The Effects of Shrinkage in Stereotyping

FIG. 1—When a newspaper page receives the maximum shrinkage in stereotyping it is reduced horizontally about 7% (or about 1¼ inches) and vertically half or less the shrinkage across the page. These conditions distort the type characters as shown by the dotted lines on this enlarged E of 8-point Opticon.

THIS UNIT is a more detailed discussion of the typographic problems which have confronted Linotype as a result of process changes in the development of stereotyping. In the story of *News Body Faces*, to which this becomes a supplement, we have observed the effects through the years of various changes in printing conditions.

Now we are concerned with the single factor of shrinkage. It is not enough for the Linotype salesman to say: "Sure, we have the answer to shrinkage—use our Corona!" He must know enough of what goes on in the stereotyping department to recognize the differences in procedures from one plant to another and to be ready to discuss intelligently their relationship to the composing room and pressroom.

The non-technical readers of this Manual are reminded that the procedures of platemaking and printing involve constant precautions to maintain accuracy of dimensions. Shrinkage (and its contrary factor: expansion) may occur in many ways, and usually as a technical handicap to be overcome or neutralized where possible. Changes in dimensions cause complications in virtually every step of printing production, beginning with the typographic designer and going on through to the bookbinder. It may help to place the stereotyping phases to look at a summary of the more significant effects:

The *designer* or *illustrator* who is required to make a drawing of extra precise dimensions must consider the stretch or shrinkage of his drawing paper, due to atmospheric changes—particularly accurate drawings must be made on sheet metal rather than paper.

The *photographer's* films and papers are subject to changes in dimension during manipulation.

The *photoengraver* combats shrinkage or distortion in films and coated surfaces, or in the metals he uses.

The *electrotyper* has distortion problems in molding and in the heating and cooling of metals, also in the forming of plates in cylindrical shapes.

In the *composing room* a measurable factor of shrinkage permits the proper ejection of cast slugs.

The *stereotyper* has become a specialist in shrinkage, as we shall note later in some detail.

The *pressman* (in a newspaper plant) must have accurate plates—may be troubled more with stretch of paper than with its shrinkage.

The *pressman* (in a commercial plant) is always confronted with problems of shrinkage or expansion of paper in the maintenance of close register.

The *bookbinder* or *finisher* of paper products is confronted with changes in paper dimensions, due to atmospheric conditions, and further with the effects of moisture-containing adhesives. (We all deplore books with curling covers.)

These various reactions involve:

a) the swelling or shrinkage of paper fibers or other materials due to variation in their moisture content (the artist's drawing paper—the photographer's films and prints—the stereotyper's matrix—the printed sheet of paper—the bound book).

b) the expansion or contraction of metals due to temperature changes (the photoengraver's plates—the electrotyper's backing metal—the type metal slug, strip or individual type—the stereotype plate).

Only in stereotyping are the effects of shrinkage so extreme (7% or more in the width of a page) and only in this process is shrinkage deliberately employed for this purpose.

Shrinkage as a Factor for Economy

No available citation names the first newspaper mechanical executive who deliberately reduced his newsprint costs by substantially reducing page widths through high shrinkage in stereotyping. But this writer, in talking with the general mechanical supervisor of one of the largest chains, saw his figures of nearly three million dollars saved for his papers in one year by this means. That saving, made at an earlier period of lower paper costs, would be more than doubled today.

No wonder that the big increases in the price of paper, which has now become some 40% of the average overall costs of newspaper production, should lead to the maximum use of extreme shrinkage. With lesser degrees of shrinkage and no marked effect on printing quality advertisers made no general complaints about the reduced area of space through shrinkage. But when the type page was reduced from an average of 16½ inches wide to 15¼ inches and national advertisers began to protest on printing quality a critical problem developed in advertiser-publisher relationships.

Following discussions at the ANPA Mechanical Conference in June, 1952, a joint committee of ANPA and AAAA (the American Association of Advertising Agencies) studied the problem and made a recommendation, which was promptly adopted, establishing a new column width for newspapers (11 picas and 6 points, termed 11–6 for short). That narrower column permits the reduction of the newspaper page to an economical width with about half of the previous maximum shrinkage, thus returning to stereotyping methods that have insured good printing.

In the joint committee's report we note that "reduction in newspaper page width has been a continuous process since before World War I, as your committee finds from reports to ANPA by approximately 500 newspapers representing about 75% of the newsprint tonnage used by all U. S. newspapers. In 1917, 50.6% of the newspapers were using pages at least 17½ inches wide. Since then that percentage has dropped steadily and in 1951 only 3% were using 17½-inch pages. The trend has been consistently toward page widths of 16½ inches or less—in 1930 only 2% were in the 16½-inch-or-less bracket, whereas by 1951 fully 70% of the U. S. newspapers were using the narrower page.

"In fact, by 1951, widths of 16 inches had been adopted by 11.4% of all U. S. newspapers. These narrower page sizes are of course reflected in narrower roll widths ordered from newsprint manufacturers."

