the machine, holding the pump lever stop lever operating lever over so the pump lever will descend. When it has reached its lowest point, stop the machine and the spring and rod can be removed.

TO REMOVE A PLUNGER THAT IS STUCK IN WELL

On new machines the plunger is sometimes liable to stick in the well and stop the machine. In such a case proceed as follows: 1. Shut off the starting and stopping lever. 2. Withdraw pin from plunger and let the cams come to normal position. 3. Take out metal from pot until well is exposed. 4. Place a piece of tallow in well or put in a little oil on top of the stuck plunger. 5. Fasten a monkey-wrench on plunger rod and try to work the plunger back and forth. A few light taps on the top of the rod with a light hammer may help to start the plunger and allow the melted tallow or oil to loosen it up. 6. Place a pin in plunger rod and fasten wrench underneath. Work the plunger upward slowly with a rotary movement, tapping wrench lightly with hammer if necessary until the plunger is released. Plunger should then be removed and thoroughly cleaned. The plunger should be cleaned once a week.

TO REMOVE JUSTIFICATION SPRINGS

1. Place a short rod of suitable size in the hole near the lower end of each rod. 2. Open the vise jaw and draw out the starting lever. When the cam rollers reach the deepest depressions in the cams, stop the cam shaft. 3. Raise the levers to full height and lift out the springs. Allow the cams to come to normal position. If the rods cannot be taken out because the

levers cannot be raised high enough, the rollers must be removed. This will allow the levers a higher movement. In replacing the springs be careful to put them back in their right places.

TO REMOVE THE POT LEVER

Start the machine and bring the pot forward to the lock-up position; stop the machine and remove the pot balancing spring; start the machine and let it run to the normal stopping position; place a block of wood or several slugs between the pump lever roll and the pot lever shaft bearing, to take the pressure off the pot lever roll. This can be done by taking out the pump locking pin and pulling the pot forward with the plunger rod. Loosen the set screw and remove the pot lever shaft; remove the pot lever eyebolt pin and take the pot lever out downward. If it is necessary to remove the pot lever roll, loosen the set screw and remove the pin. Due to the heat from the pot and the difficulty of properly lubricating this roll, the bearing is composed of two washers and nine anti-friction rolls. If any of the rolls become worn they should not be repaired, but new ones put in. Before applying new rolls they should be thoroughly cleaned; and after they are cleaned, should be smeared with a thick paste of tallow and graphite. In assembling the roll, place it on a flat surface and put in one of the washers, then the anti-friction rolls. Roll up a piece of paper and put in the center to keep them in place, and then the other washer on top. Put the roll in the pot lever and push the paper out with the pin. Tighten the set screw and the lever is ready to place in the machine.

TO REMOVE THE DISTRIBUTOR CLUTCH

Loosen the set screw and take out the clutch lever hinge pin. Then remove the clutch lever and spring; remove the screw from the clutch bracket and loosen the screw in the front screw bracket right-hand, so that the clutch bracket can be taken off its dowel pins without springing the clutch shaft; remove the clutch shaft screw, and the clutch and bracket can be removed. If it is desired to take the clutch apart, by removing the screw and washer in the end of the clutch shaft, the shaft may be withdrawn from the pulley and flange. In putting the distributor clutch back on the beam it is very important that the timing pin in the distributor screws mesh into the clutch shaft gear, where the tooth is cut away, so that the screws will be in accurate time with each other. On some of the older machines there were no timing pins in the gears, but the gears had a mark on them, and these marks must exactly coincide, in order that the screws may be accurately timed.

TO REMOVE ANY CAM FROM THE CAM SHAFT

The removal of any of the cams from the cam shaft happens so seldom that it seems almost unnecessary to mention it, but, in case it should be necessary, the following instructions may prove useful:

Start the machine and when the second elevator has descended on to the intermediate channel, stop it, and remove the second elevator lever and the second elevator cam lever; remove the first elevator cam; start the machine and bring it to its normal stopping position. Then remove the driving belt, or, if motor driven, remove the motor. Remove the step; remove the distributor shifter lever and spring; remove the ejector lever link; pull out the shaft and let the ejector lever down on to the floor; put a short rod in the hole in the justification lever spring rod, and the vise closing lever spring rod, to prevent the springs working; put a short rod in the hole in the pump spring rod in the old style, or, remove the pump lever spring (inside of the column) on the later machines; remove the pump lever; remove the pump bracket; let down the vise and put a support between the vise cap and the first elevator slide, to hold back the first elevator auxiliary lever; pull the pot forward and block it between the base and bottom of the pot to hold it away from the cams; remove the mold gear arm; remove the cam shaft bracket right-hand tie rod and cap; remove the delivery and elevator transfer cam locating piece which is fastened to the cam shaft; loosen the set screw in the delivery and elevator transfer cam, and move the cam to the left about two inches; turn the cam shaft by hand until the cams clear the pot lever; then move the cam shaft to the right in order that the vise closing and mold turning cam may pass the distributor shifter lever spring hook. The cam shaft can now be lifted from the machine to the floor and the cam required taken from the shaft, after the four bolts which hold the cams together are removed. If it is necessary to remove all the cams from the shaft, in reassembling them, place the pot and pump cam on the shaft, with the short hub to the right and position it endwise with the set screw; the shaft is spotted for the point of the screw. Place the justification and second elevator cam on the long hub, with the largest cam going on first, and turn it on the hub until the four bolt holes match, then the vise closing and mold turning cam, with the mold turning segments to the left or outside, and turn it until the bolt holes match. Put in the bolts and tighten them. Place the delivery and elevator transfer cam on the right-hand end of the shaft with the cam side toward the right, positioning it endwise with the delivery and elevator transfer cam locating piece, and the cam shaft collar on the left-hand end of the shaft. The shaft and cams are now ready to put back into the machine.

XI. The Various Models

ESSENTIALLY there are but two distinct models of the Linotype—the single distributor and the plural distributor, each designed for specific requirements of the printing art.

The original Linotype, the Model 1, was a single distributor machine, having a magazine of comparatively limited capacity with reference to the size of faces that could be used. It was designed primarily for straight newspaper body matter.

Immediately following the successful introduction of the Linotype to the newspaper composing room, the book publishers demanded improvements which would adapt it to the composition of larger faces and wider measures for book work. These improvements involved magazines of larger capacity and with certain mechanical features to facilitate rapid and easy change of face, body and measure, as represented in the Model 3 and Model 5. In order to anticipate further requirements of both newspaper and book printers and to keep pace with the rapid development of the art as a whole, other improvements in the design of the Linotype took the form of a plurality of magazines and molds as an integral unit of the machine. Thus we have the Model 8 and Model 14. These various steps in the evolution of the Linotype have preserved the basic principle of the single distributor mechanism. These developments have brought the single distributor Linotype up from a machine of limited capacity for straight newspaper composition, setting one face and one body size, to the present multiple-magazine model which will produce a dozen different faces, measures and bodies ranging up to 30 and 36 ems 60 point, all at the tips of the operator's fingers.

The other model or type of Linotype, the plural distributor, was developed for the job printer and the ad room, whose requirements demanded more rapid change of faces than is possible with the single distributor, and at the same time the possibility of assembling four or more different styles of faces in one line continuously without any delay in the distribution of matrices to the various magazines on the machine. The development of this type of machine began with an equipment of two magazines. This was followed with improvements which were designed to increase its range and utility in conformity with the normal development and growth of the printing industry. Today the plural distributor multiple-magazine Linotype is a self-contained composing room, capable of producing display advertising, job and book work, decorative and spacing material, and in fact perform

every requirement of the modern composing room with speed and economy and in the highest degree of quality.

A more detailed description of these two models of Linotype follows:

MODEL 8

Quick-change three-magazine Linotype. In its general features the Model 8 Linotype resembles the Model 5, but it is greatly in advance of that model, in that it carries three magazines, any one of which can be quickly brought into operation. The upper two magazines can be quickly removed from the machine at the front and replaced by others. The third magazine can be removed, but this requires a little more time. All magazines of the Models 5, 8, 14, 25 and 26 are interchangeable with magazines of the Model 8.

The Model 8 Linotype has but one distributor, and therefore matrices from different magazines cannot be mixed in the same line. An automatic device prevents the magazines from being shifted until all matrices have left the distributor bar. This obviates all danger of matrices being returned to the wrong magazine.

Shifting Magazines.—The three magazines rest on frames, the lowest of which is supported by an elevating screw in a barrel. A handle at the front of the machine is connected with the elevating screw by a universal joint. By turning this handle the magazines can be raised or lowered to bring any one of the three into register with the front. Connected with this handle is a mechanism which locks and unlocks the sliding bars which locate the magazines in proper position. On later machines these bars are locked and unlocked by separate handle in front of the machine. In either case, when the handle is released the locking bars slide into place automatically and lock the magazines in position.

To shift from one position to another the handle is given a quarter turn to the right, which lifts the weight of the magazine frame from the locating bars, then a quick forward thrust unseats the locating bars, and permits the magazine frame to be lowered or elevated by a turn of the handle. If the forward thrust does not at first unseat the locating bars, the handle has not been set at the correct position, and the bars are binding in the seat on the magazine frame, or all the matrices have not left the distributor bar, or one is caught at the front.

In elevating the magazines from the first to the third position, continue to press inward on the handle while turning, otherwise locating bars will not permit the magazine frame to pass the second position without automatically locking.

MODEL 8—REMOVING MAGAZINES

Removing the Middle Magazine.—Insert the locking bar in the top and second magazines. Raise the magazines with the elevating mechanism, as high as they will go. Place the frame supports under the upper magazine

frame. Remove the bar which extends across the top side of the top magazine. Turn the elevating crank until the frame descends and the second magazine is in operating position, leaving the upper magazine elevated. Place the right- and left-hand cams on the second magazine frame. Lift out the escapements of the upper magazine. Then proceed as in removing the upper magazine.

Removing the Lower Magazine.—Remove the two upper magazines and take off the frame cams; take out the sight screws that hold the right- and left-hand gibs to the frame guides; remove the gibs, using care not to get them mixed. Remove the two frames from the guides; take out the two clamps that hold the lower magazine at the rear. Have a helper stand on the frame of the machine in the rear, and reach over the top of the distributor beam to assist in lifting the magazine, while the operator in front gradually raises the magazine clear of the escapement frame.

Releasing a matrix on the Model 8.—The following action takes place:

The keyboard cam lifts the keyboard reed, which acts upon the escapement lever, in turn operating the horizontal slide and escapement. The escapement levers, when not in action, stand just clear of the mouth of the magazines, and do not interfere with the raising or lowering of them. Care should be taken to see that these levers work freely in their guides, and occasionally they should be cleaned with a little gasoline, and a *little* oil applied by the finger on the working points.

The distributor channel entrance is in all essentials like the distributing channel entrance of the Model 5. The pivoting point, however, is different, being so arranged that in case a matrix protrudes from the back end of the magazine the entrance will open as the magazine is lowered.

Recently a change has been made in the supporting frames for the magazines on the Model 8 and by turning a handle all three of the magazines can be readily removed and replaced.

MODEL 9—FOUR-MAGAZINE LINOTYPE

The four-magazine Model 9 Linotype is radical in many of its features, and was designed to meet varied requirements for advertising, head-letter, and job composition calling for frequent change of face and body.

It is equipped with four interchangeable, superimposed magazines, and the matrices from any one of the four magazines can be instantly brought into operation by the shifting of a lever, and they are all controlled from the one standard Linotype keyboard, thus placing eight different faces at the operator's command without leaving his seat. Besides this, any additional characters of infrequent use may be set into the matrix line instantly by hand, and, after casting, these will return automatically to the pi box.

Any face may be set continuously, or all faces may be mixed in the same line, enabling one operator to set complete display advertising, involving many different styles and sizes of faces on different bodies and to

varying measures, far more rapidly, economically and effectively than could ever be done in any other way.

As all of the magazines are interchangeable and may be quickly removed and replaced by others, a range of style and faces may be carried sufficient to make the Model 9 Linotype a self-contained jobbing office or ad composing department.

By equipping the four magazines with suitable matrices, the newspaper office may set at a continuous operation large news heads, sub heads, in condensed faces body matter, display figures and advertisements. The job office with suitable equipment may set chapter heads, sub heads, marginal notes, foot notes and body matter in roman, italic, small heads, sub heads, marginal notes, foot notes and body matter in roman, italic, small capitals and black faces of different styles and sizes.

The water-cooled mold disk carries four molds which give a large range of bodies and measures without necessitating a change of liners, while the universal ejector and universal knife block are instantly adjustable for all bodies and measures.

The magazines themselves remain stationary when in place, and the shift from one magazine to another is done with a lever and is simple, easy and instantaneous. Each magazine is provided with a series of escapements controlling the delivery of its matrices. The escapements of all four magazines are actuated by a single series of escapement rods, mounted in a frame. Each escapement rod has four notches in its edge, and as the shifting lever is moved it raises or lowers the escapement rods so that their upper ends connect with the escapement verges of the magazine required, and at the same time the escapement levers engage with the proper notch in the edge of the escapement rods, thus connecting the escapement with the keyboard mechanism.

By swinging the front of the machine open, the escapement rods and mechanism become easily accessible.

After casting, the line of matrices is lifted in the usual manner by the second elevator for distribution. From the second elevator the matrices pass through a primary distributor box on to a short primary distributor bar where they are separated according to font for the different magazines. This bar is provided with groups of teeth separated by blank spaces so that as each matrix advances along the bar it will be engaged by the successive groups of teeth, but will be released from the bar during its travel across the intervening spaces. Beneath the path of the matrices, as they travel along the primary bar, are stationary bridges, one being located beneath each of the blank spaces on the bar. These bridges have projections to correspond to the notches in the lower end of the matrices. As the matrix advances it will ride on the bridge while crossing a blank space and engage the teeth of primary bar at the next succeeding point, thus advancing alternately by riding a bridge or being suspended on the teeth

of the bar, until the projections on the teeth exactly correspond to the notches in the matrix, when it drops below the teeth of the bar and, after passing over the bridge, falls into a tube which carries it to a lower distributor box and thence on to the distributor bar and to its proper channel in the magazine.

MODEL 14

This is substantially a Model 8 three-magazine Linotype, with the addition of an auxiliary magazine of twenty-eight channels located to the right of the main magazine.

The auxiliary magazine is operated by a special keyboard placed at the right of the main keyboard. This magazine will carry a cap alphabet of head-letter matrices or two sets of advertising figures, small job fonts, or twenty-eight of any kind of special matrices that may be desired, in addition to the standard fonts on the three main magazines. Matrices from any one of the regular magazines can be mixed in the line with those from the auxiliary magazine.

