INSTRUCTION BOOK

LINOTYPE ELECTRIC POT

MERGENTHALER LINOTYPE COMPANY
29 RYERSON STREET, BROOKLYN, N. Y.

INSTRUCTION BOOK

FOR THE INSTALLATION, OPERATION, AND MAINTENANCE OF THE

LINOTYPE ELECTRIC POT

FOR USE WITH LINOTYPE MACHINES

One copy of this instruction book free to each user of the Linotype Electric Pot. Additional copies, 50 cents each

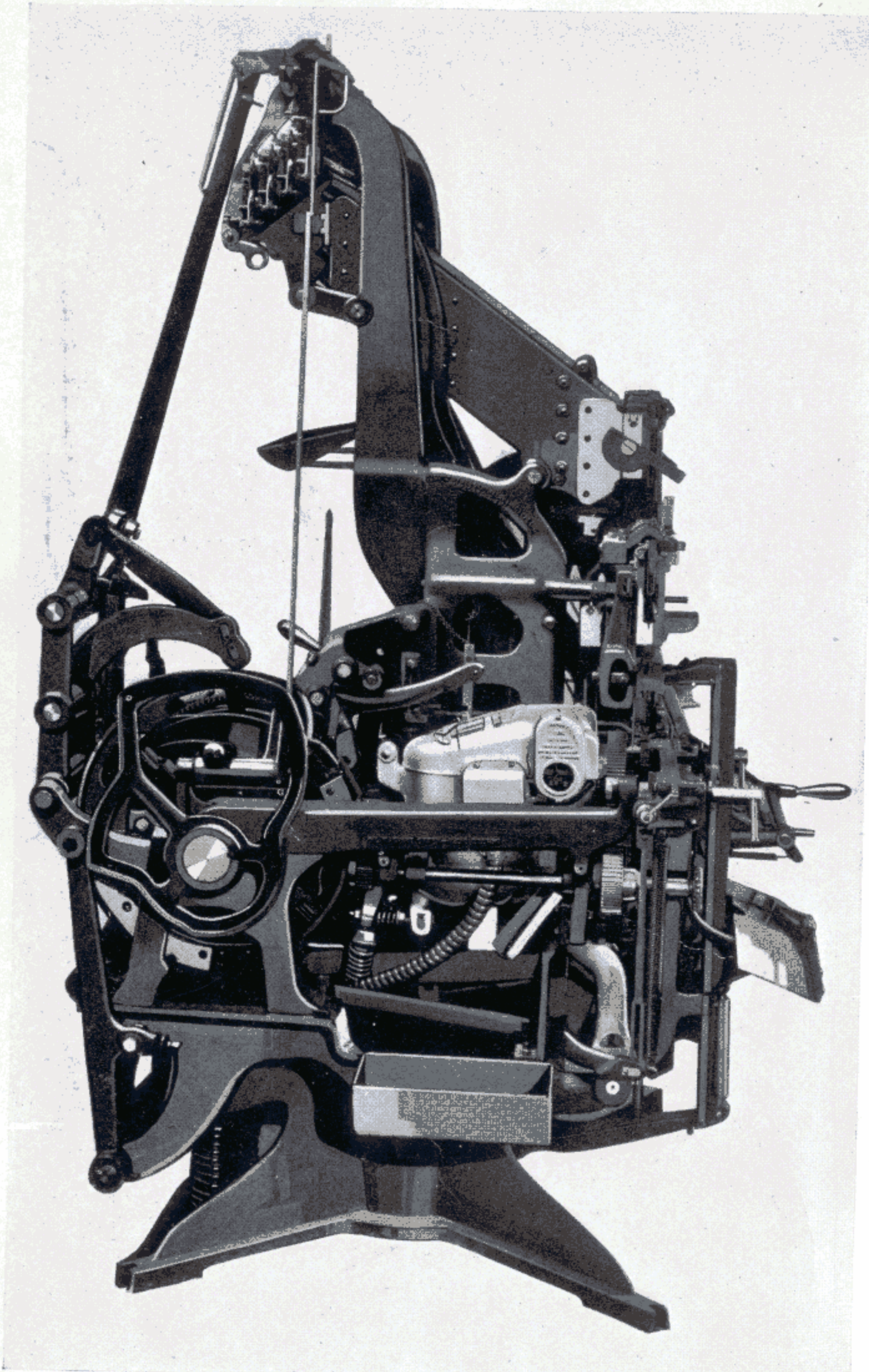
MARCH, 1923

MERGENTHALER LINOTYPE COMPANY

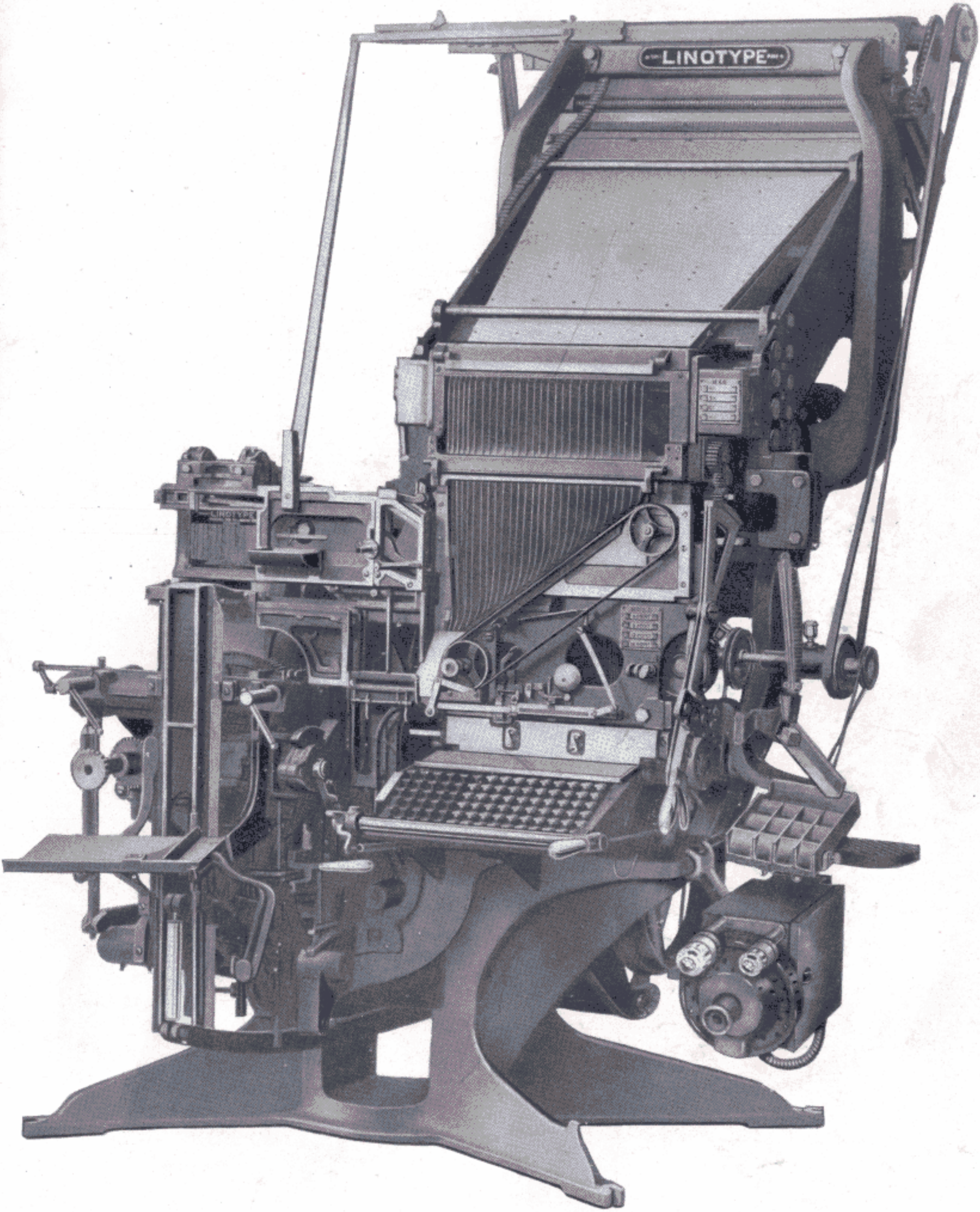
29 RYERSON STREET, BROOKLYN, N. Y.

SAN FRANCISCO CHICAGO NEW ORLEANS

Canadian Linotype Limited, Toronto



The Linotype Electric Pot



Showing Position of the Unit Control Panel

Linotype Electric Pot

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Preface

It has been our aim to make these instructions plain and simple. They are stripped of all technicalities so that the person without a theoretical knowledge of electricity may readily make the few simple adjustments, and perform the few maintenance services necessary for the equipment's successful continuous operation.

If they are given proper installation and a small amount of attention occasionally, these equipments will give uninterrupted satisfactory service for years.

Nearly ten thousand equipments are in successful operation in all parts of the world.

The Linotype Electric Pot is guaranteed against mechanical or electrical defects for one year from date of installation.

The Linotype Electric Pot is manufactured in our Brooklyn works under our own supervision, the heating elements being purchased from the Cutler-Hammer Manufacturing Company.

Our Electrical Engineering Department is constantly helping Linotype users to find the most economical and advantageous means of utilizing the electric pot in Linotype installation and frequently has been able to suggest arrangements resulting in far-reaching economies of time and labor. You are invited to consult us on any matter relating to the installation or maintenance of the Linotype Electric Pot.

Linotype Electric Pot

General Description

The Linotype Electric Pot is mechanically an exact duplicate of the Cutler-Hammer Electric Pot, so favorably known throughout the trade for the past several years. The electrical features have been slightly changed to provide a wider range of heat regulation and to accommodate a greater voltage fluctuation and all the electrical controls have been placed within easy reach of the operating