Significant of the lack of general standardization of sizes of newspapers and of the considerable differences in press capacities is the variation among paper-making machines. The same joint committee report summarizes the total of 136 machines producing newsprint in Canada as having 63 different maximum trim widths of paper, ranging from 80 inches to 296 inches. (These wide webs of paper, as manufactured, are slit to the roll widths specified by the publisher.) In the United States (which makes about one fourth of the tonnage produced in Canada), there are 48 newsprint machines with 23 different trims ranging from 56 inches to 222 inches in width.

With this aggregate of some 75 different trim widths among the mills the committee felt that no problem would be created by a change in column width of newspapers, even though that might lead to further changes in page widths.

Throughout this discussion the emphasis has been on horizontal shrinkage, the reduction in page width. Since advertising is bought and billed on page *depth*, either in agate lines or inches, it has been more than a coincidence that the stereotyping process has produced much more shrinkage across the page than down its columns. Let's consider the how and why of that characteristic.

The Mechanism of Shrinkage

SHRINKAGE or expansion of paper has been noted as a typical pressroom problem. It is not uncommon for a large sheet of book paper, say 38 x 50 inches, to change a full half-inch between an extremely dry day and a very humid period. The non-technical reader of this unit should understand this property of paper since the same phenomenon is applied and controlled in the stereotype matrix, which is also a kind of thick paper.

All paper is made by matting or interweaving fibers of cellulose. Many kinds of fibers and variations in the papermaking process produce the many kinds of paper that are familiar to us all. But the cellulose fibers, regardless of source, have a common trait—when they are moistened they swell and get decidedly thicker but not much longer.

The continuous forward motion of a papermaking machine mats the fibers together with a distinct "grain" like that of wood. The fibers flow onto the machine in a soupy pulp which emerges in a thin, wide stream across a rapidly moving endless belt made of finely woven bronze wire. This action pulls the fibers into a general parallel relationship with the sides of the machine. In a matter of seconds the water is sucked out through the bronze screen and the pulp has become paper, still very wet but strong enough to carry on over steam-heated drying cylinders.

The one-way direction of most of the fibers in paper not only produces the grain (which is important in folding and binding operations) but also makes the paper expand or contract most actively *across* the grain. The fibers swell with added moisture but their length alters very little.

Shrinkage in stereotyping, as a major horizontal effect with less vertical change, comes from this principle. The matrix is a special compound of cellulose fibers and adhesives, looking like a heavy sheet of paper, about .035 inch thick. Its grain or principle fiber direction is up and down the page and its fibers are swollen with water. When delivered by the manufacturer the water content is accurately measured and the matrices are stored in the newspaper plant with protection against evaporation. Final shrinkage is determined by the percentage of moisture in the mat.

When the matrix is molded on the type form some of the water is pressed out. The remaining moisture is then baked out ("scorched" the stereotypers call it). With this removal of their water content the fibers lose their swollen girth and the whole matrix rapidly shrinks. At the maximum of "high shrinkage" the horizontal reduction is nearly 8%, or about 1½ inches on an eight-column page. But the vertical shrinkage is only about 2½%. With these results in mind we may look at more general aspects of the stereotyping process.

The Background of Stereotyping

WHILE the subject of this discussion is shrinkage we must remember that this characteristic of stereotyping is only incidental to the vital part played by the process itself.

Without a rapid plate-making process the modern rotary newspaper press couldn't operate. Both the rotary press and the plate-making for it have developed in this country within the past hundred years. Stereotyping for book pages had been devised in Europe and brought to America by David Bruce in 1811. The first curved stereo plate for newspaper printing was used by the *London Times* in 1856, followed by the *New York Times* in 1861.

The printing of newspapers from forms of handset type advanced from the early hand-press procedure of Ben Franklin's time through various power-driven machines. By 1814 the *London Times* was using a flat-bed cylinder press, which was necessarily slow and limited to a few pages per impression. The most elaborate press to use type forms was Richard M. Hoe's Type Revolving Machine. In 1847 the first of these was installed by the *Philadelphia Public Ledger*. It used a large central cylinder on which curved beds of cast iron carried the type forms, one to a page. A number of impression cylinders, around the big type cylinder, were each individually fed with paper in sheets. The type pages were successfully held in place on the curved iron beds, aided by column rules, made v-shaped, which served as wedges. A number of these presses were used on both sides of the Atlantic.

With the development of stereotyping, to cast curved plates, the Type Revolving Machine continued to be popular into the 1870's—but it required hand-feeding. Meantime inventors had been working in various countries, as early as 1858, on the idea of printing a newspaper from a continuous web of paper. After a period of conflict and patent litigation, R. Hoe and Company became the first outstanding builders of web-perfecting press ("perfecting" means printing both sides on the paper, plus folding at the finish). The Hoe firm had been established in 1805, thus today are the oldest printing equipment company in the field. Today they share the field with such concerns as Goss, Scott, Wood, and Duplex—all using curved stereo plates.