The auxiliary magazines are short, carrying nine matrices in each channel. They are small and light and may be readily removed and replaced by others carrying different faces as desired. A bracket has been attached to the rear of the machine which will hold three extra auxiliary magazines to further facilitate the use of the auxiliary magazines. There are two auxiliary keyboards, one overlying the other, the upper one so hinged that it may instantly be swung downward and backward out of the way. The buttons on the upper keyboard, when in operative position, are in contact with those of the lower keyboard and, through them, operate the escapement mechanism.

The main magazines are interchangeable with those of Models 5, 8, 25 and 26.

SINGLE KEYBOARD MODEL 14

This new Model is called Single Keyboard Model 14. In this machine the auxiliary magazine is operated from the main keyboard instead of having a separate keyboard as formerly used. *Fig. 130* is a diagrammatic view of the operation of the auxiliary magazine from the regular keyboard. *A* is the ordinary key lever, *B* the regular key weight or key bar, *C* the ordinary trigger, *D* the ordinary cam yoke, and *E* the reed which works the escapements through the supplementary levers *K*. The key reed *E* has a lug or projection upon it, *F*. The regular position of this key reed *E* is shown in the dotted lines. When in this position the operation of the keyboard reed, supplementary lever and escapement is exactly the same as in the ordinary Model 8.

When it is desired to operate the auxiliary keyboard, the reeds *E* are moved toward the rear of the machine a little by means of a shift key located at the left of the keyboard adjacent to the spaceband key. When

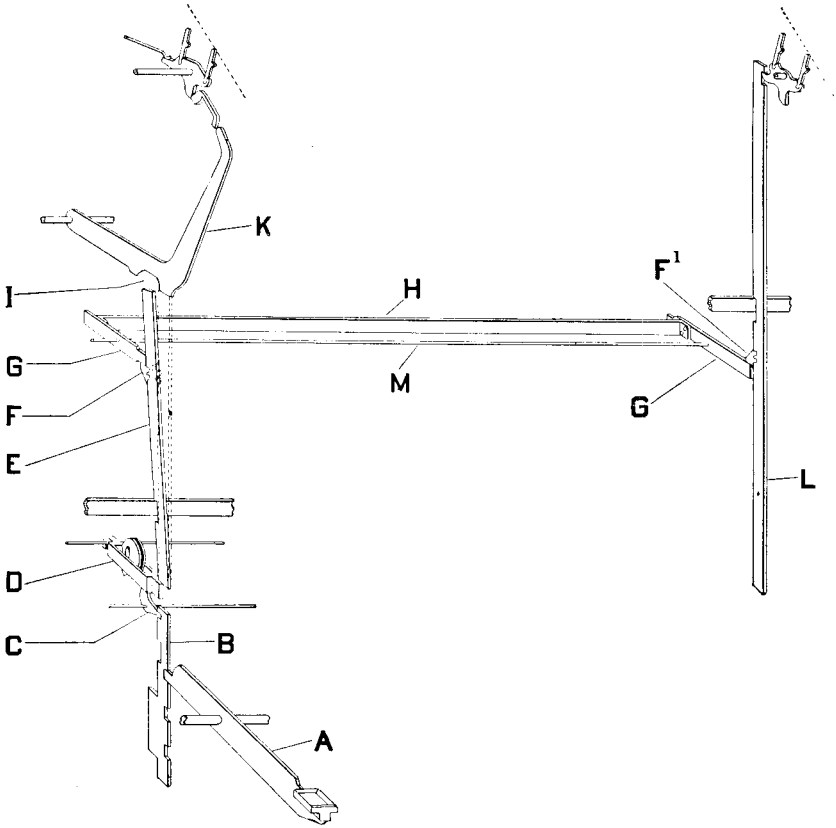


FIG. 130.—Action of Escapement for the Model 14 Single Keyboard Linotype.

in this position the lug *F* registers with the lever *G* which is mounted on a rod *M*, and this lever is connected on its rear side by a piece *H*, which runs to the auxiliary side of the machine. This device, consisting of the levers *G* and the connecting bar *H*, form a frame adapted to revolve around the rod *M*. This revolving frame is called a bail. It is evident that when the reed *E* rises under the action of the cam yoke *D* it will revolve the bail, causing the lever F^1 to raise the reed *L* operating the ordinary escapement for the auxiliary magazine. In this way the matrices are discharged from the auxiliary magazine. At this time the reed *E* does not operate the subsidiary lever *K*, as there is a notch *I* made in the lever into which the reed passes at the time the auxiliary magazine is being operated.

When the operator wishes to obtain matrices from the regular or main magazines, a touch on the shift key brings the reed *E* back into position to operate the subsidiary lever *K* in the regular manner. At this time the lug F^1 does not engage the lever *G*, shown in Fig. 130.

The operation of this shift key is very quick and easy, and corresponds identically in its action to the shift key for caps on a typewriter.

The bails are mounted in a metal box, which is designed so that it can be readily removed from and replaced on the machine.

The auxiliary magazines on the Single Keyboard Model 14 are somewhat wider than the ordinary auxiliary magazines on the Model 14, and will take up to 24 point, full width, and condensed characters up to 60 point. There are thirty-four characters in the auxiliary magazine, giving a full cap and figure font for use in ads, etc.

In other respects than those mentioned, the machine is similar to the Model 14 which has been in use for many years. The new Single Keyboard Model 14 has proved to be very popular and has found a large market.

MODEL 21

The Model 21 Linotype is also a display machine and resembles the Model 20 Linotype with the difference that it has a special keyboard, on the right-hand side of which there is a lever, and as this lever is pulled forward it locks 17 of the keylevers on the keyboard, and at the same time it shifts the connection between the keylevers and the keybars, so that many of the remaining keys on the keyboard, which are operative, release the matrices from entirely different channels of the magazine. When this mechanism is used the matrices run in only 55 channels of the magazine and therefore much larger matrices setwise can be used, and with this arrangement, extended faces up to 36-point can be used. In addition to the regular channel entrance for the 72-channel magazine, the Model 21 is equipped with a special channel entrance of 55 channels to accommodate those matrices too large to run regularly. One channel entrance may be swung out of position and the other swung into place almost instantly and without any adjustment. The Model 21 magazines are exactly the same as those used on the Model 20 and are interchangeable with the magazines of the Models 20 and 22.

MODEL 22

The Model 22 display machine is the same in every respect as the Model 21 display Linotype, except that it carries an auxiliary magazine of 28 channels in addition to the regular magazine. This auxiliary magazine, located at the right of the regular magazine, is controlled by an independent keyboard directly beneath it and within easy reach of the operator. The auxiliary magazine and keyboard are exactly the same as those on the Model 14.

SINGLE KEYBOARD MODEL 22

This model is a modification of the original Model 22, the auxiliary magazine being worked from the main keyboard in precisely the same general manner as in the Single Keyboard Model 14. The arrangement of

the shift key, bails, auxiliary reeds and escapements is exactly the same except in dimensions as in the Model 14. This gives the advantage of the single-keyboard action in this model.

MODEL 24

The Model 24 Linotype is equipped with four regular Model 9 magazines and two auxiliary magazines of 65 channels each, capable of holding six full fonts of matrices from the smallest 5-point up to extended 36-point, and being a multiple-distributing Linotype it is possible to set matrices from all six magazines in the same line, and permits continuous composition from and distribution to all magazines. The Model 24 is substantially a Model 9 with two full-size auxiliary magazines on the right-hand side, controlled by an independent keyboard directly beneath it and within easy reach of the operator. Touching one or the other of two shift keys (marked upper and lower) on the left-hand side of the auxiliary keyboard, instantly brings into operation either the upper or the lower auxiliary magazine.

The auxiliary magazines are half length and unusually wide, and the two sections are fastened together so that in removing them from or replacing them on the machine they are a complete unit. The auxiliary magazines are special and cannot be used in any other model of machine. Both the regular and auxiliary magazines are removed from the front of the machine in the same manner as the Model 9. Matrices for the regular magazines of Models 9 and 24 are separated by a combination of three notches in the lower end of the matrix and a bridge with corresponding projections in the primary distributor. Matrices for the auxiliary magazines are separated by a combination of No. 1 and No. 9 notches in the matrix and corresponding projections, or absence of them, on the bridges, and are cut away in the center so as to pass over the bridges which control the regular magazine matrices.

MODEL 25

This is a two-magazine machine, the magazines being of the regular Model 5 or 8 type, and interchangeable with these models. There is a double distributor similar to that used in the Model 16. A distinguishing feature of this machine is the fact that the support for the magazines at the rear of the machine is directly under the distributor and as close to it as possible. The magazines are mounted on these pivot points so that the front of the magazines can swing up and down about two and one half inches, bringing either one of the magazines into register with the ordinary Model 8 front.

The channel entrances on this machine are made slightly wider from front to rear, and as the pivot point upon which the magazines swing is so close to the distributor, the channel entrances swing only a very slight distance.

This enables the distributor to discharge its matrices into the channel entrances continuously regardless of the swinging up or down of the front ends of the magazines.

When the operator desires to change magazines from the upper to the lower, or vice versa, the front ends of the magazines are swung up and down by a lever within easy reach of the right hand of the operator.

The weight of the magazines is balanced by a strong spring mounted in a frame on the distributor bracket. In this way the swinging movement of the magazines is very easy and can be quickly done by using the lever.

The great advantage of this machine is the fact, first, that it is a mixing machine and that matrices from both magazines may be mixed in one line; second, the assemblage and the distribution are continuous so that the operator does not lose time waiting for matrices to distribute or in raising and lowering the magazines as in the case of a single-distributor machine like the Model 8.

MODEL 26

The Model 26 is in every respect similar to the Model 25 except that it has two auxiliary magazines, each containing thirty-four characters. These magazines are pivoted near their upper end in the same manner as the main magazines in the Model 25 and the front end of these auxiliary magazines can be swung up and down so as to bring either of these magazines into register with the front. This swinging of the auxiliary magazines is done by a handle in exactly the same manner as the main magazines. They are counterbalanced by a spring in a similar manner to that described in the Model 25. These magazines register with the double distributor at their upper end and the distributor is similar to that used in the Model 25 except that it is longer.

The operation of the auxiliary magazine is the same as that described in the Single Keyboard Model 14 except that there is a subsidiary reed similar to the reed *K* shown in Fig. 130, which operates the escapements of their magazine. The bail box, bails, and in general, the mechanism for operating the auxiliary magazines is the same as that used in the Single Keyboard Model 14.

In the Model 26 there are the same advantages as in the Model 25 of continuous assemblage and distribution, of mixing matrices from both magazines in the same line with the additional advantage that there are two auxiliary magazines which permit the use of two display cap fonts and their figures, or of special characters of any description.

NEW LOWER DISTRIBUTOR BOX

In the Model 25 and 26 Linotypes there is a primary distributor. The matrices are delivered to this primary distributor and then by means of notches in the foot of the matrix they are sent to either of the two lower distributor boxes.

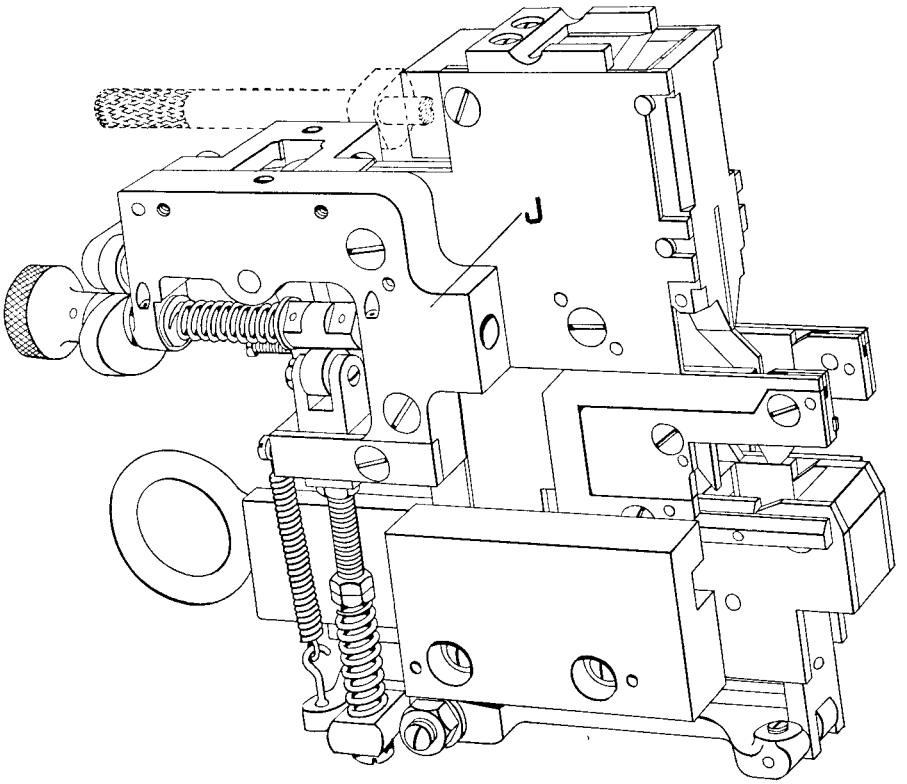


FIG. 131.—A perspective view of the new distributor box which has been adopted for use in the Models 25 and 26.

In the lower distributor boxes heretofore used on the Models 9 and 24, a beveled notch was required in the lower part of each matrix. In each distributor box there was a pair of pawls working vertically which cooperating with this beveled notch caused the matrices to be separated and delivered to the distributor screws one at a time. In the new distributor box the beveled notch in the matrices is not required and the pawls are replaced by other mechanisms.

One of the great advantages of the new box is that in the Models 25 and 26 a magazine can be taken from the Model 5, Model 8 or any model using the standard Model 5 magazine, and this magazine and its matrices can be used, as will hereafter be described.

In the Model 9 these lower distributor boxes have pawls which fit closely together and are operated much like an escapement. In the bottom at the center of all matrices used in these machines there is a beveled notch which comes down to a sharp edge. These pawls register with the beveled notch and by their action separate the matrices, delivering them to the distributor screws, one at a time. These lower distributor boxes are in use in many hundreds of Linotypes of the Model 9 type.