position. It follows closely the design of the standard gas pot and is interchangeable with the Cutler-Hammer Electric or the standard gas pot on all models of Linotypes. Installation can easily be made by your Linotype operator or machinist. The electrical features of this equipment are few and simple and do not require the attention of an expert electrician. Close attention to our instruction for installation and maintenance assures uninterrupted satisfactory service.

The pot is the same size and capacity as the gas pot. It holds 38 pounds of metal, 12 pounds of which can be used without exposing the heaters.

The electrical equipment consists of four heaters, a dynamic thermometer and a unit control panel. The passage of electric current through the windings inside the heaters generates heat which melts the metal in the crucible and raises it to the proper operating temperature, while the dynamic thermometer and the control panel operate to keep the metal at this predetermined temperature.

The heaters consist of strong, substantial, metal encased units. Two of them are immersed directly in the metal and partially surround the pump-well, heating the metal by direct contact. All of the heat generated is immediately transmitted to the metal exactly where it is required and there is no loss of heat due to faulty conduction. The mouth and throat heaters are clamped in close contact with the crucible throat to keep the metal at the operating temperature while being pumped from the crucible to the mold. The heating element or resistor of these heaters is composed of resistance ribbon wound on strips of clear mica. Strips of mica entirely surround the resistor, completely insulating it from the metal parts of the pot and making a heating element that is indestructible under ordinary conditions. As the resistors are protected by the strong metal casing which surrounds them they are not subjected to wear and tear and do not deteriorate in normal service.

The dynamic thermometer which is attached directly to the pot, automatically controls the temperature of the metal in the crucible. It operates by the expansion and contraction of mercury contained in a metal bulb which is placed within the crucible close to the pump-well. It responds to the temperature of the metal, connecting the heaters to the circuit when the metal begins to cool and disconnecting the heaters from the circuit before the metal gets too hot.