The various rotary presses require plates of different curve and thickness for differing cylinder diameters. The Duplex uses plates that are nearly complete cylinders—that press is called the Tubular. Various methods are used for attaching plates to cylinders—a vital function, for plates revolving at high speed do serious damage if they fly off. These details become competitive sales factors which involve various plate-finishing procedures.

The Procedures of Stereotyping

SOME hundred and fifty years ago stereotyping began as a process of molding the type page in plaster. The plaster matrix was baked to remove all moisture—then the plate was cast. Early books carrying a colophon item "printed by stereotype" show fairly clean type reproduction. The same plaster process has been used in our time to make plates of aluminum, but not with enduring success.

About 1810, as a substitute for the slow and dirty plaster molding, the *flong* or paper process was devised, developing into today's procedure.

The flong (from the French *flan*) was a kind of papier mâché and in regular use about the time that Linotype machines began to supplant foundry type in newspapers. Then the stereotyper prepared his own flongs, using layers of special paper materials, held together with a smooth paste specially made of flour, starch, alum and whiting. The back of the flong was a sheet of brown paper, to which was pasted a sheet of blotting paper, usually followed by a second sheet of blotting and finished with two or more layers of tissue paper. All these materials were dampened in the process of combining the flong and it was used while moist and pliable.

To form a stereo matrix, the type page was placed on an imposing surface (marble in those days) and the face of the type was slightly oiled with a brush. The flong was applied, tissue side next to the type, and covered with a piece of strong linen, dampened. Then the flong was forced into the details of the type by beating with a stiff-haired, long-handled brush. On removing the linen, the larger depressions on the back of the matrix, formed by the open spaces in the form, were filled with clay or other packing material. Then a pasted backing sheet was applied and the form, with flong in place, was placed in a gas or steam-heated press and dried in about ten minutes. The baked matrix was then ready for casting, either flat or curved as the printing equipment demanded.

This was the general stereotyping practice when Linotype's early Number One and Two Roman faces were widely used. In the unit "News Body Faces" Mr. Griffith has commented on this procedure. About 1880 the first patents were granted for the so-called "dry flong" process, but it was fully twenty years later that the newspapers began to use it generally.

The "dry mat" (a ready-made flong which eliminated the slow and cumbersome pasting of materials together) required mechanical molding, replacing the hand-beating of earlier days. The molding pressures were considerable, causing the re-designing of display and headletter molds to produce Linotype slugs of adequate strength.

Today's stereotyping continues the use of the "dry" flongs but with varied degrees of moisture content to produce the shrinkage which has become so important a factor. The making of flongs has become a specialty quite apart from the manufacture of the molding equipment and this need of the industry is serviced by specialists. Since a single metropolitan paper, getting out several editions daily, may use several thousand flongs in a single day, the market for this material is constant and sizeable.

Molding the Matrix

STEREOTYPING practices today are not wholly standardized and the records of mechanical conferences are full of debates and discussions, notably on the molding techniques. Two basic methods are used to apply the heavy pressures needed to force the flong into the details of type and engravings. The more generally used method employs a mangle—a heavy, power-driven roller whose rolling pressure can be controlled. The alternative uses a flat-surfaced hydraulic ram to apply direct pressure (plus heat) over the entire surface of the form. Some papers use both, for purposes mentioned later. Thus we find mechanical executives discussing the "rolling of matrices" versus "direct pressure" production.

Either procedure utilizes resilient materials between the roller or platen to transmit the molding pressure with sufficient "fluid" effect to shape the flong around and into the type characters and the dots or lines which comprise engravings in the form. The resilient, elastic materials include:

cork blankets—from ⅛ to ¼ inch thick

woolen blankets—specially woven, about ⅛ inch thick

nylon blankets—now supplanting wool, about ⅛ inch thick

plastic blankets—developed by ANPA Research Laboratory and well received for their high degree of resiliency.

More rigid materials are combined with the resilient layers. They include:

fiber board—about 1/16 inch thick

bakelite board—about .090 inch thick

kraft paper—about .006 inch thick

The stereotyper makes his preferred selection of molding materials, depending partly on the degree of desired shrinkage, on the nature of the prepared flong, and on the equipment used. Usually a sheet of kraft paper is placed next to the flong as it absorbs a good

bit of the moisture that is forced out of the flong during the molding—a fresh piece of paper being used for each molding. Then "corks," blankets, and boards—in various combinations—make up a layer that transmits the pressure of roller or platen.

Stereotypers are individualists—far more than any other craftsmen in newspaper printing. Said a recent speaker at an ANPA Mechanical Conference: "Molding is a highly controversial subject, but whether you use plastic, cork, steel, fiber board or felt is relatively unimportant. What *is* important is the ability, through experience and knowledge, to determine when you are getting a mold with a good dot structure and good bowl depth without distortion." When the topflight stereotypers across the country disagree about their methods, as they regularly do in these mechanical conferences, we realize the element of uncertainty about the performance of our type faces that is inevitable with such lack of fixed standards.

For the uninitiated, "dot structure" in the above comment refers to the varying-sized dots which comprise a halftone engraving. "Bowl depth" refers to the bowls of the type characters—such as a-e-g-o, etc. See page 21 of the ANPA-AAAA Report No. 2, which should be in the Typographic section of your Sales Manual.