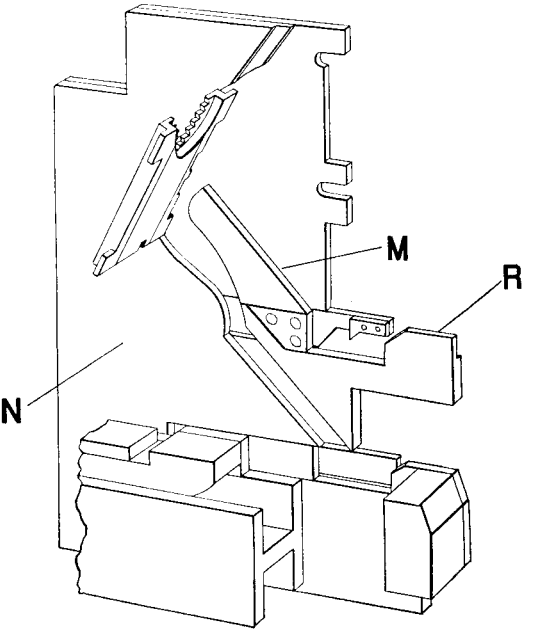


FIG. 131a.—A view of the inside of the distributor box, showing the path of the matrix as it comes from the primary distributor.

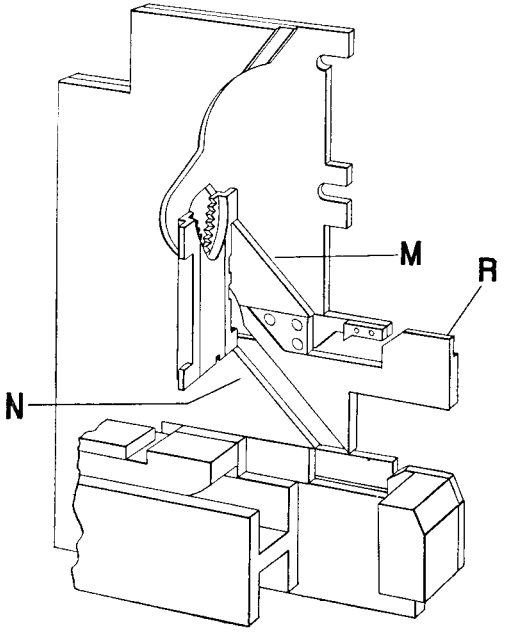


FIG. 131b.—Showing the matrix a little farther on in its descent. The top or long ear of the matrix is now riding on the rail *M*, while the lower ear is riding on the rail *N*.

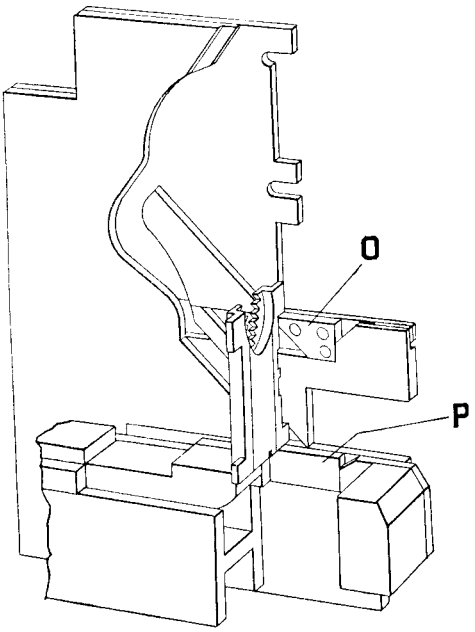


FIG. 131c.—Showing the matrix at the bottom of its descent and resting on the rails *O* and *P*.

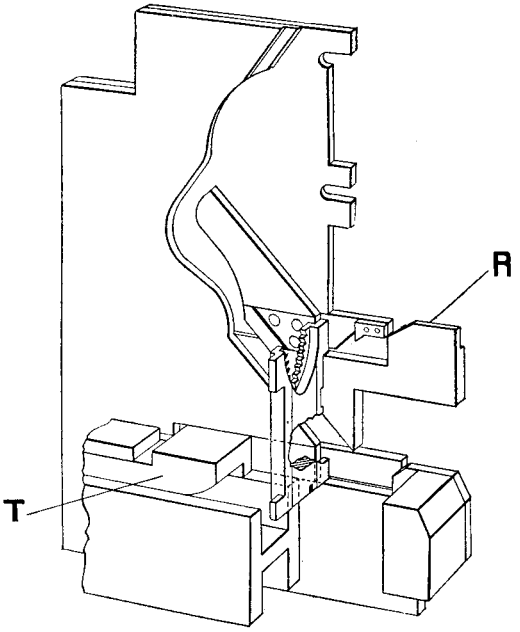


FIG. 131d.—Showing the rails *O* and *P* withdrawn and the matrix falling by its own gravity so that it rests on the rails *R*.

In the new distributor boxes the delivery of the matrix from the primary distributor to the lower box is substantially the same as formerly used. When the matrix is delivered into the box, however, instead of using pawls, the matrices are arrested in their fall and finally allowed to drop in front of four lugs mounted on two yokes. These yokes engage with the ears of the matrix instead of the body, as in the former distributor shifter lever. The lugs pushing the matrix by the ears bring these ears forward against the shoulders of the rails. An ordinary lift, exactly similar in its action to that used in the Linotype from the beginning, raises the matrix into the

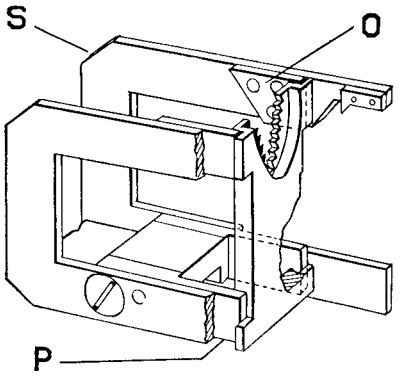


FIG. 131e.—Showing the matrix ready to be pushed forward by the rails *O* and *P*. There are two of these rails in each case, the upper and lower rails *O* and *P* being mounted on two yokes *S*. These yokes *S* are in turn mounted upon the slide *T*. The slide *T* is caused to reciprocate carrying the yokes *S* and the rails *O* and *P*, and pushes the matrix forward by the four ears against the shoulders of the rails *R*. At this time the matrix is in position to be raised by the lift.

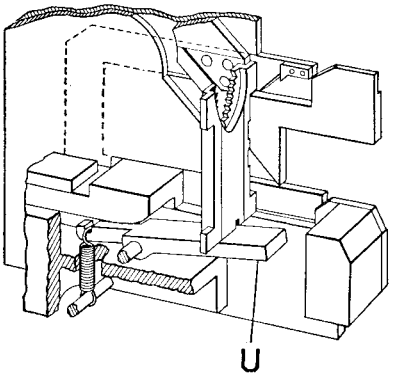


FIG. 131f.—Showing a small revolving member *U*. This is pivoted at its rear portion and is held up by a coiled spring. While the matrix is descending, this small coiled spring holds the member *U* up at a slight angle to the rails of the box. As the slide *T* goes forward it forces the member *U* down until it is horizontal with the floor and parallel to the rails. The object of this device is to prevent a very thin matrix from sliding down fast and turning or twisting in the box before the rails *O* and *P* come against the matrix.

distributor screws. The action of this box being much more positive than that of the pawls, has proved more satisfactory. A little dirt does not have so much tendency to make the box work badly. A circular describing in full the action of this box, with illustrations, can be obtained from the Company and is to be sent out with all Model 25 and 26 machines.

The cams *X* and *Z* are mounted on a shaft *I*. This shaft *I* is mounted in the bracket *J* on the side of the box. On one end of this shaft *I* there is a thumb screw and at the other end where it passes into the bracket *J*, the shaft has one-half of it cut away. This cut-away portion registers with a

similar portion of the distributor screw. This is shown in the cut-away portion in Fig. 130—*G*. The revolution of the distributor screw causes the revolution of the shaft *I* having on it the cams *X* and *Z*. It will be noted that this arrangement of the shafts *I* and the shaft of the distributor screw permits the whole distributor box to be removed and replaced. The shaft *I* also has a small longitudinal movement so that by taking hold of the thumb screw and pulling the shaft *I* away from the box the connection between the distributor screw and the shaft may be broken so that while the distributor screw continues to revolve, the shaft *I* will stand still.

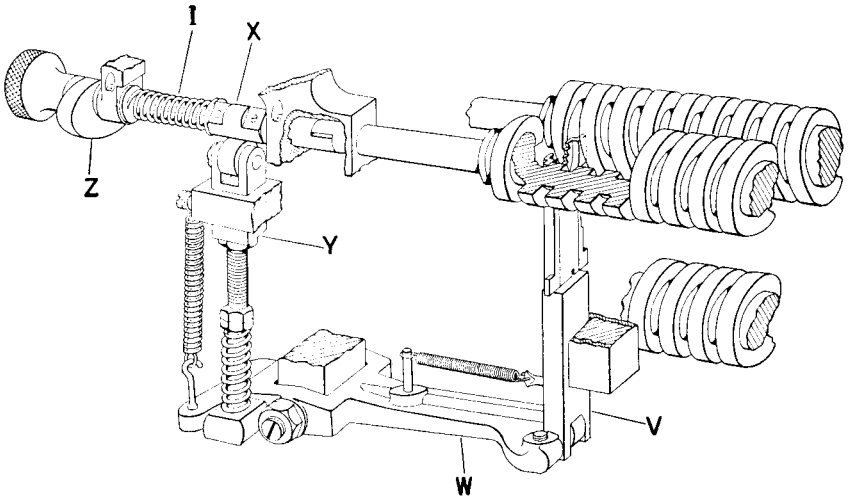


FIG. 131g.—A diagrammatic view showing the lift *V* mounted on the lever *W*. This lever *W* is caused to rock around its pivot by the cam *X* acting on the roller of the stud *Y*. The cam *X* is timed in the same way as the cams on all distributor boxes, so as to lift the matrix into the screws at the proper time.

It will be noted in general that the matrix which descends by gravity into the box is pushed forward positively into position and lifted positively into the screws in a manner similar to that used in the distributor boxes of the Linotype machine from the beginning. In the new box, however, the matrices are pushed forward by the ears instead of being pushed forward by the body of the mats in line, which are pushed by the distributor shifter. The action of the lift of the matrix into the screws is precisely like that of the ordinary distributor box such as is used in the Models 5 or 8.

In the distributor boxes used in the Models 9 and 24, the matrices which were separated by pawls acting on the beveled notch go downward and forward into the screws by gravity. In the new box the matrices are positively pushed forward by the slide *T* acting through the rails *O* and *P* so as to be brought in position to be lifted into the screws by positive action.

In the Models 25 and 26 the bracket *J* is on the side toward the front of the machine, while in the Models 9 and 24 the bracket *J* and its accompanying mechanism is on the rear side of the box. In other respects the boxes are exactly the same.

On the Models 25 and 26 the distributor screws which drive the shafts *I* in the two boxes revolve in opposite directions. *It is therefore impossible to transpose the box for the upper and lower distributors in the Models 25 and 26.* These boxes are numbered and there is a corresponding number on the bearings into which the boxes fit.

On the Models 25 and 26 when a box is to be removed *the distributor* should be stopped. Take hold of the thumb nut on the shaft *I* and turn the cam *Z* out of the way. This should be done on the box which is not being removed. The other box can now be removed and when replaced the distributor should be started, the box shoved into its position and locked. With the thumb nut the shaft *I* can then be turned and through the action of the spring mounted on the shaft, the shaft *I* will be connected with the distributor screw and the machine is then in operative condition.

PRIMARY DISTRIBUTOR—MODELS 25 AND 26

The primary distributor on the Models 25 and 26 is very similar to the primary used on older styles of plural distributor Linotypes, except that the dimensions on the rails on which the matrices rest when they are being carried to the chutes are somewhat different.

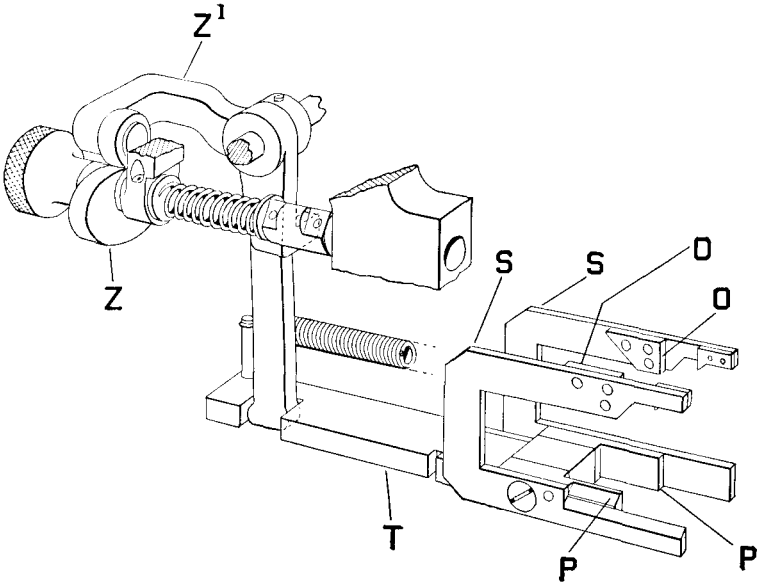


FIG. 131h.—A view showing the slide *T* carrying the yokes *S*, having mounted on these yokes the rails *O* and *P*, and the means for reciprocating the slide *T*. The cam *Z* working through the arm Z^1 causes the slide *T* to reciprocate.

There are two bridges used and the second one of these bridges is what is generally called a blank bridge. That is to say, there will be no projections upon it. The matrices that are intended to go into the lower magazine are notched in a manner similar to that in use in the Models 9 or 16. The matrices that go into the upper magazine, however, do not need to be notched when the blank bridge just mentioned is used.

This arrangement enables a customer to use any magazine of the Model 5 type and the matrices therein on the upper magazine of the Models 25 or 26.

In all ordinary cases the pi matrices used in either magazine need not be notched, but will be discharged from the second bridge, pass into the upper magazine, along the distributor bar and drop into the pi tube at the end of the bar and pass to the pi stacker.

There are some special cases, however, where both the pi and the matrices running into the upper magazine will need to be notched, and this arrangement can be provided when it becomes necessary.

In setting the lift which raises the matrices into the distributor screws, the cam *X* has a set screw in it and the cam is adjusted by means of the set screw, so as to lift the matrix into the distributor screws in exactly the same time and in the same way as is done on the Models 5, 8, or any single-distributor machine. When the matrix is lifted in the proper way, the cam *X* is pinned with a taper pin to the shaft *I* in the usual manner.