The unit control panel consists of a magnet switch mounted on a slate panel, enclosed in a steel cabinet on which is mounted a rheostat for controlling the mouth and throat heater circuit. It also supports a suitable fuse cutout and the switches controlling both the pot and the electric motor (if used) and places all controls within easy reach of the operator. Connection is made between the pot proper, the dynamic thermometer and the control panel by suitable wiring enclosed in a flexible conduit.

The large space between the crucible and the jacket of the pot is entirely filled with a special grade heat insulating powder which prevents radiation of heat into the room and insures a minimum current consumption.

These equipments are practically "universal" and are interchangeable (by making minor changes) on any commercial electric light or power circuit from 100 volts to 250 volts direct current, or 100 volts to 250 volts alternating current of from 25 cycles to 100 cycles per second. All of the electrical equipment consists of standard fittings and materials arranged in accordance with present accepted practice and conform to the requirements of the National Electrical Code. This equipment has been approved by the National Board of Fire Underwriters.

It is of the greatest importance that the serial number of the pot be specified on all supply orders and in all correspondence relating to your equipment.

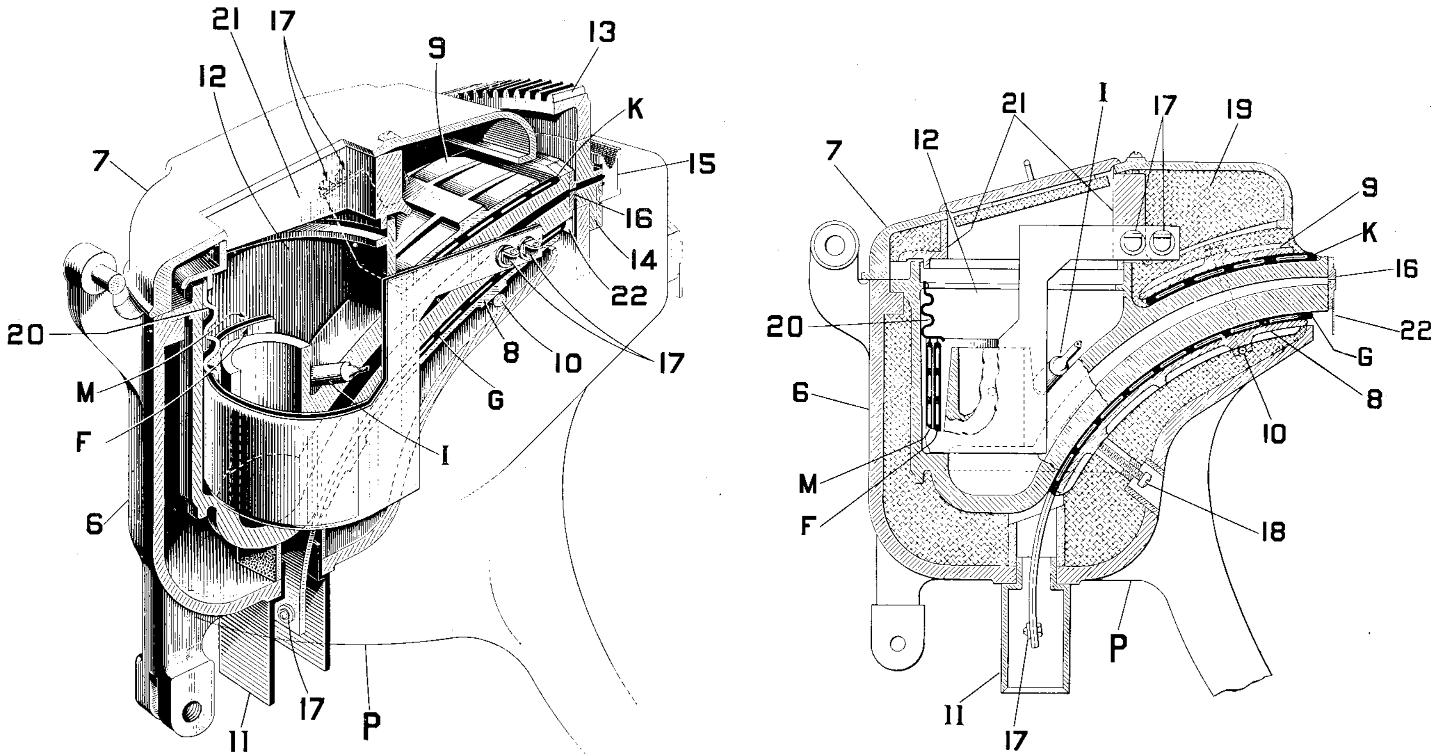
Sectional View

The Electric Pot *P* is shown in Fig. 1 in both perspective sectional and cross sectional view so that you may familiarize yourself with the disposition of the component parts.

The No. 2 crucible heater *F* and the No. 1 crucible heater *M* are inside the crucible 12 where they closely surround the pump-well.

The dynamic thermometer bulb *I* is located directly adjacent to this pump-well and on top of the crucible throat so that it will register the temperature of the metal actually being used.

The throat heater *G* extends the full length of the crucible throat



Sectional View, Fig. 1

F—No. 2 crucible heater.
G—Throat heater.
I—Dynamic thermometer bulb.
K—Mouth heater.
M—No. 1 crucible heater.
P—Electric pot.

6—Pot jacket.
7—Pot cover.
8—Throat heater clamping plate.
9—Mouth heater clamping plate.
10—Clamp bolt.
11—Throat heater terminal cover.

12—The crucible.
13—Mold disk.
14—Mold.
15—Matrices.
16—Mouthpiece.
17—Heater terminals.

18—Throat heater clamp screw.
19—Heat insulating material.
20—Crucible heaters holding clamp.
21—Splash guard.
22—Drip guard.

and is held in close contact with it by the throat heater clamping plate 8 assisted by clamp bolt 10 and clamping screw 18.