In this review of the procedures of stereotyping we now have a molded stereo matrix—whether by "direct pressure" or by "rolling." Either way the matrix, freshly molded, still contains a high percentage of moisture which must be removed before it can be cast into a printing plate.

Drying the Matrix

SCORCHING is the word commonly used for the quick-baking process used to drive out the remaining moisture in the matrix. Some of the water content was squeezed out in the molding but most of it is evaporated by direct application of heat. Here the actual shrinkage takes place and the special oven or scorcher is also built with a cylindrical form to shape the matrix into the general curvature in which the plate must be cast to form a printing surface on the press. Again the stereotyper uses judgment rather than an exact routine—the amount of heat and the period of scorching vary with the local conditions and materials.

Matrices molded under direct pressure may be dried on the form before the pressure is released. A heated platen on the molding press accomplishes this, but the process requires more time. It must be used for the duplication of color plates to preserve their accurate register—if stereotyped by rolling and scorching that accuracy may be lost.

On page 15 of the ANPA-AAAA Report No. 2 note the specification of *direct pressure-baked* mats as "acceptable by most newspapers for all types of advertisements, including those containing printable type and halftones." (See Report No. 1.)

Cold-molded dry mats are limited, in this report, to "advertisements consisting entirely of type (10-pt. size or larger) or advertisements containing very open line drawings, provided proper depth of open space and depth of type bowls are retained."

Again the emphasis on the handicap to quality which results from the repeated stereotyping through which such duplicated advertisements must pass.

Packing the Matrix

OPEN AREAS in the type page, such as the white space in display ads or around headings, must remain sufficiently below the printing surface of the cast plate so that they will not be touched by the ink rollers and produce inky smudges. If these areas were left without reinforcement in the matrix the pressure of molten metal, cast with heavy impact, would destroy the molded contours and make a plate that "bottoms" in printing.

The preventive is a procedure called packing. Strips of blotting paper, kept at hand in varying widths, are cut to fit the open areas and are fastened to the back of the matrix with a special cement.

Many inventors have sought some quick and effective means to replace this stage of stereotyping which takes valuable time with hand work. One substitute process was offered to Linotype for marketing, but it hadn't been proved out in practice and nothing came of it. Other automatic packing methods have been tried in trade practice—none as yet seems to be established.

Casting the Plate

TWO DISTINCT purposes are met with the pouring or pumping of molten metal into the stereo matrix. "Flat casting" produces a flat, plane-surfaced plate. Curved plates, for the cylinders of rotary presses must be cast with the matrix held in a curved mold.

In newspaper printing, flat casts are made from stereo matrices sent in by national advertisers. Then the flat-cast plates are made up into the newspaper form for subsequent stereotyping in full-page, curved-plate style. This duplication of the molding and casting multiplies the incidental losses in printing quality. See pp. 12–15 of ANPA-AAAA Report No. 2.

The casting of curved plates, with the subsequent cooling and trimming of the edges of the plates, is accomplished with elaborate, automatic equipment. Most of the press builders also make stereotyping mat rollers, direct-pressure machines, scorchers, and casting machines. Prominent among the latter is the Wood Autoplate, made by Wood Newspaper Machinery Corporation in this country, and also made under license by Linotype and Machinery Limited in England.

As Linotypers we recognize the precisely controlled conditions that are required to cast one sharp, clean Linotype slug. Thus we must duly respect any mechanism that will cast a 50-pound full page, with 300 or more square inches of printing surface filled with type characters and engravings. This process is more scientifically formulated than is matrix molding, with metal temperatures controlled by thermostat, and water-cooling likewise pre-determined. The metal formula differs from Linotype metal, with higher tin content and less antimony—but stereo metal must also be maintained at correct proportions.

With the big automatic casting machines, cooling the plates requires special water facilities, with storage tanks and auxiliary water-cooling devices to maintain constant temperature of the water supply. A rate of flow of 300 gallons per minute through the casting machine, at a temperature of 68 degrees, is typical. Faulty cooling of the cast plates can impair their printing quality.

The plate-finishing operations, all automatic, require inbuilt cutting tools and shaving devices. When the plate is ejected, only a few seconds after casting, it is ready for the press.

In Ben Dalgin's book *Advertising Production* he describes the functions of the *New York Times*, of which he is Director of Art and Reproduction. "On a Saturday night," he says, "when we are printing the Sunday paper with its many sections, we cast as many as 6,000 plates! In our composing room there are a hundred slug-casting machines, with a capacity of casting 8 tons of metal per night. The stereotype department may cast 45 tons of metal every night and about 150 tons on Saturday night. To cast 6,000 plates, each weighing about 50 pounds, in just a few hours is a tremendous operation."

Printing the Plates

THE EFFECTS of shrinkage in stereotyping, which are the subject of this brief discussion of newspaper printing, are revealed in the printed product. Here, of prime importance, is the necessity for speed—the news must get out on the street and catch trains. And every mechanical executive admits that printing quality must be compromised for speed.