Very little oil is required and very little should be used on these distributor boxes. The bearings of the cam shaft and the levers should be oiled with a drop or two of clock oil. The yokes where they rub on the side of the boxes may be lubricated with a very little fine powdered graphite. The slide *T* can also be lubricated in the same way. After the boxes have run a few weeks and worn themselves in, a drop or two of oil once or twice a week on the pivot points and the bearings will be all that is necessary. While these boxes do not require cleaning as often as the boxes formerly used in the Models 9 and 24, they should be cleaned once or twice a week. When using oil or graphite, use as little as possible. It is very desirable that oil and graphite should be kept away from the matrices. This is important.

If clogs or stoppages of matrices in passing through these boxes occur, it will be found almost invariably that it is caused by the matrices being bent or the ears, especially of the thin matrices, being twisted. When such a clog occurs the offending matrix or matrices should be laid aside where it is possible, and examined, and if the ears are bent or damaged in any way they should be repaired before they are put back into the machine. This feature of the box is intentional because nothing is of greater trouble than a matrix having its ears bent and wedged into the channel of the magazine. It is far better that the matrix should be detected and stopped before it gets into the magazine.

Care should be taken when one of these boxes is removed and replaced that it is firmly locked in position.

Two thin matrices are prevented from being raised by the lift by a "bar point" which acts in exactly the same way as the bar point on other distributor boxes. These bar points, of course, have to be made very thin and they sometimes get bent and in time will wear and must be renewed. This renewal, however, should not take place oftener than once in two years. It is best, however, to always have on hand an extra one of these bar points so that if the one in the machine is bent or worn or broken it can be instantly replaced. In all these respects this bar point serves the same purpose and must have the same attention as the bar point on any Linotype machine.

LEAD AND RULE CASTER

This machine embodies the main features of the casting mechanism of the Linotype. It casts automatically rules, borders, dashes, blank slugs, two-point leads, etc. The machine is equipped with a water-cooled mold disk, and either two regular molds for casting rules, borders, dashes, etc., or two low-slug molds for casting blank slugs, leads, etc. Two molds only are furnished with the machine, the others being extra supplies. The lead and rule caster has a self-contained water-cooling device. This consists of a tank fitted inside the column of the machine, with an opening near the top and one near the bottom. When this is connected up with the mold disk in the usual way it will avoid the necessity of piping to the machine from some outside water supply. The difference in temperature between the water at the top and bottom of the tank will maintain a slow and constant circulation through the mold disk.

Both the molds for casting rules and the molds for casting leads which are furnished with the Lead and Rule Caster are hybrids, between the regular universal adjustable mold and the adjustable mold. They use the slot for the liner, the same as the universal adjustable mold, but they also use the two screws that were in the adjustable mold for holding the cap on the body of the mold after the liners had been placed in position. The thickness of the cap on the front face of the rule mold is the same as on the lead mold.

Matrix slide blocks of any length up to 30 ems can be used in the Improved Lead and Rule Caster. With a block shorter than 30 ems, it is, however, necessary to fill the space remaining between the end of the block and the vise jaws, either with another block or with matrices. The movable vise jaw on the Lead and Rule Caster does not close in on a short line of matrices or short matrix slide block, as is the case with the Linotype. We recommend the use of the full length block, 30 ems, using such length of slide in the block as may be necessary. This will involve the use of a blank filling piece, or pieces, of the same cross section as the matrix slide, and which can be furnished in any length up to 17 ems.

The lead and rule caster works automatically after the machine is started. It is necessary only to keep the metal pot supplied with metal,

and each machine is equipped with an automatic low metal alarm, which strikes a bell when the level of the metal in the pot gets below a certain point. Two molds of the same kind are required for casting either leads or rules, as the machine is so constructed as to cast from the molds alternatingly. The low mold for leads and the high mold for rules, borders, etc., are both adjustable from 2 to 12 points inclusive in thickness of body, and from 4 to 30 ems in length of slug. Slugs which are to be used as furniture are also easily cast.

The high mold, for rules, borders, etc., is designed for casting from border slides or from matrices which have the character in the auxiliary position. It is not possible, with this mold, to cast slugs from characters in the regular position on two-letter matrices, nor from one-letter matrices with the character punched in the regular position. This is on account of the thickness of the lip of the mold cap. Special matrix slide blocks with the slide in the position corresponding to the auxiliary position of the two-letter matrix are required.

If it is desired to cast slugs from the regular character of two-letter matrices, or from one-letter matrices with the character punched in the regular position, or from matrix slides used in the ordinary matrix slide block with the slot in the regular position, it will be necessary to substitute the parallel universal adjustable mold, which produces a slug that is parallel and ribless, and is adjustable from 5 to 14 points, inclusive, in thickness of body.

It is possible to cut two regular Universal mold pockets in addition to the two Lead and Rule mold pockets, making a four-mold disk on the Lead and Rule Caster. When this is done, use the parts for operating the vise automatic which we use in the regular four-mold disk.

Caution: Four molds (two of them universal and two of them rule molds) can be used in this four-mold disk, and changed from rules to universal molds, or *vice versa,* by simply revolving the disk. It is not possible, however, to do this when using the lead molds or low molds, because the mold disk is advanced, and in this case the universal molds would have to be taken out of the four-mold disk and replaced by dummies, as the full-height molds would strike upon the jaws or the knives when using the lead or low molds. It seems, therefore, not expedient to use the four-mold disk on the Lead and Rule Caster.

The low mold used in this machine is somewhat different from our regular low mold. The height is the same, but the regular low mold is provided with a rib, or projection, which prevents the face of the mold being wiped and interferes with the casting of leads against the movable vise jaw, which is the approved method when using this machine. It would be possible to use the regular low mold in the Lead and Rule Caster, but the results would not be as good as may be obtained with the special low mold for this machine.

Matrix slides can be furnished for casting either on 2 point body or in the center or on the edge of larger bodies.

A special matrix slide block, 30 ems long, should be used in the lead and rule caster. This special matrix slide block has the slot on one side to accommodate the slide in the regular position, and on the reverse side has the slot in a position corresponding to the auxiliary position of a matrix. Thus, the block serves the purpose of casting from either position. These blocks are always carried in stock.

Do not attempt to use a short slide in a 30-em block without filling up the balance of the slot with a blank slide. If you do you will get a very bad squirt.

The liners for both the rule and lead molds used on this machine are special. These liners are parallel and lack the .003 of an inch taper of the regular Universal Adjustable liners.

Regular ejector blades are used for slugs 5 points or more in thickness; these blades can be used with either high or low molds; for slugs thinner than 5 points special ejector blades and guides must be used.

Ejector Blades and Ejector Guides.—To protect and strengthen the thin ejector blades when casting slugs thinner than 5-point, it is necessary to use rigid ejector-blade guides. Therefore, to equip machine for casting 2-, 3-, or 4-point leads and rules, use special spring or guide plate in knife block; also special ejector-blade guide blocks in mold slide. When casting 5-point or over, use ejector blade, guide F-353.

Use short ejectors when using low-slug molds.

Low Leads and Slugs.—When casting low leads and slugs, advance the mold disk by means of the lever provided for that purpose; also advance the metal pot by turning eccentric pin in pot lever from R to L. Remove the first-elevator back jaw.

Matrix Blocks and Slides.—When using matrix slide blocks with the special high-slug mold, place the matrix slide in lower position in block, and place block in regular position in first-elevator jaws. Also use two-letter attachment on vise cap.

When using the matrix slide block with the regular Universal mold or with the parallel mold, the slide may be used in regular position in the block and the block in the regular position in the first-elevator jaws without the two-letter attachment on the vise cap.

Border Matrices.—One-letter border matrices cannot be used with special high-cap mold. If border matrices are used with this mold they would necessarily have to be two-letter matrices, and cast from the auxiliary punchings.

Casting from One Mold Only On Lead and Rule Caster.—If for any reason it is desired to cast from one mold only, remove the mold-turning segment, which has but seven teeth, and attach mold-turning long segment, which has teeth full length. This change causes the disk to make a

complete revolution, instead of a half revolution, as is the case when casting from alternate molds.

Gas-Pressure Governor.—It is advisable to attach an extra gas-pressure governor to the supply line for the Slug Caster, in addition to the main plant governor, as it is often necessary to regulate the heat for this machine differently from the regular machines.

Casting 13-Em Lines from Border or Other Regular Matrices.—Blank out balance of the line with the 17-em matrix quad block, or matrix quads.

The reader may think that in the directions given there are a very large number of points to be noted. This is correct. This fact, however, is not the fault of the Linotype Company, but is due to the fact that the printing art as now practised contains an infinite number of small details in furniture, type, rules, size and dimensions of borders, etc. Our customers are respectfully urged to remember the above statement and to be sure that in ordering they state explicitly and distinctly everything desired in the particular part or parts that are ordered. It is only by taking especial pains in this matter that mistakes and exasperating delays can be avoided.

If our customers will take a little time and special care in ordering supplies or special matrices, matrix slides, molds for casting leads, etc., they will save themselves and the Linotype Company much expense and vexatious delay. The number of specialties used on the Linotype is very great and increasing constantly.

XII. Attachments

ROGERS TABULAR

THE Rogers system for rule and figure work has made the composition of tables and other intricate rule work on the Linotype practically as easy as straight matter. By this system the most complicated tabular matter can be composed rapidly, conveniently and economically. The necessary parts for using the system can be readily applied to any outstanding Linotype. They consist of a special mold, mold cam lever, matrices and spacebands, and some minor parts.

Rogers tabular matrices are like ordinary Linotype matrices, except that the figure or letter is in the bottom of a slot, so that when the matrices are assembled their slots align and form a part of a mold in which the top part of the slug is cast. They are made on the unit system setwise, a unit being one quarter of a point.

At the proper points in the line, where the rules are to be inserted, special space matrices without routing, of a thickness corresponding to the brass rule, are assembled from the keyboard in the regular way. Thus, the machine produces slugs with narrow slots in them for the reception of shallow brass rule.

The mold is identical with the Universal Adjustable mold, except that it is of less thickness from front to rear. When the line of matrices is presented to the mold, the matrix slot aligns with and forms a continuation of the mold slot, so that the body or base part of the slug is cast in the mold as usual, while the top part is cast in the matrices.

The slugs are delivered from the machine with rule slots cast therein and no sawing, cutting, or other work is necessary. After proofs have been taken and corrections made, the rules should be inserted. When the form is locked up the rules are held securely in place, on account of the very slight variation in the rule slots.

Box heads, cross rules, etc., may be set with equal facility. The brass rules may be made continuous throughout the form and extended beyond the slugs for the box heading. All tables, however complicated with reading matter between column rules, reference marks, light and dark figures, light and heavy rules, leaders, horizontal rules, etc., can be reproduced by the Rogers tabular system more rapidly and more satisfactorily than in any other manner.

Hints to Operators.—The Rogers tabular attachment does not require any extraordinary degree of skill to use it successfully. Any reasonably

good operator can, with a little study of the system, equip himself to set the most intricate and complicated tabular work at practically the same speed as straight matter.

The Rogers tabular attachment greatly simplifies the problem of tabular composition. Justification being practically automatic, and the operator requiring only one spaceband in a line, the entire operation of producing lines with this attachment is really easier than without it. All that the operator need do is to familiarize himself with the practice of "casting up;" the remainder of the operation, i.e., the actual composition, is easy.

ADJUSTMENT OF TRIMMING KNIVES

All Rogers tabular matrices are made on the one point unit system, which enables the operator to run text characters through the figure columns and obtain a perfect justification. When a table is divided into several "takes" that are set on two or more machines, be sure that the side trimming knives on the different machines are adjusted so as to trim the slugs to exactly the same thickness. If they are not so adjusted, the parallel columns will be of unequal length. Care should be taken that the face portion of the slugs is of equal length. It is important that the right-hand jaws of all machines be adjusted uniformly to obtain a correct alignment of the slots in the slugs. The operator should keep a slug showing the layout of the table before him for ready reference to assist him in case corrections are to be made. It is important that the matrices be kept clean and straight.

DISPLAY EQUIPMENT

With this equipment it is possible to cast slugs up to 36 point on the Linotype direct from the keyboard. This improvement gives the quick-change magazines a range from 5 to 36 point in body and 5 to 42 point in face.

The mold used is similar to our recessed mold, the recess being deeper to accommodate the increased slug. Some older styles of molds have a range of 5 points only, thus, to cover the entire range of bodies from 15 to 36 points, four molds would be required as follows:

15 to 19 point mold	26 to 30 point mold
20 to 24 point mold	32 to 36 point mold

The above will cast any measure except 5½, 7½, 9½, 11½, 13½, 15½, 17½, 19½, 21½, 24, 27, 29, 29½. On any of the excepted measures a special mold is required, which, if necessary, will be made upon special order.

Display molds which are now standard have a greater range of adjustment than those listed above, one of which is adjustable from 18 to 24 point, and one from 30 to 36 point.

In ordering a display mold be sure to state the body of the slug to be cast and the various lengths, as it is sometimes necessary to move or leave out a groove in the mold cap for certain lengths of slug.

If the machine is equipped with a four-mold disk, the entire range of bodies can be accommodated without changing molds, and the operator can change from one mold to another without leaving his seat, having only to turn the mold disk pinion in order to bring the mold required into action.

Solid ejector blades can be used with head-letter molds as follows:

5 point blades will eject 15, 20, 26, or 32 point slugs.
6 point blades will eject 16, 21, 27, or 33 point slugs.
7 point blades will eject 17, 22, 28, or 34 point slugs.
8 point blades will eject 18, 19, 23, 24, 29, 30, 35, or 36 point slugs.

DISPLAY-ADVERTISING FIGURES

In many department-store advertisements the price of articles advertised appear in display figures from 12 to 42 point, in connection with two to four lines of matter set in roman. When set on the Linotype the usual custom has been to set the text matter, quad out that part of the line where the display figures appear, then cut off the blank space and insert the figures by hand.

With the advertising-figure equipment display figures can be cast at any desired point in the line of text matter, the figures casting on the first slug and against the lip of the mold, thus overhanging one or more slugs, the first slug which carries the overhang is not trimmed. In succeeding line or lines, a blank space is left at the point corresponding to the overhang for supporting the large overhanging characters. This eliminates cutting the slugs and inserting the display figures in type by hand and the subsequent distribution.

To use these figures the advertising-figure mold and universal knife block are required.

The Advertising-figure mold has a wide lip on the cap. The grooves of the cap are ground parallel, instead of being tapered, as in the universal adjustable mold. With this mold a regular slug of any size may be cast from 5 to 12 point, inclusive, but not above 12 point. The reason for this is that if a mold cap with this extra-thick lip were raised any higher it would interfere with the back jaw of the first elevator.