The mouth heater *K* is clamped tightly to the mouth of the pot by the mouth heater clamping plate 9 and clamp bolt 10.

See wiring diagram No. 1 for a clear understanding of the electrical connections of these heating units.

No. 19 shows heat insulating material entirely filling the large space between the pot jacket 6 and the crucible 12.

The pot cover 7 may be removed by removing four screws.

The throat heater terminal cover 11 protects the throat heater terminals 17 from mechanical injury.

The mouthpiece 16 is shown in proper relation to the mold disk 13, mold 14 and matrices 15.

No. 20 is a clamp for holding the crucible heaters in place.

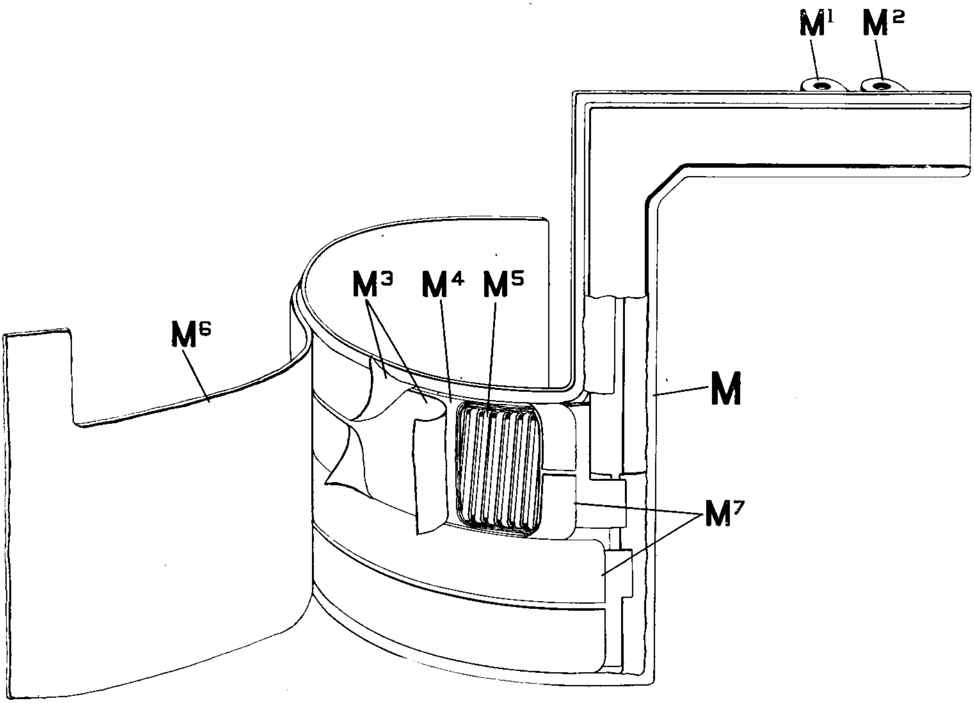
No. 21 is the cast iron splash guard which prevents careless splashes and holds the cover insulation securely in place. No. 22 is a drip guard to prevent metal touching the throat heater.

The Heaters

There are four heaters to each pot. No. 1 crucible heater, No. 2 crucible heater, mouth heater and throat heater. The No. 1 crucible heater and the No. 2 crucible heater are immersed in the molten metal and closely surround the pump-well.

Since these crucible heaters are immersed in molten metal it is necessary that they be absolutely liquid tight. Fig. 2 shows a crucible heater with the metal envelope *M*-6 cut open exposing the interior units *M*-7, one of which has been opened to show the construction of the heating elements. The heating element or resistor *M*-5 is a resistance ribbon wound on mica strips enclosed in a sheet mica insulation *M*-4. The sheet metal envelope *M*-6 is formed of a special grade of metal which resists corrosion. After the envelope is formed and the heating elements assembled inside, the edges of the envelope are sealed together by autogenous welding, thus making an absolutely liquid metal tight structure. In autogenous welding no spelter or foreign material is used, but the metal of the envelope itself is fused together so there is no joint at the point of the weld and the envelope at this point is just as impervious as the sheet metal itself.

Heating by direct contact with the metal inside the crucible by these immersion type heaters, increases the efficiency of the equipment and the dynamic thermometer bulb being immersed in the metal adjacent to the heaters and the pump-well permits of a very close temperature regulation. As these heaters are completely immersed in the metal, there is no possibility of cracking a crucible by metal expansion when heat is