Again quoting Dalgin: "It is a common thing to send fifteen pages to press in ten minutes, allowing but a few seconds to a page, and then as many as ten presses begin to grind in a few minutes. In the *Times* plant there are eighty-eight press units, each carrying eight pages on its printing cylinder. That means a capacity of 670,000 24-page papers per hour, running at a speed of 50,000 per hour." These facilities of a big paper are duplicated on a smaller scale by the functions and performance of the pressrooms of the smaller dailies—there the circulations are much smaller but the same need for speed remains as a driving force.

Space here does not permit a description of a rotary press and its operation. But we Linotype people are concerned with the relationship of presswork and paper to the subject of shrinkage. Of equal current interest is the establishment of 11–6 column width. Both have been forced upon the industry by mounting costs of newsprint.

We may visualize the curved plates that have just left the stereotypers carried by conveyor to the pressroom. Eight pages to a press unit is the normal printing arrangement—though four or even two pages may be run when the paper doesn't make up into even eight's.

The pages, which have been cast to fit vertically around the cylinder, are approximately half the circumference of the cylinder with their vertical dimension. Thus four pages across the width of the cylinder, on each side of it, make up the normal printing arrangement.

The depth of the newspaper page, from top edge to bottom edge of the paper, is determined by a cutting device which chops off the printed and folded papers just before they are delivered from the press. That dimension (overall length of the page) is called "cut-off"—a term we must recognize in newspaper conversations.

The *width* of the page, as we receive the printed and folded paper, is one-quarter of the width of the web of newsprint running through the press. Thus any possible reduction in the width of a single page becomes multiplied by four in its effect for saving on the width of the web. What has happened to page widths tells the story of the extremes of shrinkage in stereotyping—and now the definite move toward narrower columns.

From the ANPA Report on Column Width, Sept. 4, 1952; we have quoted earlier in this unit the highly significant figures that show action by fully 70% of our daily newspapers toward the use of narrower rolls of newsprint.

The earlier page width of 17½″ called for rolls of newsprint 70″ wide—4 x 17½″ equals 70″. The reduction of page width from 17½″ to 16″ brings the roll width to 64″. That 6-inch difference in roll width represents important money to the larger papers. It puts a price of hundreds of thousands of dollars on the saving in paper, always provided that acceptable printing quality can be maintained, both in advertisements and in body matter.

Probably no mechanical aspect of newspaper printing in the past twenty-five years has caused more debate or has brought a more difficult note into advertiser relationships than these various aspects of the need to save on paper tonnage. It was one of the most concerned mechanical executives who suggested that Linotype might helpfully prepare some demonstrations of the effects of shrinkage on the several body types.

FIG. 2—These enlarged type characters show the effects of shrinkage in stereotyping as illustrated in the blocks of type on pages 10 and 11. Enlargement here is about sixteen times actual type size.

A) First line is a direct engraving from the pattern proofs of 8-point Corona, to show the letters as designed and cut.

B) As printed direct from slugs on regular newsprint, *without* stereotyping.

C) Stereo shrinkage of ½″—3%.

D) Stereo shrinkage of 13/16″—5%.

E) Stereo shrinkage of 1⅛″—7%.

The type characters have remained clean and undistorted.

Test Pages Show Shrinkage

COMPREHENSIVE tests of stereotyping shrinkage were made by Linotype's Printing Department with the cooperation of New York and Brooklyn newspapers. Four full news pages, composed in the six Legibility Group faces, were stereotyped in various amounts of shrinkage. Then they were printed on four different grades of paper, thus producing sixteen pages. Sent to mechanical executives and publishers of daily newspapers these test pages have been found highly interesting and a source of excellent Linotype publicity.

For convenient reference to these test pages in this Manual it has been found impracticable to bind in the full pages, and it is not necessary here to have the four grades of paper used for the tests. But we have prepared sections of the pages, cut down to Manual size, which preserve the essential comparisons and have been stapled together to present overlapping columns of the body types in each degree of stereotyping.

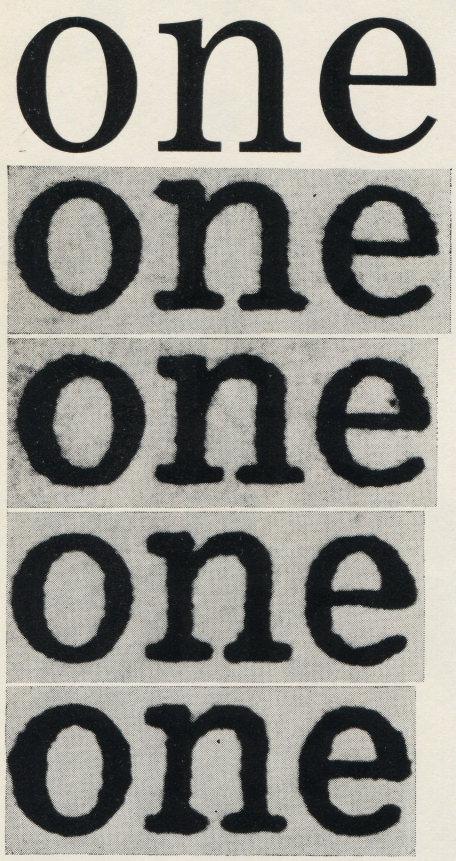

FIG. 3—Effects of impression and shrinkage on 8-point Paragon. Top line engraved direct from patterns of type characters. Remainder of illustration from photographs enlarging the type about eleven diameters. Upper photo from direct impression of slug on paper with other lines showing 3, 5, and 7% shrinkage, used on the Linotype test pages.