Special Advertising-Figure Mold.—A special advertising-figure mold has been developed particularly for use with extra large figures and display faces. It can be used on any Linotype having a head-letter attachment. This mold will cast large advertising figures up to and including 42 point; thus its scope is much larger than that of the ordinary advertising-figure mold. This mold has a wide face cap to provide for an extra-large overhang, and is a one-letter mold for use in the auxiliary position only. Regular mold liners of 5 to 12 point can be used, but the 12 point liner makes

the largest solid body that can be cast on this mold (matrices in auxiliary position, of course). It will fit in any mold disk with a head-letter pocket.

Only matrices punched in the auxiliary position can be used with this mold. Ordinary advertising figures cannot be used, as they are punched in regular position; but regular head-letter matrices (18-point and larger) can be used, as they are punched in auxiliary position. One-letter matrices punched in regular position cannot be used; but auxiliary characters in two-letter matrices can be used. In assembling a line in which two-letter matrices are used in conjunction with the large overhanging figures, a space matrix should be placed between the large figures and the adjoining two-letter matrices, to prevent metal escaping into the regular position of the two-letter matrices. The amount of space that can be used on the face of the mold cap of this mold is 27 points. To determine the size of liners to be used with the large overhanging figures, subtract the sum of the blank slugs used as supports from the size of the face.

Advertising-Figure Layout.—We have arranged a special advertising-figure layout for the keyboard, by means of which both the regular figures contained in the font in use and an extra font of advertising figures can be run in the magazine at the same time, as follows:

1 in fi channel	8 in Z channel
2 in ffi channel	9 in @ channel
3 in ffl channel	0 in lb channel
4 in ? channel	¢ in & channel
5 in | channel	. in (channel
6 in * channel	, in) channel
7 in X channel	$ in ! channel

In ordering advertising figures, be sure to state whether they are to run in the regular channels of the magazine according to the special advertising-figure layout, or as sorts. If the former, whether they are to be used for upper or lower magazine. Certain large faces of advertising figures, 18- to 42-point, are too wide to run in the channels of the regular magazine, and must be run as sorts or in the auxiliary magazine.

The use of the automatic sorts stacker is recommended in connection with the advertising-figure equipment. It is a valuable addition to any Linotype, whether using display figures or other sorts matrices.

SORTS STACKER

This device is simple in construction, compact and durable. This attachment permits the convenient use of any number of special characters in addition to those obtained from the keyboard. It is especially valuable on machines equipped for head-letter, advertisements and technical work, where extra and special characters are always in demand. An endless

number of special characters can be used in addition to the 180 in a single-magazine machine and 820 in a four-magazine machine. The extra matrices in the line are delivered to the pi stacker and assembled in the order in which they were used. When names, addresses, or the like are to be repeated, the group of matrices are all transferred by one action from the pi stacker to the assembler, thus saving much time. The pi stacker is a great time saver where composition runs to irregular sorts and a large number of extra characters. It can be attached to any model, but when ordering, the model to which it is to be applied should be stated. The pi stacker is valuable also in saving the walls and ears of sorts matrices.

The Linotype Company has recently placed upon the market a small tray made of aluminum, for the purpose of holding sorts matrices. The use of these holders or cases is recommended especially where there are a large number of pi characters used in connection with the work of the machine.

Many offices use a little cabinet to contain these holders, made with drawers specially designed for the use of the office. These cabinets are found very useful and convenient by many of our customers.

In large offices where many fonts of matrices are used the "sorts" should be kept in a properly designed cabinet. This Company furnishes such cabinets but many offices design and build their own. Matrices are expensive and easily mixed up, and much time will be saved by having an orderly and systematic arrangement of matrices so that they can be found instantly when wanted.

Wherever possible, full fonts of matrices should be stored in their own magazines, and these magazines should have proper holders as spoken of in another part of the book.

Where magazines are changed, care should be taken that the pi which belongs with the magazine should go with it. On split magazines, in some cases, a little case is provided attached to the magazine.

Where this is not the case, a small box or holder of some sort should be made which can be stored with the magazine.

Many of our customers have fifty or more different type faces in one office. Each of these faces or fonts has its own pi characters. It is of the greatest importance that system should be used in the storage of this pi and in seeing that the operator or machinist when a change is made, have the pi follow its proper magazine.

Nothing is more annoying or causes more delay and expense than the discovery after a galley or more of proof is set that there is a wrong font character or characters used.

A systematic scheme for handling and storing magazines usually includes a number or distinguishing letter for each magazine. This, in turn, forms the basis for a copy-marking system whereby it is possible to avoid writing repeatedly the names and sizes of the type faces.

Much profanity, bad temper and serious loss of time and money can be saved by giving the matters above mentioned forethought and attention. The most successful offices are those which are the most systematic in their equipment and operation and which require their operators to conform to the system.

It is not at all necessary that "the system" be irksome or arbitrary; it can be flexible enough without sacrificing efficiency and performance to slovenly morale.

XIII. Accessories

QUICK CHANGE LINOTYPE MAGAZINE RACKS

THESE racks are made all of iron and steel, and take up less room than any other device for storing magazines. The magazines hang vertically on lugs, the same as on the Linotype, and at about the same height as on the machine. Any magazine is instantly available, and all are equally accessible—always in position and ready for immediate use.

In offices where changes are frequent, the quick-change magazine rack will prove itself a time and money saver, as well as a space saver. *Magazines should never be laid down flat, or leaned against a wall.*

Made in standard sizes to carry four, five, six, seven, eight, nine, ten, eleven, twelve, thirteen, fourteen, fifteen and sixteen magazines. The one for the Model 9 is only made to carry five magazines.

In ordering, always figure on one extra arm to take the magazine lifted from the Linotype. This will obviate the necessity of setting it down and handling twice.

Shipping weight (five arms), about 385 pounds; add 50 pounds for each arm.

SUPPLEMENTAL KEYBOARD

The supplemental keyboard is so made as to permit of its being placed on the top of the regular Linotype keyboard when matter in a foreign language is to be set on a machine equipped for regular English. For instance, if it is desired to set Russian on an English machine, a supplemental keyboard equipped with the Russian keyboard layout can be placed on the top of the regular keyboard. With this change all that is necessary is to have the proper matrices in the magazine. The characters on the supplemental keyboard can be arranged according to the layout desired. The supplemental keyboard does away with the necessity of changing the keybuttons and gives the added advantage of having but one keyboard layout before the operator at a time. When ordering these keyboards it should be stated on what model of machine they are to be used, the language to be used, and the layout carefully indicated.

LINOTYPE PRACTICE KEYBOARD

This keyboard is constructed substantially the same as the standard Linotype keyboard. It is exactly the same size and is equipped with standard parts. The keybars are weighted so as to give the same feel or

sense of touch as the regular keyboard on the machine. While designed primarily for use in schools of instruction, a number have been purchased by individuals who desired to take up linotype operating as a trade.

MATRIX CABINETS

Provide a convenient, safe, and dust-proof receptacle for matrices, spacebands, liners, tools, etc. The advantage of having all supplies concentrated and classified in a cabinet of this sort will be readily apparent in time and labor saved, and the annoyance of hunting for misplaced material avoided. Strongly and substantially constructed of steel, in keeping with modern steel composing room furniture that will last a lifetime, or it can also be furnished in hardwood. Made in two sizes with eight or twelve matrix drawers in either steel or wood.

MATRIX GALLEYS

Small sheet-iron galleys for storing advertising figures and miscellaneous sorts are a great convenience for offices using a variety of special characters and part fonts.

Detachable and adjustable clip holds matrices in upright position. The high wall at back of galley has two perforations for convenience in hanging it up. Every office should have enough of these galleys to accommodate the sorts of all its fonts—one galley for each font.

The increasing number of special characters and miscellaneous sorts which are continually being added to our various fonts, and for which no allowance is made on the keyboard, renders this device invaluable. It serves the purpose of a sorts tray and obviates the necessity of changing trays on the machine each time the magazine is changed. Its use is particularly advantageous in connection with the pi stacker. All that is necessary is to remove the matrices from the stacker, insert them in the storage galley, and replace with other matrices.

MATRIX TRAYS

Wooden trays to hold full fonts of matrices will be found very convenient for storing and handling fonts when not in actual use and for which no extra magazines are provided.

LINOTYPE THERMOMETER

In operating the Linotype, proper temperature of metal is of the highest importance. It should be held between 535 and 550 degrees. A low temperature gives imperfect faces, and a very high temperature injures the metal, produces poor slugs, and in time affects the matrices.

A special thermometer can be secured from the Linotype Company. This thermometer, inserted in the pot of the machine, enables the attendant to adjust the governor so that the metal may be brought to and maintained at the exact temperature desired. Every office should have one or more of these thermometers.

REMELTING FURNACES

These furnaces are used for remelting Linotype slugs and casting them into pigs which can be put into the metal pot as desired. It is very desirable in remelting Linotype slugs to keep the dirt and dross out of the metal pot, and by the use of the remelting furnace this result may be obtained, and it more than pays for itself in the better product of the Linotype in the way of more perfect face and solid slugs. There are several kinds of these furnaces manufactured, using wood, coke, coal or gas, and of different sizes to meet the requirements of different offices. We shall be pleased to furnish information regarding them at any time.

LADLE AND SKIMMER

These are for use with any remelting pot. They are standard articles of their kind, and necessary for proper treatment and handling of the Linotype metal.

TO PREVENT HAIR-LINES USE "NOTABUR"

To prevent the accumulation of metal on the side of the spaceband wedge at the casting point, we have prepared a compound in hard wax form, called "Notabur." After bands are given their daily cleaning, rub the side of wedge over with "Notabur." This keeps the surface of the wedge smooth and clean and prevents the metal from adhering to it. It is of vital importance that the band be kept free from the accumulation of metal at the casting point, and we know of no easier and cheaper way of doing it than by the use of this substance.

TAPS AND DIES

For the accommodation of our customers we have made up sets of taps and dies, which are the most difficult to obtain from hardware stores, and carry them in stock at our factory and agencies. They are packed in a neat case which contains a die stock and one each of the following size taps and dies: 4 x 48, 6 x 48, 8 x 32, 10 x 32, 10 x 28, and ¼ x 24.

LINOTYPE METAL

Producing Solid Slugs—Preventing Burrs.—Proper treatment of the metal is vital to success in operation of the Linotype. The first and most important matter is to keep the temperature of the metal within the proper limits. Very high temperature results in porous and spongy slugs, in defective faces, in deterioration of the metal, and in the sticking of the slugs in the mold. A temperature that is too low results in imperfect faces and in the fouling of mouthpiece and mold, so that the machine will not lock up properly.

The machinist should test the temperature of the metal and adjust the machine gas governor and the gas flame under the pot to maintain the temperature at from 535 to 550 degrees Fahrenheit. The pressure of the gas in the supply pipes should be as low as possible, consistent with

the production of a good flame. Adjust the cock of the burner so as to produce a steady blue flame. Do not permit the gas to blow through the burner or light back at the air entrance of the Bunsen burner and produce a yellow flame, as this deposits lampblack on the burner.

Having first seen that the gas flame and pressure are within proper limits, test the temperature of the metal by a thermometer, or otherwise, and then regulate the gas governor on the machine until the proper temperature is reached in the pot.

Keep the metal in the pot at a nearly uniform level. Do not permit it to run too low. Do not introduce a large quantity of cold metal at a time.

Keep the metal clean and free from foreign substances. Avoid, particularly, the introduction of zinc, brass, type, or stereotype plates. They destroy the composition and render the metal unfit for Linotypes.

The pot should be cleaned occasionally to remove the oxide or dross that collects thereon. The plunger should be cleaned daily with a wire brush made especially for this purpose.

Heating the Metal.—A uniform gas-pressure burner underneath the melting pot will consume about thirteen cubic feet of gas per hour. The gas furnished in different towns and cities varies. Either illuminating or natural gas may be used. Gasoline-kerosene burners can be supplied with new machines before shipment, for use where gas cannot be obtained. To prevent excessive heating of the metal the pressure at the burners should be low and uniform. In most cities and towns the pressure in the gas mains changes greatly in the course of a day or night. Where the change in pressure is excessive, we advise the installation of a plant governor on the supply pipe, to control the pressure.

Treatment of Metal.—The life of good metal depends upon the care it receives. Having put in good metal, see that it is treated properly. Under no circumstances should slugs be fed directly into the metal pot. They should be melted and cleaned in a remelting furnace, in as large quantities as possible. The temperature for remelting should be about fifty degrees in excess of the mean working temperature in the machine.

When the whole mass has become molten, it should be stirred thoroughly for fifteen or twenty minutes. The dross and dirt will then appear on the top in the form of a black powder. This should be skimmed off carefully, leaving the surface of the metal clean and bright. The metal should then be poured as quickly as possible, always ladling from the bottom of the pot.

Linotype metal is a mechanical and not a chemical mixture. On account of the difference in the specific gravity of the ingredients entering into it, it is most important that the entire mixture be kept in constant agitation while under heat when remelting. Otherwise the heavier parts will settle to the bottom of the pot, thus forming an imperfect and unsatisfactory mixture.

Whenever possible new metal should be mixed in the furnace proportionately to the loss of the old stock. This will help to standardize the entire mixture and keep it uniform.

Reviving Old Metal.—After the metal has been used for a long time and remelted many times it becomes brittle and unsuitable for use. Purification may best be effected by treating the metal with "Reductio" Linotype metal flux, furnished in pint cans. This quantity is sufficient to clean two or three tons of metal. Instructions for its use are given on each can. The dross skimmed from the metal should be saved and added to the mass during purification.

"Reductio" is a perfect metal flux that removes all dross, dirt and other foreign matter from the metal. It saves a large percentage of the richer ingredients which are usually skimmed off with the dross, thus giving a much longer life to the metal. It amalgamates the ingredients that have become separated by the chemical action of the heat.

Some of the companies manufacturing Linotype metal will carefully test, free of charge, samples of old Linotype metal submitted to them, advising whether it can be properly toned or not, and if so, the expense involved. This is more satisfactory than furnishing a toning metal for indiscriminate use without directions.

THE LINOTYPE GASOLINE-KEROSENE BURNER

Under conditions where gas or electricity is unavailable, the Linotype gasoline-kerosene burner provides a thoroughly efficient and satisfactory source of heat for the metal pot of the Linotype. Where gas is available the burner can be easily substituted in contingencies involving the temporary shutting off of the gas supply and, moreover, its cost is low enough to warrant keeping one or more in reserve for such emergencies.