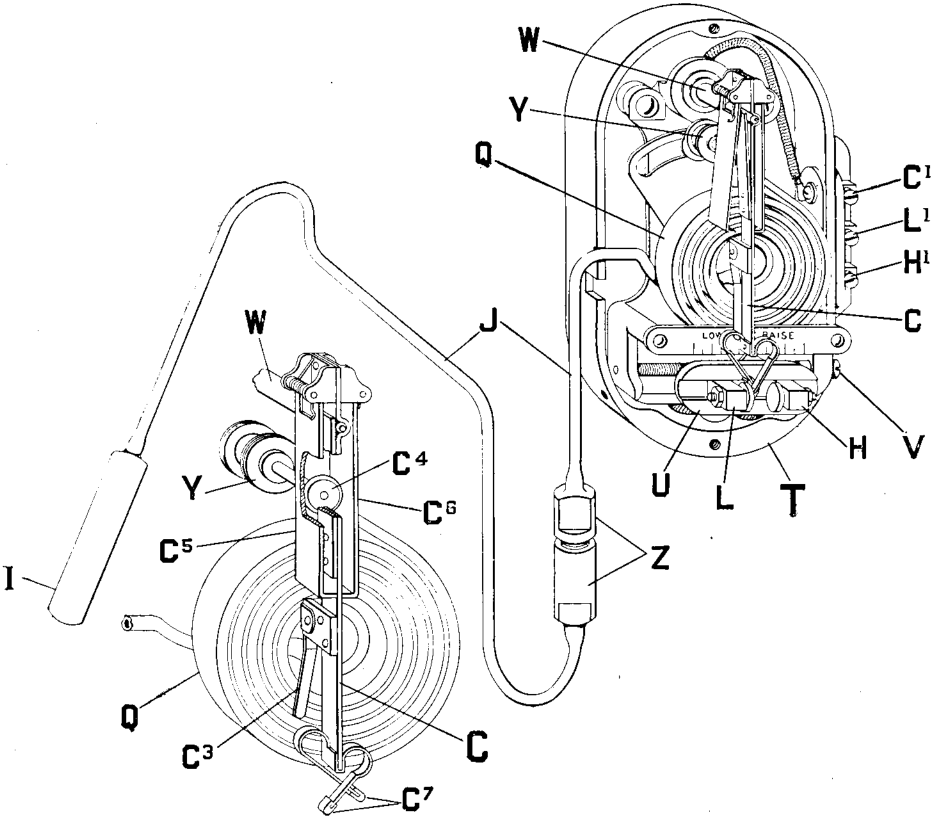
Heating Units, Fig. 2

M —No. 2 crucible heater.
M-1 } Electric terminals.
M-2 }
M-3—Sheet metal, protecting the resistor.
M-4—Sheet mica, insulating the resistor.
M-5—Resistor ribbon wound on strip mica.
M-6—Sheet metal envelope.
M-7—Heating units.

The envelope is cut away and laid back exposing the interior units, one of which is cut open to show the construction of the heating elements and the method of winding the resistor ribbon.

first applied to the pot. When the metal begins to heat, it is that portion in direct contact with the heaters which first becomes molten. Internal pressure is relieved by this melted pathway and the molten metal will flow to the top of the pot.

If through abuse the metal envelope is punctured, molten metal will enter the element, result in a ground, and destroy the unit. Metal in the crucible should always be kept at a level which completely covers the heating units. They are not designed for operation in air and continued



Dynamic Thermometer Cover Removed, Fig. 3

C —Contact lever.
C-1—Electric terminal for contact lever C.
C-3—Tension brake.
C-4—Roller head of insulated pin Y.
C-5 and C-6—Spring leaves.
C-7—Silver contact points.
H —High temperature contact.
H-1—Electric terminal for high temperature contact H.
I —Mercury bulb.
J —Small capillary tubing.
L —Low temperature contact.
L-1—Electric terminal for low temperature contact L.
Q —Flattened coiled spring tubing.
U —Adjustable plate carrying contacts L and H.
V —Adjusting screw.
W —Contact lever post.
Y —Insulated pin.
Z —Tube coupling.

exposure will cause them to burn out or ground. The crucible heaters are intended for heating the metal to the proper temperature and the mouth and throat heaters are only intended to keep the metal at the proper temperature while being forced from the crucible to the mold. The mouth heater and the throat heater are designed for operation in air but are protected from external injury by the same air tight construction.

The throat heater extends the full length of the pot throat and is held in close contact with it. The mouth heater is clamped tightly to the pot mouth. Both heaters are surrounded with heat insulating material and are in good metallic contact with the pot throat and mouth, therefore, all the heat generated by these units is conducted directly into the path of the metal.

The crucible heaters are the same for all voltages; they are connected in "*series*" for 200 volt to 250 volt circuits and in "*parallel*" for 100 volt to 125 volt circuits. See Page 20 for definitions of series and parallel.

The mouth and throat heaters are always connected in *series,* one set being used for 100 volt to 125 volt and another set for 200 volt to 250 volt.

The Dynamic Thermometer

The dynamic thermometer, Fig. 3, automatically controls the heating of the metal in the crucible, maintaining it constantly at a satisfactory operating temperature. It consists of a metal bulb *I* connected by a small tube *J* to a flattened coiled tube *Q*. The coiled tube is made of spring metal and the bulb, tube and spring are entirely filled with mercury and are absolutely air tight. *Z* is simply a coupling used in the first assembly. To the free end of the coiled spring tube is fastened an insulated pin *Y*. Insulated pin *Y* has a roller head *C*-4 which rests between spring leaves *C*-5 and *C*-6 and moves contact lever *C* as the coiled spring tube expands or contracts. The bulb is immersed in the type metal near the pump-well and as the temperature of the metal rises the mercury in the bulb expands causing the coiled spring tube to unwind, driving the contact lever toward contact *H*. Contact *H* is located in such a position that the contact lever will touch it when the temperature of the metal has reached 550° F. If you now follow wiring diagram No. 4 you will see that when contact lever *C* touches contact *H* magnet switch coil *E*-4 is short circuited and magnet switch *E* will immediately fall open disconnecting the crucible heaters *M* and *F* from the line and the metal will start to cool.

As the temperature of the metal falls, the mercury in the bulb contracts allowing the coiled spring tube to wind up slightly and resume its former position driving the contact lever toward contact *L*. Contact *L* is located so that the contact lever will touch it when the temperature of the metal falls to 535° F.

Now follow wiring diagram No. 2 and note that when the contact lever touches *L* current passes through magnet switch coil *E*-4 which immediately closes magnet switch *E* connecting the crucible heaters *M* and *F* to the line and they will start to heat the metal. This cycle will be repeated as long as the switch *B*, Fig. 4, is in the *on* position.

Contacts *L* and *H* are fastened to an adjustable plate *U* controlled by adjusting screw *V*. Ordinarily the adjustments should be so made that the temperature of the metal will remain between 535° F. and 550° F. If hotter metal is required turn screw *V* right handed and for cooler metal turn screw *V* left handed. A good thermometer (X-1480, listed in Special Supplies Catalog) should always be used when adjusting screw *V* for proper heat. You cannot get results by guessing at the heat of type metal.