The test pages were printed in black ink on a warm gray and a cool gray newsprint, on a white book paper, and on a gray book paper similar to newsprint. The latter printing forms the inserted sections with this unit of the Manual. By including both the upper portions and the lower portions of the four pages we preserve the essential information they carry. The portion of the pages not bound in here carried the story of their production, as here discussed.

In preparing for these tests Linotype held several conferences to determine the controlling conditions. The ANPA Mechanical Department cooperated cordially, applying their studies of the industry to specify the three degrees of typical shrinkage—½ inch, 13/16 inch, and 1⅛ inch across the full 8-column page. The fourth page was printed direct from slugs as the basis of the comparisons.

Through the many years of selling newspaper body faces, printing conditions have always been vital—but always difficult to compare. Various weights, colors, and finishes of newsprint are sufficiently different to have brought about the designing of Paragon (as related in *News Body Faces*). Thus, for these tests, it would not have brought us comparable results if a page had been sent to each of three plants using the specified amount of shrinkage, with the resulting page "tailed through" a press run as a printing test. Nor could we expect one newspaper plant to stereotype these pages in three degrees of shrinkage and make a comparable press run—press dimensions are elaborately set to print a specified page size. The three variations wouldn't fit any existing plant.

Thus it was decided to use newspaper plant facilities to mold the matrices in the three degrees of shrinkage, and to make flat casts for each page. Then these flat casts, varying in page width from 15¼ inches to 15⅞ inches wide, could be printed on the same flat-bed cylinder press with the original slug page, which is 16⅜ inches wide. This printing was done in the Linotype Printing Department, where uniform conditions of press makeready and running could be maintained.

The composition for these pages was also planned to maintain a reliable basis of comparisons. A column for each of the six Legibility Faces, set with identical copy, provides a selling demonstration of relative word-count in the popular 8-point sizes. The page was arranged with Times Roman at the left (1160 words in a 21½-inch column, 12-pica measure, of the 8 point). Progressing by set widths across the page, the Opticon at the right sets 970 words in a 21½-inch column.

To provide four sets of identical slugs each line was cast four times. Thus four original type pages became available, identical in their copy, identical in their slug casting and in their makeup.

Using these original type forms, the first was held intact to be printed direct as the basis of comparison. The other three were molded with stereo matrices specially prepared to produce the required shrinkage. No type form was molded twice—there was a clean, original page for each molding. Thus any possible distortion of the type by repeated molding pressures was eliminated. The flat casts were carefully finished and blocked for printing. The same press and pressman produced each printing.

Results of the Shrinkage Tests

CLOSE STUDY of the test pages shows that the Corona and Paragon faces best preserve clean-printing legibility in the extreme degrees of shrinkage. This is demonstrated in Fig. 2, which reproduces photomicrographs of 8-point Corona lower-case characters s-t-i-g. Above the photo reproductions a line engraving from the original type patterns permits comparisons. The enlargement is approximately sixteen diameters.

First of the s-t-i-g photos was made from the page printed direct from slugs on cool gray newsprint. Compare it with the pattern plate just above—note the thickening of the letters due to impression and to the absorption of ink by the fibers of the paper. This page was *not* stereotyped yet it shows a thicker impression than the metal type characters themselves.

The second, third, and fourth photos show respectively the ½-inch, 13/16-inch, and 1⅛-inch shrinkages. The engravings have been trimmed to show (at their right edges) the successive steps of shrinkage.

While the fourth photo shows the more extreme effect, it remains true that the type characters are in no respect rendered illegible. Corona stands stereotyping to the limit.

In Fig. 3 we have a similar comparison of the characters o-n-e from 8-point Paragon, with the letter patterns at the top. Here the enlargement is about eleven diameters. In the bowls of the o and e we may note how the areas diminish with shrinkage—again recalling the emphasis in the ANPA-AAAA Report on the requirement that type bowls must remain open in satisfactory stereotyping.

The lower-case n in Fig. 3 shows the special problem brought by shrinkage in type characters that have parallel letter elements, such as h-n-m-u. In the studies that led to the Corona design it was early noted that shrinkage is not a mathematically uniform reduction across the face of the matrix. On the contrary, the compression of the fibers of the matrix seems to produce individual variations, with more pronounced effect on some letters than on others.

Fig. 4 reproduces the characters o-n-e of 5½-point Classified, enlarged approximately ten diameters. The degrees of shrinkage are those used in all the tests reported here and the enlarged letters tell their own story of the changes, as compared with the pattern letters, which begin with the printed impression from the slug itself. The demonstration shows that Classified performs properly under moderate shrinkage—but where high shrinkage is employed we should recommend a more open face like Corona or Excelsior.