This burner is adapted to either gasoline or kerosene. Like the familiar types of heaters using gasoline and kerosene the burner vaporizes its fuel and produces the gas that it consumes by forcing the mixture against the heated burner plate. It gives a steady blue-green flame that heats the metal evenly, and it is at all times under perfect control.

The equipment for one Linotype consists of the burner assembled, the pressure tank with either one, two or four outlet valves, the pump, and ten feet of hollow feed wire to carry the gasoline or kerosene to the burner.

The equipment has no threaded joints to give trouble through leakage. It is equipped with a positive mouthpiece burner control. The burner can be taken apart for cleaning without removing screws, and its position on the machine is such that it is easily accessible to the operator.

The fitting of a Linotype gasoline-kerosene burner to the machine is a simple matter, and its adjustments and operation are equally simple. It can be supplied to any model of Linotype in a few minutes, and no special tools are required.

In using the gasoline or kerosene burner the greatest point is keeping clean everything connected with the burner and its connections. Much of the gasoline and kerosene now furnished for commercial use contains impurities and sediment, and sometimes makes a deposit of carbon or similar substance in the pipes leading to the burner or in the burner itself. As mentioned before, this burner is now designed so that the cleaning recommended can be done easily and readily. This must *not* be neglected if good results are to be obtained from the burner.

It is also to be remembered that in many cases insurance companies require special arrangements to be made, such as having the tank outside of the building, and other precautions are sometimes required. When installing a gasoline or kerosene burner the insurance agents should be consulted and care taken that the insurance policies are not vitiated in any way.

As a matter of fact no accidents or trouble of any kind has been reported from the use of these burners.

XIV. Ordering Parts and Supplies

THE operator, machinist, business manager, or the proprietor of a machine, or any one who orders parts or supplies is especially asked to read this chapter and carefully note the suggestions given.

The printing art in four hundred years of development has run into an innumerable number of specialties. The development of the Linotype machine is keeping pace with the development of the printing art. This has required an enormous number of special characters such as matrices, matrix slides, special ornaments, etc., to be made. The Mergenthaler Linotype Company is now manufacturing about four hundred thousand different characters in matrices in sizes running from 5 to 60 point. These characters cover something like fifty different languages. Besides these there are borders, rules, dashes, mathematical signs and the like, in endless variety. While most languages use the roman style of type, there is the German or Gothic text, the Semitic text, the Hebrew, Arabic, etc., yet even in the languages using the roman character there are special accented letters belonging to each different language.

It is manifest that if our customers wish some particular one out of four hundred thousand characters, that character must be very carefully designated. If it is not so designated there are many chances to one that a mistake will be made. Carefully prepared printed order blanks are furnished gratis, and the use of these instead of ordinary stationery will greatly help in exact designation of the part or supply needed. If these order blanks are not on hand they should be ordered at once and will be promptly sent. A duplicate order should be retained by the customer. It will help the Company sometimes if the orders are consecutively numbered. The Company sometimes has three or four orders from the same customer and it is not always easy to determine as to which order should be filled first.

The Mergenthaler Linotype Company has in its various storerooms in the factory and at the agencies more than one hundred and twenty-five million matrices. This enormous stock is kept on hand to meet these special needs of the customer. However, if the greatest care be not taken by the customer in ordering from this enormous number of characters the result will be that the wrong character or characters will be sent, making it necessary to return them and having the order explained more at length. The Service Department is so organized that in most cases the parts or supplies ordered are sent the same day.

To facilitate the ordering of parts a catalogue is furnished with every machine, and new catalogues are published from time to time bringing them up to date. Customers should state plainly the letter, number and full name of the parts desired as shown in the catalogues. Where possible, give the Model and serial number of the Linotype for which the parts are required. The Model and serial number appear on the patent plate upon the machine.

If unable to find an illustration in the catalogue of the part desired, or if in doubt between two illustrations, a rough sketch should be made of what is wanted, stating where it is used and its function.

Always state whether goods are to be shipped by freight, express, or parcel post, and give the preferred route of shipment.

ORDERING MATRICES

In ordering matrices use the order blanks which are furnished gratis by the Company. Write the characters wanted clearly and distinctly and the number thereof. Especially make the name of the series and the size of the matrices clear and distinct. Where special characters are required and there is any doubt it is best, if possible, to send a proof of these characters or note the page and line in which these characters are shown in our specimen book. Always give the model of machine in which the matrices are to be used. If matrices are to be used in more than one model, please state this on the order, giving all the models in which they are to be used.

When ordering matrices for a Model 2 or 4 state whether they are to be run in the upper or lower magazine. When ordering matrices for use with Models 9, 16, 17, 24, 25 or 26, give the number of the bridge in use as the matrices must be specially notched.

When ordering matrices for Models 16 or 17 specify whether they are to be used in the upper or lower magazine, as matrices used in the lower magazine of these machines cannot have the ears offset. All matrices will be cut to run according to standard keyboard diagram unless otherwise specified. In ordering sorts, accents especially, or matrices for foreign languages, indicate the channels in which the characters are to run. In ordering cap fonts of head-letter matrices, state keyboard arrangement desired. When head-letter matrices are ordered it is very desirable to send a diagram of the keyboard arrangement. These keyboard diagrams will be furnished on request.

TAG YOUR PACKAGES

If our customers would make it a rule to tag each machine part sent to our factory to be repaired, it would save much correspondence and loss of time. Innumerable parts are received at the factory with no means of identification whatsoever. Guessing takes time. *Help us and yourselves by tagging your packages, even if you also write.* It takes time to identify a package by means of a letter only.

XV. Brief Recapitulation

WHEN a matrix fails to respond:

1. Take off cover and see whether the keyboard cam drops promptly at the touch of the key.
2. See if the keyboard cam revolves without slipping on rubber roll.
3. Look to see if the keyboard rod has full movement upward and downward.
4. See if the escapement pawls are worn or burred.
5. Look to see if matrices are clogged in channel.
6. See if a matrix in the channel has been bent or is lying flat in the magazine.
7. See if the matrix is striking on the front partition.
8. Examine the matrices to see whether the ears have been bent or bruised or burred.
9. See if the ears of the matrices, especially the lower ear on the character side, are badly worn so that they may drop into the escapement hole.
10. See whether a wrong-font matrix has by mistake been put into the magazine.
11. See if there is oil or grease or dirt of any kind upon the matrix.
12. See if the ears of matrices have been shaved by the mold so as to cause bad alignment.

The remedies for these troubles have been described in the previous pages.

ASSEMBLING OF MATRICES

The assembler slide must work smoothly and not jump or vibrate.

Care must be taken that there is no oil on the slide, and that the brake and brake block are sharp and do not have rounded corners; that the brake spring is not too strong, causing the assembler slide to resist the action of the assembler star, not so weak that it will jump when a thick matrix comes into the line.

The releasing screw must not be set too low.

The spring which returns the slide must bring it back smoothly, but not be so strong as to pound the assembler slide stop, or so weak as to allow it to clatter or jump.

The assembler chute spring must be adjusted so as not to retard the passage of the thinnest matrices and to hold back the thicker matrices only a very little.

SPACEBANDS

Spacebands must be cleaned daily.

Must be polished with graphite.

The use of "Notabur" is recommended.

Spacebands, when placed in the machine, must have the slides to the right.

There should be a full set of spacebands kept in the box all the time.

The spaceband pawls must be kept even, must be cleaned occasionally, and should stand normally one thirty-second of an inch below the shoulder.

The lost motion of the spaceband lever should be set so as to give the matrix a slight advantage over the spaceband.

DELIVERY SLIDE

The delivery slide is moved forward; that is, to the left of the operator, by a spring, and is returned by cam action. In the old machines the cam roller was upon an eccentric pin by means of which the return stroke could be adjusted.

The delivery lever cam-roller arm is adjustable upon the shaft, on all the later machines.

The delivery slide must come to the right sufficiently to catch the end notch of delivery pawl.

The pawl is thrown upward by a wire in the assembler elevator, and the height of this wire can be adjusted so as to just throw off the pawl.

The piston in the delivery air cylinder regulates the speed of the left-hand movement of the delivery slide. There is also in the top of the cylinder a small hole with a screw and notched washer by which the size of the hole can be regulated.

The delivery slide should carry the short finger just inside of the first-elevator jaw pawls before the machine starts.

There is a bracket with an adjusting screw on the later machines against which the delivery slide stops.

When the packing of the air piston is worn it must be renewed.

FIRST ELEVATOR

The rails in the first-elevator jaw upon which the matrices ride and the grooves with which the ears of the spacebands register must be exactly in line or just a trifle below the corresponding rails and grooves in the delivery channel. This distance should not exceed eight thousandths of an inch.

The position of the first-elevator jaw with reference to the line-delivery channel is obtained by the adjustment at the bottom of the first elevator. This adjustment consists of a barrel which has a connecting link to the first elevator. The adjustment of the elevator is made by turning the barrel. There is a little flat spring adapted to drop into the notches in the

top of the barrel and hold the barrel from turning on account of the jar of the machine. This little spring must be lifted out before the barrel is turned.

The front and back jaws of the first elevator must be kept parallel, and they should permit a matrix to enter and leave freely, but there should not be any greater looseness, or play, than just enough to permit this.

The first-elevator jaw is mounted upon the elevator slide, and this slide descends by its own weight and is lifted by cam action. As the elevator descends by its own weight, it should run freely in the gibs, but should not have any looseness, or side-play.

The first elevator, when it descends, should go far enough so that when it rests upon the vise, the lower ears of the matrices can enter the grooves of the mold freely.

The elevator rises slightly for alignment, as previously described.

When the elevator goes up after casting, to register with the upper channel, it must rise high enough so that the matrices when they pass under the pawl will register exactly with the second-elevator bar.

On many machines knife wiper is operated by first-elevator slide.

Care must be taken that this device does not bind the elevator slide so as to prevent its free descent.

VISE AUTOMATIC

The vise automatic prevents the mold disk and mold from coming forward unless the first-elevator jaw is down to its correct position.

As previously mentioned, the proper setting of this vise automatic is very important.

The adjustment of the vise automatic is made by a screw mounted in the head of the first-elevator slide, and which strikes the jaw as a bearing in the vise cap.

The vise automatic should be tested occasionally by putting a hair space on the vise cap where the screw regulating the down stroke will strike it. The automatic should stop the machine. If it does not, the vise automatic should be carefully reset.

THE VISE

The vise should never be opened when the mold disk is forward upon the locking studs.

As the vise is mounted on a pivot below, the bushings do not come out straight, but describe an arc when the vise is lowered. If the mold-disk bushings are over the locking studs when the vise is lowered, the vise can be forced open, but it will be sure to cause damage.

The vise can be lowered to two different positions. In the first position, the mold slide can be pulled forward a few inches. In the second, or lower, position, the mold slide can be entirely removed from the machine. This is seldom necessary.

The mold slide can be disconnected from the machine by a mold cam lever handle on the pump bracket.

On most machines it is necessary to remove the first-elevator back jaw guard before pulling out the mold disk.

The first elevator should be in its lowest position if the vise is to be lowered to the second position.

MOLD WIPER

The object of the mold wiper is to clean the mold of particles of metal which adhere to the mold.

There are two or three forms of this mold wiper, but in any case the mold wiper should be set so as to be against the mold when it is in the normal, or starting, position.

The mold wiper must be kept clean and working properly to get the best results in the operation of the machine. Some operators use a very little graphite rubbed into the felt of the mold wiper. If graphite is used, only a little is required.

CARE OF THE MOLD

Occasionally the mold should be removed from the disk, taken apart, and cleaned with a paste of graphite and a soft wooden stick. This is most important.

Any hard substance like steel or brass should never be used in polishing the mold.

The metal pot must never be allowed to remain against the mold for any length of time. It will take the temper out of the mold, cause it to warp, and is liable to ruin it.

When the mold comes forward it must not press against the matrix line at its first forward movement.

In this case the spacebands cannot be driven up, and the line cannot be properly justified.

On the other hand, when the mold comes up the second time against the matrices just before the cast takes place, it must press firmly and with very great force against the line.

If the pot-lever spring is too weak, what is called "spitting" takes place, and eventually a "squirt" is liable to occur.

When the mold disk goes forward upon the locking studs, the mold disk should rise very slightly, only two or three thousandths of an inch. It should go on smoothly and firmly forward upon the locking studs without chatter or jerk.

The mold disk must not travel too far through its momentum before it goes forward upon the locking studs.

The block which holds the mold-turning cam through the shoe may be too loose, in which case the shoe must be set closer to the block by means of the adjusting screws.

BACK KNIFE

The back knife must be set so as to press against the back of the mold and shave off the bottom of the slug, removing all the metal from the back face of the mold. If the back knife is set too tight it will shave, or scrape, the back side of the mold and make trouble. If set too loose, the slug will not be of the proper height, and pieces of metal will be left on the back of the mold, which, after they accumulate, may cause a "squirt."

METAL-POT

The adjustment of the metal-pot by the screws at the bottom of the pot legs has already been described. A correct lock-up is of the very greatest importance in the smooth operation of the machine.

A poor lock-up may result from a warped mouthpiece. In this case the mouthpiece ought to be brought to correct shape by means of a fine file. This is best tested by using Prussian blue, allowing it to register against the mold.

The second case of a bad lock-up is caused by a warped mold. If this warping is not too great, the mouthpiece can be fitted to it and the mold can be used for a long time. If the mold is badly warped it must either be repaired by grinding or discarded.

The holes in the mouthpiece must be kept open, otherwise there will be a poor face.

Under certain conditions the mouthpiece must be removed and the throat of the pot cleaned out. A tool is provided for this purpose. If pains are taken not to overheat the metal this will seldom be necessary.

AUTOMATIC PUMP STOP

Care must be taken that the pump stop is properly adjusted.

In most of the machines the pump stop is operated by the right-hand vise. When the right-hand vise is pushed out to the right, the catch, or lug, on the pump lever should just clear, allowing the pump lever to descend.

When once set, the tension of the pump-stop spring should not be altered.

DISTRIBUTOR BOX

When the ears of thin matrices are bent, the first thing to look for is to see whether the lift is raising the matrices over the shoulders of the rails. When the lift goes down, it should go only a very short distance, say, about ten thousandths of an inch below the matrix. The distributor lift should be examined occasionally to see whether it is being worn so that the matrix may slip off the lift, or in some cases the shoulder of the lift may be worn so that it will raise two matrices at once.

The bar point on the end of the rail in the distributor box will wear in time and may become too short, so that two thin matrices may be lifted at once.