Contact lever *C* and contacts *L* and *H* are connected to binding posts *C*-1, *L*-1 and *H*-1 respectively.

Contact lever *C* and contacts *L* and *H* do not carry current except at the instant that contact lever *C* touches contact *L* or *H*, therefore they do not break a current when contact lever *C* leaves contact *L* or *H*. Breaking a current at this point would cause burning and pitting but by following wiring diagram No. 3 you will see that as soon as magnet switch *E* closes, a maintaining contact is made at *E*-3 which relieves contact lever *C* and contact *L* of carrying current. Follow wiring diagram No. 5 and you will see that when magnet switch *E* is open no current can flow through contact *H* and contact lever *C*.

As mounted on the pot the working parts of the thermometer are thoroughly protected from mechanical injury by the cast iron cover, but the electric contacts are visible through the glass panel for convenient inspection at all times. These contacts *L* and *H* should be kept clean and bright by occasional rubbing with No. 00 sand paper. Dirt and corrosion are electrical insulators and if these contacts are allowed to get dirty, electrical contact may not be made when contact lever *C* touches contact *H* when the temperature of the metal has reached 550° F. The result would be that the magnet switch *E*, Fig. 4, would not open and the crucible heaters would continue to increase the temperature of the metal until the fuses are blown, the dynamic thermometer permanently injured or the heating units burned out. On the other hand when metal has cooled to 535° F. and contact lever *C* touches contact *L*, and owing to dirt and corrosion no electrical contact is made, magnet switch *E*, Fig. 4, will not close and the metal will continue to cool until it cannot be used.

Care should be taken that the small tube *J* is not injured when feeding metal to the pot, or that no sharp bends be made in it. The hole in this tube connecting the bulb *I* to the flattened coiled spring *Q* is very small and sharply bending the tube or flattening it will close this hole and interfere with the proper functioning of the thermometer.

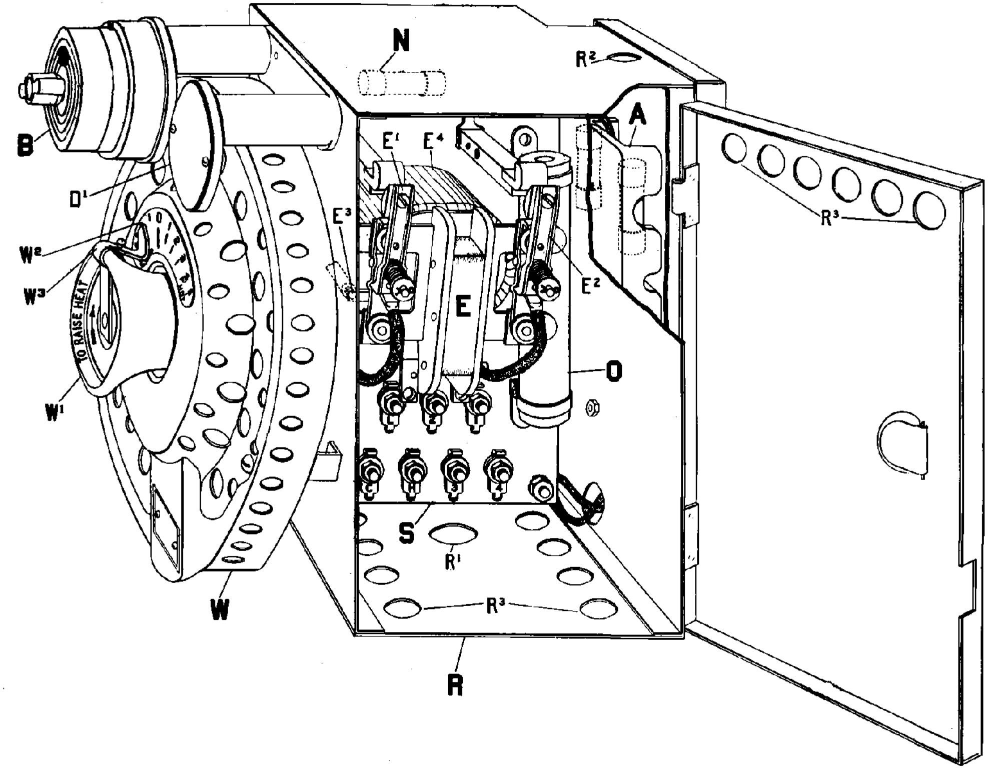
Contact lever *C* should be free to move on its bearings and coil *Q* should be free to expand and contract at will.

Fig. 3 shows contact lever *C* enlarged for a closer examination. *C*-3 is a tension spring or brake for the purpose of slightly retarding the action of contact lever *C*, preventing it from swinging too easily and making premature contact due to chattering pot, rough operation or cold break away. Care should be taken that the tension of this spring is not sufficient to prevent the free movement of coil *Q* in expanding or contracting. The insulated pin *Y* is fitted with a roller head *C*-4 which should, when the pot is at operating temperature, bear against both spring leaves *C*-5 and *C*-6 and both of these spring leaves should touch the contact lever *C* at their lower ends, so that there will be no lost motion at this point. These spring leaves are to protect contacts *C*-7 from injury when an abnormal movement of insulated pin *Y* is necessary, as when the metal cools to room temperature.

The Control Panel

The control panel, Fig. 4, Page 18, is mounted on the frame of the Linotype to the right and slightly to the rear of the key board, where it is within easy reach of the operator. It consists of a magnet switch *E* mounted on a slate panel *S*, enclosed in a steel cabinet *R*, on which is mounted a rheostat *W*, pot control snap switch *B* and fuse block *A*.