Stereotyping Shrinkage Versus Photographic Reduction

LOCALIZED variations in shrinkage, as noted in the foregoing, were studied for Linotype by means of a special photographic process, with results shown in Fig. 5. This is a photoengraving on copper, made from photographs made with a "distortion" camera which produced horizontal reduction with little or no vertical change, thus approximating the conditions of shrinkage in stereotyping.

In Fig. 5 the upper block of type corresponds to an impression direct from slugs, with successive steps of reduction in width corresponding to the shrinkages used

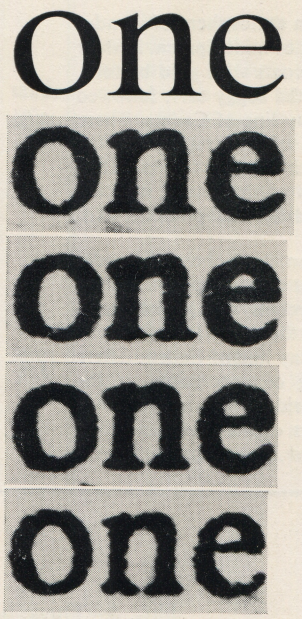

FIG. 4—Effects of impression and shrinkage on 5½-point Classified. Top line engraved direct from patterns of type characters. Remainder of illustration from microphotographs enlarged about ten diameters. Upper photo from direct impression of slug on paper, with other lines showing 3, 5, and 7% shrinkage, used on Linotype test pages.

Comparisons of the Effect of Stereotyping on Body Types

TIMES ROMAN—8 on 9 *L. C. Alphabet Length, 109 pts.* *Lines to 21½" Column, 172* *Approximate Word Count to 21½" Column, 1160*		*CORONA No. 2—8 on 9* *L. C. Alphabet Length, 126 pts.* *Lines to 21½" Column, 172* *Approx. Words to Column, 1004*		*EXCELSIOR—8 on 9* *L. C. Alphabet Length, 126 pts.* *Lines to 21½" Column, 172* *Approx. Words to Column, 1004*
There was an atmosphere of wonder as the regiment of midshipmen, in their long blue overcoats with gold buttons, marched onto the soggy turf, followed by the long gray line of Cadets. There was a feeling of uncertainty as the Army mule, ridden by two reckless cavalry officers of the future, and the Navy goat, led by two potential Ad-	ORIGINAL	There was an atmosphere of wonder as the regiment of midshipmen, in their long blue overcoats with gold buttons, marched onto the soggy turf, followed by the long gray line of Cadets. There was a feeling of uncertainty as the Army mule, ridden by two reckless cavalry officers of the future,	ORIGINAL	There was an atmosphere of wonder as the regiment of midshipmen, in their long blue overcoats with gold buttons, marched onto the soggy turf, followed by the long gray line of Cadets. There was a feeling of uncertainty as the Army mule, ridden by two reckless cavalry officers of the future,
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There was an atmosphere of wonder as the regiment of midshipmen, in their long blue overcoats with gold buttons, marched onto the soggy turf, followed by the long gray line of Cadets. There was a feeling of uncertainty as the Army mule, ridden by two reckless cavalry officers of the future, and the Navy goat, led by two potential Ad-	Less 5%	There was an atmosphere of wonder as the regiment of midshipmen, in their long blue overcoats with gold buttons, marched onto the soggy turf, followed by the long gray line of Cadets. There was a feeling of uncertainty as the Army mule, ridden by two reckless cavalry officers of the future,	Less 5%	There was an atmosphere of wonder as the regiment of midshipmen, in their long blue overcoats with gold buttons, marched onto the soggy turf, followed by the long gray line of Cadets. There was a feeling of uncertainty as the Army mule, ridden by two reckless cavalry officers of the future,
There was an atmosphere of wonder as the regiment of midshipmen, in their long blue overcoats with gold buttons, marched onto the soggy turf, followed by the long gray line of Cadets. There was a feeling of uncertainty as the Army mule, ridden by two reckless cavalry officers of the future, and the Navy goat, led by two potential Ad-	Less 7%	There was an atmosphere of wonder as the regiment of midshipmen, in their long blue overcoats with gold buttons, marched onto the soggy turf, followed by the long gray line of Cadets. There was a feeling of uncertainty as the Army mule, ridden by two reckless cavalry officers of the future,	Less 7%	There was an atmosphere of wonder as the regiment of midshipmen, in their long blue overcoats with gold buttons, marched onto the soggy turf, followed by the long gray line of Cadets. There was a feeling of uncertainty as the Army mule, ridden by two reckless cavalry officers of the future,

FIG. 5—These blocks of type show horizontal shrinkages corresponding to the ½, 13/16, and 1⅛ inches of full-page shrinkage which are typical in newspaper production.