When the bar point is worn, it is best to discard it and get a new one, and not attempt to lengthen it by peening, or anything of this sort.

If trouble is experienced in the dropping of matrices, the first thing to look for is to see whether the gears are properly timed. There is a "timing pin" in the gear which should prevent a wrong timing.

If for any reason the machine is stopped by the handle, when not in normal position, the spaceband-lever pawl should be locked and the distributor-shifter latch thrown in, so that when the machine is started neither the spaceband lever nor the distributor shifter will work until after the machine has come to the normal position, when both of them should be released.

CHANNEL ENTRANCE

The channel entrance should stand in such a relation to the distributor bar that a thin matrix like the letter "i" will fall immediately after it passes its partition. This should be watched when the machine is actually running and not when the distributor screws are turned by hand.

In some of the machines the channel entrance partitions are flexible and operate the automatic stop as shown in Fig. 117.

When matrices are removed from the channel entrance in case of a clog the partition should be looked at, and if bent should be brought back to its proper position.

After a long time it happens that the channel-entrance partitions sometimes lose their elasticity so that they must be removed and new partitions put in their place.

In the channel entrances in the later machines the partitions are thinner and fixed, and are not very likely to get bent or moved out of position.

THE MAGAZINE

The magazines, when removed from the machine, should be hung vertically upon a rack. They should never be allowed to rest flatwise or lean against a wall. Above all, magazines should never be piled one upon another.

In some offices where there is a good deal of dirt and dust floating in the air, especially in the summertime, it is necessary at certain intervals to clean out the magazines. In this case, the matrices should be entirely removed and the magazine thoroughly cleaned with a brush provided for the purpose.

If the matrices have become oily and have transferred the oil into the magazines, the magazines should be brushed out with French chalk. This will absorb the oil, and when the chalk has been thoroughly brushed out, the magazine will be clean and the matrices will run freely.

No exact rule can be given as to how often the magazines should be cleaned. In some offices it is necessary once a month, and in other offices once in six months is sufficient.

Some machinists use graphite in the magazines. Where this is done, *only a very little* should be used. It is best, if possible, to blow the dry graphite in with a small pair of bellows or something of that kind, and then brush the excess graphite out. Unless the operator or machinist has had experience in the use of graphite in the magazine it is not recommended.

ESCAPEMENTS

On the Models 5, 8, and 14 machines, also Models 18 and 19, the escapement is not attached to the magazine. The escapements are mounted in a brass member which can be removed separately from the machine. In this case it is easy to repair or remove a pawl which has become damaged or burred. When a pawl is in its lowermost position, it should just be in line with the bottom of the channel so that the ear of the matrix will slide over the pawl without either rising or falling. After a long time the pawls sometimes become worn, so that they are below the surface of the channel when they are in position. In such case the pawls should be discarded and new ones put in.

Oil should not be used around the escapement, but a little dry graphite can be brushed into the escapement with an old toothbrush. Oil must be kept away from the escapement, as it is almost sure to get on to the matrices and cause trouble.

In some climates that are moist, the pivot rods on which the escapement verges turn are liable to rust, in which case the verges may not turn freely. In this case the escapement rods may be removed and wiped with an oily rag and replaced. *Only enough oil must be used on these rods to prevent their rusting.*

The escapement bars, if carefully handled, will not suffer any damage. It is almost impossible in the action of the machine to injure this part. When off the machine, however, there is a possibility of damage, and in this case it can usually be repaired by the use of a fine file. Great care should be taken, however, in this matter, as this part is made with extreme accuracy and an inexperienced man can easily ruin an escapement bar, which is an expensive part to replace.

CARE OF TRIMMING KNIVES

There are two kinds of knives used in the Linotype machine, two called "side knives," and the other, "the back knife." The back knife trims the bottom of the slug while the mold disk is revolving. The side knives trim the sides of the slug as it is ejected out of the mold into the galley.

Proper care of the knives is of importance. The sharp edge of the knives is easily nicked or damaged by a hard instrument. In working around the machine, care must be taken not to bring a screwdriver or anything of that sort in contact with the edges of the knives. This sometimes happens when cleaning out a squirt or driving out a stuck slug.

The edges of the knives should be sharp, but should not have a razor edge. If the edge is too sharp it will tend to dig into the slug. When the knives become dull, or if they get nicked by accident, it is best to send them to the factory or agency to be reground. This requires a duplicate set of knives so that the machine may not be stopped while the knives are being sharpened.

Knives can be successfully sharpened by those who have some mechanical skill by the use of a lapping block and a very fine emery.

The edge of the side knife is not exactly at right angles with the bottom of the knife, but has an opening of about one-half degree. Unless the operator or machinist has considerable skill it is better to have the knives ground by the factory or an agency, as above suggested.

The back knife is more easily sharpened than the side knives, and this can be done on an emery wheel or a lapping block. If sharpened in this way, the feather edge of the knife should be stoned off.

"DON'T"

Don't oil the escapements. The oil will surely get on to the matrices.

Don't put oil in the magazine. In other words, don't be foolish.

Don't slam the channel entrance when closing it. It may injure the parts of the automatic stop.

Don't pound the magazine to make the matrices drop. You are liable to bend the plates and make a bad matter worse.

Don't forget, when pulling down the channel entrance, to do so quickly, as opening it slowly is liable to cause a matrix to fall into the magazine flatwise.

Don't attempt to remove a magazine without first inserting the locking bar. If you do, the matrices will spill on the floor.

Don't forget to close the cover on the lower magazine before starting to remove it. The matrices may run out.

Don't expect a rusty or bent locking bar to work freely. Clean it. If bent, straighten it.

Don't delay ordering new keyboard rubber rolls when grooves have become worn in those in use. Time spent in correcting transpositions and double letters is worth money.

Don't release the lock on the left-hand side of Model 5 magazine, except with the magazine-locking bar.

Don't insert the keyboard-locking bar of a double-magazine machine unless the magazine-locking bar is in place. A matrix will run out of each channel.

Don't try to change the register of a double-magazine machine from upper to lower with the keyboard-locking bar in place.

Don't keep pulling on the starting and stopping lever when machine "stalls." See that the friction clutch is clean and that the leather shoes are properly packed.

Don't force the first elevator when a tight line prevents its dropping far enough to release the vise automatic. Ruined matrices will result, and a "squirt" is bound to follow if you do.

Don't strike the keybutton impatiently and repeatedly if a matrix fails to respond. Locate the difficulty and correct it.

Don't try to force in the magazine-locking bar. It should enter freely. If not, the trouble is probably due to a defective matrix failing to slide over the pawl. This should be removed, or pushed back in place, before inserting the locking bar.

Unless in a great hurry, do not punch out "stuck," or hot, slugs with the ejector lever. Back the machine up slightly, release the ejector-lever adjustable pawl, and allow machine to come to normal position, open the mold cap and remove the slug by hand. Driving out slugs tends to round off mold edges, which will produce feathers on the bottom of slugs.

Don't turn a magazine upside down, or in such a way that the lugs of the matrices jump out of the channel at the opening in the lower end of the magazine. If it is found necessary at any time to turn the magazine upside down, after placing it on the machine, push the matrices back by running the finger along the opening at the end of the magazine, and see that the matrices fall in the proper places in the channel. This should be particularly guarded against in the lower magazine.

When about to go to press and something happens to the machine, don't go at it blindly with a screwdriver and wrench, changing every adjustment in sight. You will only lose time. Investigate and find out what is the trouble before applying a remedy.

Don't abuse the machine when it balks or stops or fails to function properly. It is because you have neglected something, or something has broken. The machine is the most reasonable thing in the world, no matter how unreasonable it may seem.

Don't forget that the machine always does the best it can, in view of the treatment it receives.

Don't forget that time spent in keeping the machine clean, oiled where oil is necessary, and free from rust, is time well spent. This is a case where "an ounce of prevention is worth a pound of cure."

Don't forget that with fair, intelligent treatment, you will find the Linotype one of the most obedient and useful servants in the world.

THE ERECTION OF THE LINOTYPE

First, ascertain if there is a door or window wide enough to admit the machine without dismantling, and if not, a suitable opening should be provided, for it would prove expensive and unsatisfactory if, at the last minute it should be found necessary to strip the machine to the base.

The largest assembled section of any model Linotype is the base, which is shipped firmly bolted to heavy wooden skids and completely enclosed in a box measuring 44½ x 52½ x 66½ inches and weighing 2,000 pounds.

Provided your building contains an opening large enough to admit this section, it is best to place the base in position before removing the boxing; however, it is frequently necessary to strip the boxing from the skids, which reduces the section to a width at its narrowest point to 36 inches, thus allowing it to pass through a 36-inch door frame by careful handling.

If for any reason it is impossible to make above provisions, the width of machine may be reduced still further by removing the driving pulleys and shaft, but to accommodate a smaller opening complete dismantling becomes necessary.

Foundation.—To insure smooth running, freedom from vibration must be had, therefore, if possible, a concrete foundation covered with a tight wood floor or galvanized iron mat to prevent grit from the concrete into the machine bearings is recommended.

An ordinary floor constructed of 2 x 12 inch joist spaced 12 or 16 inches center to center will hold a Linotype, but for safety and efficiency the foundation should be the best obtainable.

Power.—The ideal method of driving a Linotype is by use of a direct connected geared motor. The speed of the main driving pulley on the Linotype, which is 14½ inches in diameter, should be from 66 to 68 revolutions per minute. To ascertain the size of pulley required on shaft, if driven from a line shaft, multiply the diameter of the main driving pulley on the Linotype (14½ inches) by the number of revolutions desired (66 to 68), and divide the product by the revolutions of the driving shaft. The quotient will be the diameter of the pulley required.

Floor Space.—The actual space occupied by a Linotype is 25 square feet. The distance from front of keyboard to outside of step on rear of machine is 5 feet, and the width, including all overhang, is 5 feet. In order to give a proper working space all about the machine, the total floor space apportioned should be not less than 76 square feet. There should be 3 feet clear in the front and 18 inches in the rear, these added to the machine space (5 feet) make 9 feet, 6 inches, from front to rear. On the left hand side of the machine there should be a working space of 18 inches, and the same amount on the right hand side, this added to width of machine (5 feet) makes 8 feet as the total space required in width. For the Model 8 allow 5 feet 4 inches for each machine and 20 inches between machines in addition. The Model 14 requires a width of 6 feet, 4 inches and 2 feet between machines in addition.

The following diagram will serve as a guide in laying out floor space and finding location for gas pipe, where piping comes from beneath; also for electric wiring and water piping for the water-cooled mold. Where gas connections cannot be made from below, it is best to drop pipe from a point directly above.

The diagram shows floor plan for a Model 8 Linotype. The diagram represents the machine as standing in a floor space 60 inches square. Every

part of the machine comes inside of this space except the step, which projects about three inches beyond the line. The points on ceiling and floor for gas, water piping, and electric light wiring are indicated on the diagram, with their distance from the boundary line given in inches. The distance between the feet of the machine is given to enable its location on the floor over joists, etc. By careful study of this diagram all preparations can be made for installing the machine in advance of its arrival; that is, the electric wiring can be put in and brought to the points indicated in the dia-

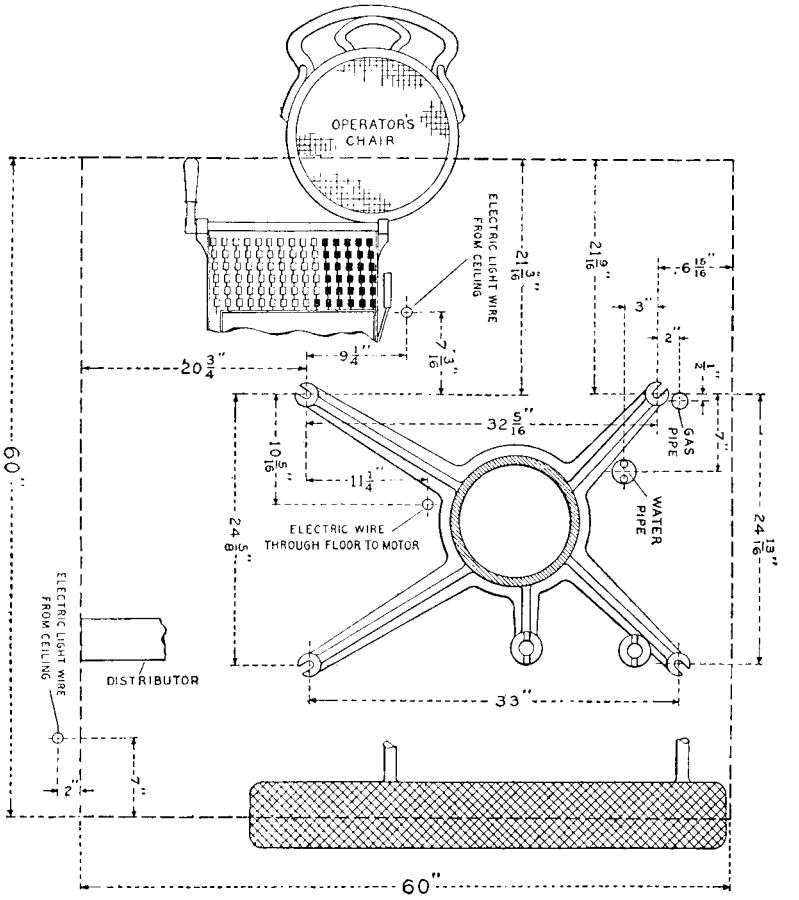


FIG. 132.—Floor diagram.

gram and the connections put in so that when the machine arrives the electrician will only have to make the connection with the machine. The same can be done with the gas and water piping. It is important that this should be attended to in advance of the arrival of the Linotype, as these connections should be made as soon as the machine is placed in position.

The location of a machine is dependent on such a variety of circumstances that it would prove an almost impossible task to lay down any one specific rule for guidance. For example, convenience in transmitting power from a line shaft might arbitrarily fix a certain location in one office, where the use of an individual motor or gasoline engine in another office would entirely eliminate this phase of the question.

Another determining feature is the matter of light, especially where daylight alone is depended upon; on the other hand, where artificial light is available, this feature need not be considered.

The floor plan shown is for a Model 8. The same plan can be used for a Model 14, except that 12 inches additional space must be allowed at right of machine for auxiliary magazine.

The Linotype should be installed and adjusted *only* by skilled mechanics familiar with the construction and mechanical action of their various parts. Such men are to be found in the leading offices of all large cities. An incompetent man may cause trouble, delay, and injury to the machine.