E is a double-pole clapper type magnet switch, which is controlled by the dynamic thermometer. It consists of poles *E*-1 and *E*-2, maintaining contact *E*-3 and magnet switch coil *E*-4. The magnet switch coil *E*-4 surrounds an iron magnet (not shown) and is wired directly to the dynamic thermometer contact lever *C* and contact *L* (Fig. 3). When contact lever *C* touches contact *L* a current of electricity will flow through magnet switch coil *E*-4, (see wiring diagram No. 2) energizing the magnet and immediately closing magnet switch *E*, which will remain closed until the contact is broken. When magnet switch *E* is



Control Panel, Fig. 4

A —Fuse block.
B —Pot control switch.
D-1—Position for motor switch.
E —Double pole magnet switch.
E-1 }
E-2 } The two poles of magnet switch.

E-3—Maintaining contact.
E-4—Magnet switch coil.
N —Fuse in mouth and throat c
O —Resistance coil.
R —Sheet metal cabinet.
R-1—Hole for pot connection.
R-2—Hole for line connection.

R-3—Holes for ventilating cabinet.
S —Slate panel.
W —Rheostat.
W-1—Rheostat handle.
W-2—Rheostat scale.
W-3—Rheostat pointer.

closed the crucible heaters will be connected to the line and heating the metal in the crucible. As soon as the switch closes a contact is made at *E*-3 which maintains the current through magnet switch coil *E*-4, (see diagram No. 3) allowing contact lever *C* to leave contact *L*, without making a spark. If the flow of current through magnet switch coil *E*-4 is interrupted as when contact lever *C* touches contact *H* (see diagram No. 4) magnet switch *E* will immediately fall open, disconnecting the crucible heaters from the line, and remain open until a contact is again made. When magnet switch *E* is open the crucible heaters are not connected to the line and the metal in the crucible will begin to cool. The purpose of the maintaining contact *E*-3 is to prevent the dynamic thermometer contacts carrying current while magnet switch *E* is closed and also to prevent the contacts arcing when they leave each other.

The rheostat *W* controls the mouth and throat heater circuit only. Turning the knob *W*-1 right handed will increase the heat at the mouthpiece and turning the knob left handed will decrease it.

W-2 is a rheostat scale and *W*-3 is a pointer to indicate the approximately correct adjustment for different work. This pointer should not be adjusted until the best position for the rheostat knob has been found by trial.

Pot control snap switch *B* connects the pot to the line when turned to *on* position and disconnects the pot from the line when turned to the *off* position. When switch *B* is in the *on* position the pot is "alive" and will heat the metal until turned to *off* position when the pot is "dead."

Fuse block *A* supports fuses *A*-1 and *A*-2 (see diagram No. 1). Fuses *A*-1 protect the entire pot from overloads or accidents. Should these fuses be blown they should always be replaced with other fuses of the same rating.

Fuses *A*-2 and snap switch *D* are in the Linotype motor circuit and where a motor is not installed they will not be used.

Fuse *N* is in the mouth and throat heater circuit only to further protect this circuit from accidents. If this fuse should be blown it should be replaced by another fuse of the same rating.

Resistance coil *O*, located on the control panel along side of the magnet switch, prevents a destructive rush of current through contacts *C* and *L* or *H* when they touch and it also restricts the amount of current consumed in magnet switch coil *E*-4 when magnet switch *E* is closed.

Both resistance coil *O* and magnet switch coil *E*-4 are different for different voltages and frequencies. All of the wiring is back of the slate panel where it is thoroughly protected from mechanical injury.

Terminals *C*-1, *L*-1 and *H*-1 are for connecting to the wires leading from the dynamic thermometer and the other four terminals are for connecting to the wires leading from the same numbered terminals on the pot.

The cable connector *R*-2 is used for connecting to the line, and cable connector *R*-1 is for connecting the flexible cable from the pot.

R-3 are holes for cabinet ventilation.

Definitions

The CIRCUIT is that part of the equipment which is intended to carry electric current such as, copper wires, resistance wires, switches, etc. They are all insulated from the frame of the pot.

The CURRENT is the electricity passing through the equipment.

AMPERES is the volume of current passing through.

VOLTS is the strength or pressure of the current.

A WATT is the product of the volts multiplied by the amperes.

A KILOWATT is 1,000 watts.

A KILOWATT HOUR is one kilowatt of current used for one hour.

A GROUND is a bare part of the electric circuit accidently touching the frame of the pot.

A SHORT CIRCUIT is one or more grounds which allow the current to take a shorter path.

An OPEN is an interruption in the electric circuit caused by a broken wire, etc.

RESISTANCE is an obstruction in the electric circuit retarding the flow of current.

SERIES connection means that two or more units are connected in line with each other. Current enters one terminal, passes through the windings, out of the other terminal and directly into the next unit, through its windings and out to the opposite side of the line.

PARALLEL or MULTIPLE connection means that two or more units are wired in such a way that each makes a complete circuit of themselves. Current enters a unit, passing through its windings and directly back to the line.

An electrical circuit carrying current can best be simply explained by considering an iron pipe through which water is flowing under pressure. The pipe represents the *circuit* and water passing through it represents the *current*. The volume of the water flowing represents the *ampères* and the pressure of the water represents the *volts*. A leak that allowed the water to escape would represent a *short circuit* and a valve in the pipe partially closed would represent *resistance.*

Current Consumption

The maximum current consumption is 1,500 watts and the minimum 325 watts, the average consumption throughout a day's work is approximately 600 watts or .6 kilowatt. The cost of current varies widely in different localities, but you may find the cost of operating your pot by multiplying the number of hours by the cost of current per kilowatt hour and then by .6. The result will be the cost in cents. For instance operating a pot nine hours with current costing six cents per kilowatt hour would cost thirty-two and four-tenths cents—9 x 6 x .6 equals 32.4 cents.

Wiring Diagrams

The Linotype Electric Pot has two separate and distinct electric heating circuits. One circuit is through the crucible heaters and is automatically controlled by the action of the dynamic thermometer on the magnet switch.