Three Degrees of Shrinkage Compared with Original Type

IONIC No. 5—8 on 9 *L. C. Alphabet Length, 127 pts.* *Lines to 21½" Column, 172* *Approx. Words to Column, 996*		*PARAGON—8 on 9* *L. C. Alphabet Length, 129 pts.* *Lines to 21½" Column, 172* *Approx. Words to Column, 990*		*OPTICON—8 on 9* *L. C. Alphabet Length, 130 pts.* *Lines to 21½" Column, 172* *Approx. Words to Column, 970*
There was an atmosphere of wonder as the regiment of midshipmen, in their long blue overcoats with gold buttons, marched onto the soggy turf, followed by the long gray line of Cadets. There was a feeling of uncertainty as the Army mule, ridden by two reckless cavalry officers of the fu-	ORIGINAL	There was an atmosphere of wonder as the regiment of midshipmen, in their long blue overcoats with gold buttons, marched onto the soggy turf, followed by the long gray line of Cadets. There was a feeling of uncertainty as the Army mule, ridden by two reckless cavalry officers of the fu-	ORIGINAL	There was an atmosphere of wonder as the regiment of midshipmen, in their long blue overcoats with gold buttons, marched onto the soggy turf, followed by the long gray line of Cadets. There was a feeling of uncertainty as the Army mule, ridden by two reckless cavalry officers of
There was an atmosphere of wonder as the regiment of midshipmen, in their long blue overcoats with gold buttons, marched onto the soggy turf, followed by the long gray line of Cadets. There was a feeling of uncertainty as the Army mule, ridden by two reckless cavalry officers of the fu-	Less 3%	There was an atmosphere of wonder as the regiment of midshipmen, in their long blue overcoats with gold buttons, marched onto the soggy turf, followed by the long gray line of Cadets. There was a feeling of uncertainty as the Army mule, ridden by two reckless cavalry officers of the fu-	Less 3%	There was an atmosphere of wonder as the regiment of midshipmen, in their long blue overcoats with gold buttons, marched onto the soggy turf, followed by the long gray line of Cadets. There was a feeling of uncertainty as the Army mule, ridden by two reckless cavalry officers of
There was an atmosphere of wonder as the regiment of midshipmen, in their long blue overcoats with gold buttons, marched onto the soggy turf, followed by the long gray line of Cadets. There was a feeling of uncertainty as the Army mule, ridden by two reckless cavalry officers of the fu-	Less 5%	There was an atmosphere of wonder as the regiment of midshipmen, in their long blue overcoats with gold buttons, marched onto the soggy turf, followed by the long gray line of Cadets. There was a feeling of uncertainty as the Army mule, ridden by two reckless cavalry officers of the fu-	Less 5%	There was an atmosphere of wonder as the regiment of midshipmen, in their long blue overcoats with gold buttons, marched onto the soggy turf, followed by the long gray line of Cadets. There was a feeling of uncertainty as the Army mule, ridden by two reckless cavalry officers of
There was an atmosphere of wonder as the regiment of midshipmen, in their long blue overcoats with gold buttons, marched onto the soggy turf, followed by the long gray line of Cadets. There was a feeling of uncertainty as the Army mule, ridden by two reckless cavalry officers of the fu-	Less 7%	There was an atmosphere of wonder as the regiment of midshipmen, in their long blue overcoats with gold buttons, marched onto the soggy turf, followed by the long gray line of Cadets. There was a feeling of uncertainty as the Army mule, ridden by two reckless cavalry officers of the fu-	Less 7%	There was an atmosphere of wonder as the regiment of midshipmen, in their long blue overcoats with gold buttons, marched onto the soggy turf, followed by the long gray line of Cadets. There was a feeling of uncertainty as the Army mule, ridden by two reckless cavalry officers of

FIG. 5—The reproductions of these six News Body Faces were made by special photographic methods, photoengraved on copper, to preserve the details for a common basis of comparison.

for the Linotype Test Pages. As reprinted here the intervening step of photoengraving and press impression inevitably change the minute relationships in these test blocks of type. This illustration is included to become one more element of sales conversation, an example of the varied studies that have been made to get every possible typographic angle on the design of news body faces that will print most legibly.

What Consideration of Stereotyping In the Sale of Body Faces?

WHEN a news body or classified face is to be purchased first factors toward a selection usually include appearance, word-count, and often the question of TTS operation. Appearance is partly the effect of basic design but also the outcome of the procedures of stereotyping and presswork.

The discussion of *News Body Faces* in this Manual and this supplementary consideration of stereotyping should make the Linotype salesman well aware that his prospective sale of matrices will be influenced by plant conditions quite beyond the composing room. Thus it becomes important to know what amount of shrinkage is effective and whether the normal for presswork is a heavily inked page, a pale impression or a happy medium. Newspaper executives will welcome and respect an intelligent discussion of these broader aspects of newspaper printing.

This unit has been produced at the period of change, by many papers, to the 11–6 column measure. That change usually is accompanied by an easing off of shrinkage to a half-inch or so. This is primarily done to appease the advertisers, but we may reasonably expect a corresponding improvement in the printed quality of the papers.