The Linotype machines are constructed with the greatest possible care and by the use of standard tools, jigs, and gauges. Every machine is tested before leaving the factory, to the end that every part and every detail may be absolutely true and correct. No change or alteration whatever in any of its parts should be permitted in the process of installation.

ARRANGING AND DRIVING LINOTYPES

In order that each new user may decide as to the arrangement of machines best adapted to meet the conditions of his office, where the special Linotype motor is not used, we give below the various plans that have proved satisfactory.

Source of Power.—Linotypes may be driven from any existing shaft having a uniform speed of rotation, or from an electric motor, gas engine, or water motor. Each machine requires *one-fourth of a horsepower,* but an allowance somewhat in excess of this amount is recommended to insure steadiness of motion. The most economical and practical method of drive is by individual electric motor designed for the purpose. Illustrated literature and prices may be had on application.

Drive Machine from Below.—Where possible to avoid it, do not drive the machine from an overhead shaft. There are many advantages in belting upward to the driving pulley. Do not cut belt openings through the floor. Have your driving shaft above the floor in every instance.

Uniform Speed Important.—The speed of the main driving pulley, which is fourteen and one-half inches in diameter, should be from 66 to 70 revolutions per minute, *and no faster.* Fluctuation in the speed will seriously interfere with the operation of the machine and reduce the output.

Heating the Metal.—The most modern, up-to-date method is the Linotype electric pot. There are many advantages peculiar to the electric

principle of heating that particularly recommend this pot to those who wish to avail themselves of the most modern and efficient plant equipment. The electric method is primarily clean, safe, quick, economical and easily controlled. The necessity for ventilating systems is, for instance, eliminated, as there is an absence of open flames and the resultant products of combustion. Again, while the output of the Linotype is increased, the life of the metal is conserved by the close and accurate regulation of temperature, preventing the consumption of tin, which is the most expensive element that enters into type metals. As the metal is uniformly heated from within the crucible a high temperature can be applied at the start and the metal can be quickly reduced to a fluid state. This would be unsafe with gas or any system by which heat is applied externally, as the rapid expansion would endanger the crucible. The Linotype electric pot delivers the molten metal to the casting point at the exact temperature registered in the crucible. This insures a perfect cast of each character and slugs that are solid and close-grained.

Next to the electric pot, gas is the fuel most generally used. The Linotype gas burner will consume about 13 cubic feet of gas per hour. A plant governor should be installed on the gas supply pipe in order to maintain a uniform gas pressure.

For those localities where neither electricity nor gas can be obtained, there is the gasoline-kerosene burner which provides a thoroughly efficient and satisfactory source of heat for the metal pot of the Linotype. Special descriptive literature will be furnished on request.

LIGHTING

For daylight the machines, if possible, should be arranged to receive light from above or from one side. The best arrangement is to have the light coming to the left side of the operator.

Gas lights may be arranged in any suitable position. For electric lights, each machine is provided with a removable support, or holder, in front of the operator.

VENTILATION

In order to keep the air of the room cool and pure, we recommend the use of an overhead ventilating pipe leading to a chimney, or other flue, and provided with branches, or feeders, leading down to the top of the metal-pots of the machine. In most States this arrangement is required by law. This is not required when the electric pot is used, one of the numerous advantages of being electrically equipped.

Even where the electric pot is used, a good ventilation without draught upon the operator or upon the metal pot is very desirable, and in fact, necessary. In the newer composing rooms, attention is being paid to this matter of ventilation, and in older rooms it will well pay the proprietor to see to it that the air of the composing room is pure and healthful.

COMPARATIVE WEIGHTS OF LINOTYPE SLUGS

BODY AND MEASURE	Solid Mold, Slugs per lb.	Recessed Mold, Slugs per lb.	Solid Mold, Slugs in 100 lbs.	Recessed Mold, Slugs in 100 lbs.	Solid Mold, Ems in 100 lbs.	Recessed Mold, Ems in 100 lbs.
6-pt., 13 ems, solid.....	19½	..	1,950	....	50,700	....
6-pt., 13 ems, on 7-pt...	17	..	1,700	....	44,200	....
6-pt., 13 ems, on 8-pt...	15	..	1,500	....	39,000	....
8-pt., 13 ems, solid.....	15	..	1,500	....	29,250	....
8-pt., 13 ems, on 9-pt...	13	..	1,300	....	25,350	....
8-pt., 13 ems, on 10-pt..	12	18	1,200	1,800	23,400	35,100
10-pt., 13 ems	12	15	1,200	1,500	18,720	23,400
10-pt., 22 ems	7¼	9	725	900	19,140	23,760
10-pt., 30 ems	5½	6½	550	650	19,800	23,400
11-pt., 13 ems	11½	14	1,150	1,400	16,307	19,852
11-pt., 22 ems	6½	8⅓	650	834	15,600	20,016
11-pt., 30 ems	5	6	1,000	600	16,365	19,638
12-pt., 13 ems	10	12½	600	1,250	13,000	16,250
12-pt., 22 ems	6	7¼	425	725	13,200	15,950
12-pt., 30 ems	4¼	5⅓	900	534	12,750	16,020
14-pt., 13 ems	9	10½	500	1,050	10,026	11,697
14-pt., 22 ems	5	6	384	600	9,425	11,310
14-pt., 30 ems	3⅝	4½	....	450	9,869	11,565
18-pt., 13 ems	..	9	....	900	....	7,803
18-pt., 22 ems	..	5⅔	....	567	....	8,318
18-pt., 30 ems	..	4¼	....	425	....	8,500
24-pt., 13 ems	..	7½	....	750	....	4,875
24-pt., 22 ems	..	4½	....	450	....	4,950
24-pt., 30 ems	..	3⅓	....	334	....	5,010
30-pt., 13 ems	..	6½	....	650	....	3,380
30-pt., 22 ems	..	4	....	400	....	3,520
30-pt., 30 ems	..	2¾	....	275	....	3,300
36-pt., 13 ems	..	5¾	....	575	....	2,495
36-pt., 22 ems	..	3⅓	....	334	....	2,450
36-pt., 30 ems	..	2½	....	250	....	2,500

NEWSPAPER AND BOOK MEASUREMENTS

NEWSPAPER MEASUREMENT

13 EMS PICA	5½-Point	6-Point	7-Point	8-Point	9-Point	10-Point
Ems in line.....	28⅔	26	22¼	19½	17⅓	15½
Lines in 1,000 ems....	35⅓	38½	45	51⅓	57⅔	64½
Inches in 1,000 ems....	2⅔	3¼	4⅜	5⅔	7¼	9
Ems in 22-inch column.	7,900	6,785	4,970	3,865	3,050	2,520

BOOK-WORK MEASUREMENT

SIZE	21 ems: Ems per Line	21 ems: Lines in 1,000 Ems	21 ems: Inches in 1,000 Ems	23 ems: Ems per Line	23 ems: Lines in 1,000 Ems	23 ems: Inches in 1,000 Ems	25 ems: Ems per Line	25 ems: Lines in 1,000 Ems	25 ems: Inches in 1,000 Ems
6-point	42	24	2	46	21⅔	1¾	50	20	1⅔
8-point	31½	32¼	3½	35	28⅝	3¼	37½	26½	3
10-point	25¼	39½	5½	27⅝	36	5	30	33⅓	4⅝
11-point	23	43½	6¾	25	40	6⅛	27¼	36¾	5⅝
12-point	21	48	8	23	43½	7¼	25	40	6⅔

TABLE OF TYPE MEASUREMENTS

The Following Table Shows the Number of Ems in Running Inch in Columns from 10 to 30 Picas Wide

WIDTH OF COLUMNS IN PICAS

	10	11	12	13	14	15	16	17	18	19	20
6-point	240	264	288	312	336	360	384	408	432	456	480
7-point	177	194	212	229	247	265	282	300	318	335	353
8-point	135	148	162	175	189	202	216	229	243	256	270
9-point	107	117	128	139	149	160	171	181	192	203	213
10-point	86	95	104	112	121	129	138	147	155	164	173
11-point	71	79	86	93	100	107	114	121	128	136	143
12-point	60	66	72	78	84	90	96	102	108	114	120

WIDTH OF COLUMNS IN PICAS

	21	22	23	24	25	26	27	28	29	30
6-point	504	528	552	576	600	624	648	672	696	720
7-point	371	388	406	424	441	459	477	494	512	529
8-point	283	297	310	324	337	351	364	378	391	405
9-point	224	235	246	256	267	277	288	299	309	320
10-point	181	190	199	207	216	225	233	242	250	259
11-point	150	157	164	171	178	185	192	200	207	214
12-point	126	132	138	144	150	156	162	168	174	180

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The foregoing description of the Linotype machine and the various accessories does not cover every detail of the different models and of special devices which have been put upon the various machines. While every detail of these different models has not been described, the general principle and most of the important mechanical details in all models are identical. Where there are slight differences anyone with mechanical ability can readily perceive their action.

If the various machines and mechanical functions in the foregoing pages are carefully studied and understood, the slight variations in the different models will offer no difficulty.

There are a number of so-called "attachments" which can be placed on the Linotype machine for doing special work. There is an attachment called the "Greek attachment," so called because it was first used on the machines for setting the Greek language. This is used in a few cases on foreign machines where there are a large number of special characters and accented letters.

There is another attachment called the "quadding-out attachment." By the use of this attachment, where work is very open, like some forms of legal work, considerable extra speed can be obtained by the use of this attachment, as it saves the operator's putting in nearly a whole line of quads and spacebands. This quadding out attachment is in use in a few offices where this special work is done.

There are a number of special molds such as the "fudge mold" mentioned in this book, and other special molds have been constructed for special purposes.

Special knife blocks have been made in some cases so as to take care of an overhanging initial letter.

A special device has recently been made for casting large leads and inserting them alongside of the slugs in the galley for a particular class of work.

It has not been deemed best to illustrate and describe all of these "attachments." They would occupy quite a space, and as each one of them is used only in a very small number of offices where special work is required, the vast majority of our customers would have no interest in them.

The printing art in the last thirty-five years has advanced with wonderful rapidity. Special characters, special devices, and special arrangements for accomplishing some particular object are continually being developed. It is the desire and the policy of the Mergenthaler Linotype Company to assist its customers in every possible way and the industry may rely upon the fact that every important demand of the art will be met.

XVI. The Product of the Linotype

THROUGHOUT all its years of tireless experiment and development, the Linotype Company has never lost sight of the fundamental fact that the machine itself was secondary and the important thing was its product. Every improvement in the machine; every typographic advance, has been planned to enable the individual Linotype user to produce more and better composition and to produce it at a lower cost.

The Company's responsibility does not end with making these increased facilities available; its many thousands of customers throughout the world must be informed and kept informed of them and so there has grown up the Service of Information which includes what is commonly termed "advertising," but which goes much further than mere exploitation of the Company's product. In its various publications, the Company passes on to printers any kind of information that will help them in their business, including not only production methods but typographic arrangement and business management as well.

TYPOGRAPHIC SPECIMENS

Linotype Specimen material is planned to give the printer a comprehensive showing of the resources available on the machine and also to assist him in the proper use of these resources.

The One Line Specimen Book: A concise index for quick and convenient comparison of Linotype faces in all sizes.

The One Line Supplement: A loose-leaf binder containing folders which give a more complete showing of the important type families and which permits the addition of new faces as they are cut.

Linotype Decorative Material: A catalogue of Linotype decoration classified according to the kind of type with which each series can best be used.

De Luxe Specimen Booklets: The important type families are shown in individual brochures with suggestions for their appropriate use.

THE MANUAL OF LINOTYPE TYPOGRAPHY

A Work Planned to be Profit-producing Service to Linotype Users

Work on "The Manual of Linotype Typography" occupied more than seven years. The time was not spent to make the book luxurious or "splendid." We are sure that its recipients will prize it as one of the fine examples

of book making in our own or any previous period; but if the only object had been to produce a beautiful book it could have been finished long ago, without any such investment of thought and constructive effort.

The purpose has been to produce a permanently valuable service for the Linotype-equipped shop—a true manual for practical daily reference in the practical daily work of the printing plant, a definite guide for the daily jobs as well as a general and constant source for inspiration. All the time and labor expended on it have been used to put into every illustrative specimen the best that each of the many collaborators could contribute of typographical knowledge and long experience.

Under the guidance of William Dana Orcutt of the Plimpton Press and Edward E. Bartlett, President of the Bartlett Orr Press and Director of Linotype Typography, these men have produced what we believe to be a genuinely authoritative compilation of typographical object-lessons, showing how to achieve beauty and unity in any printing job. Every page is "working stuff." There is no padding. There is no disquisition or academic discussion. Everything is directed, straight and practical, at the printer's practical problems. The pages show type-pages worked out in every detail. Many of them represent repeated designing and re-designing, composition and re-composition. The work was done to save the printer work, to present the page in its most direct simplicity and lucidity.

The pages exemplify the sound use of types as demonstrated clearly and completely in the sound book-page. The effort has been to illustrate those permanent and universally applicable book-making principles whose observance makes the simple job beautiful and the beautiful job economical. "The Manual of Linotype Typography" is a volume of applied knowledge. *It tells how by showing how.* Of its 272 pages, 248 are specimens pure and simple, so that the men in the printshop can refer, easily and quickly, to desired examples. Each page carries concise, definite instruction and explanation.

The man who can produce a correct book-page is, by that ability, qualified to produce any printing job. This fact, recognized as essential to all typographic technic, is the vital feature of "The Manual of Linotype Typography." Nearly 200 of its pages present book-pages in a variety to make them effective guides for any task in commercial printing.

TYPOGRAPHIC REFERENCE LIBRARY

At the main office, 29 Ryerson Street, Brooklyn, New York, there is a Typographic Reference Library in which are filed specimens of Linotype work of every variety. Customers are cordially invited both to use this Library and to contribute to it interesting samples of their own work.

Among the samples are editions de luxe, school books of all kinds including mathematical texts, edition books, catalogues, booklets and magazines. There are many specimens of ad work, tabular work, combinations of display faces and other forms of intricate composition.

There are also books and specimens of printing in about fifty different languages.

Similar, though somewhat less complete reference libraries are maintained at the agencies.

EDUCATIONAL WORK

In order to provide proper training for the employees of Linotype users, the Linotype Company has for many years maintained at its Brooklyn factory a school for the instruction of Linotype machinists and operators. Similar schools are maintained by the Agencies at Chicago, New Orleans and San Francisco and by Canadian Linotype Limited at Toronto. Any Linotype user can send his employees to these schools free of charge.

In addition to its own schools, the Company has given every assistance to schools conducted under other auspices. Many of them have been loaned machines and equipment.

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