The other circuit is through the mouth and throat heaters and is controlled by manually adjusting the rheostat attached to the outside of the control panel cabinet.

A wiring diagram will be found on the inside of the control cabinet cover, but for those of our customers who are not familiar with electrical diagrams, we are inserting between Pages 20 and 21 a sheet of simplified wiring diagrams.

The lines shown on these diagrams represent the wires on the back of the control panel. The electric circuits and the connections may be traced by following these lines.

The heavy lines show circuits carrying current. Arrows are used to assist in following the circuits. These lines are run straight and parallel or at right angles but the actual wiring on the panel is usually run the shortest distance between terminals.

To make these diagrams more clear, they are all shown with the crucible heaters wired in parallel but it should be understood that the crucible heaters in 200 volt to 250 volt pots are wired in series and only the 100 volt to 125 volt pots are actually wired in parallel. The mouth and throat heaters in all pots are always wired in series.

In the first five diagrams the circuit through the crucible heaters only is considered and in the next diagram the circuit through the mouth and throat heaters is explained.

The seventh and eighth diagrams shows the difference in the connection of the crucible heaters for series and parallel connections.

Installation

In ordering the equipment you gave us the electrical characteristics of your supply line and we have supplied an equipment to meet these requirements. Both the pot and the control panel are shipped completely assembled and wired, but the connecting conduit and wires are not attached. The wires in the flexible conduit are plainly marked with fibre tags and care must be used in connecting them to the proper terminals. The pot is installed in the machine in the same manner as the gas pot, the same adjustments being used for the lockup and alignment.

To remove a gas pot and install an electric pot, you should remove the pump plunger and dip out the molten metal. Lower the first elevator to the casting position and let vise down to second position, disconnect the mold cam lever and the ejector lever link, ejector blade connector link and link rod, when the mold disk and slide can be removed. Take off the pot leg caps, turn out front adjusting screws in the pot legs, back off the nut on the pot lever eyebolt to release the spring tension, take out the pot lever shaft, remove the pot lever and take off the mold disk shield and pot pump stop lever bracket. The old pot jacket and crucible can now be lifted out. To do this to the best advantage, put a rope through the supports on the jacket for the pot lever shaft, so that you can raise up the jacket while it is being guided out and away from the machine by taking hold of the bottom of the pot jacket legs.

The electric pot can now be placed in position and the parts that were removed and disconnected can again be placed in position and connected up. After it is placed in position it is ready to wire up and can be brought into proper position in relation to the mold through the adjusting screws.

The holes in the mouthpiece should be made to line up just above the edge of the mold body, so that they will be in the center of a 6 point slug. This adjustment, if you have a pot mouth aligning gauge F-550, is made by turning the machine until the first elevator is in the lowest position, when the vise should be opened, the mold removed and the gauge placed between the vise jaws.

If you do not have the gauge, remove the mold cap, so that you can watch carefully the location of the mouthpiece holes. Raise the first elevator, blocking it up with a piece of wood, one end of which should rest upon the upper end of the vise automatic stop rod. Close the vise, unlock the mold cam lever and move the mold disk forward by hand so that the studs will enter the bushings.

If using the pot mouth aligning gauge, have the two lugs in the gauge resting on the seat of the mold pocket in the disk and turn the machine by hand until the mouthpiece advances to within one-quarter of an inch of the gauge. Force the pot forward against the gauge, using a bar at the back.

If using the mold as a gauge, proceed in the same way and bring the mouthpiece up by hand against the mold, raise or lower the pot so lower edge of mouthpiece holes are in line with top of gauge or mold body, by using the top and bottom adjusting screws in the pot legs, being careful to bring the end hole inside of 30 em liners in the mold. When the correct position is secured tighten up the check nuts.

To adjust the pot so that the mouthpiece will lock up square with the mold, have the machine in the same position as when adjusting the height. Place two pieces of thin paper between the mouthpiece and the gauge or the mouthpiece and the mold, as the case may be, one at each end. Adjust with the front and back screws in the pot legs so that both pieces of paper will be held tight. When this adjustment is secured, tighten up the check nuts.

The control panel cabinet may now be placed in position. It is provided with a bracket for mounting in the proper location on the machine and should be mounted level to insure correct operation of the magnet switch. The flexible conduit is threaded through the pedestal of the machine, care being taken that it does not touch any moving parts of the machine. By the use of the conduit clamps one end of the table is made fast to the pot and the other end to the panel cabinet, bringing both ends of the seven wires in proper position to connect to their respective terminals. Remove the terminal cover on the pot and the cover of the dynamic thermometer to expose the terminals at the pot end. You will notice that the terminals on the pot and dynamic thermometer are marked the same as those on the panel. The wires are marked the same at both ends, so you will connect each terminal on the panel to the terminal on the pot or dynamic thermometer that bears the same number or letter.

The line connection from the control panel cabinet to the current supply may be of any approved construction, such as "Greenfield" flexible conductors, but the two wires to each pot should not be smaller than

No. 10 B & S, the distance to a junction box should be short and the main lines should be of ample size.

The pots in all cases are two-wire. On a single-phase circuit connect direct to the two wires of the circuit. On a two-phase circuit a pot is connected to the two wires of one phase only, the two wires of the other phase being disregarded entirely, and where several pots are used the phases can be balanced by connecting to alternate phases. On a three-phase circuit a pot is connected to any two of the three wires of the circuit and the phases may be balanced in the same manner as in the two phases.

On a two-wire direct current circuit, connect direct to both wires. On a three-wire direct current circuit, connect to the two outside wires or to the neutral and one outside wire, depending of course upon the voltage of your pot.

A wiring diagram will be found on the inside of the door of the control panel cabinet. After the connections are completed, but before turning switch *B*, Fig. 4, to the *on* position, a test should be made for grounds. A magneto should be used for this purpose and the current should not be turned on until it is certain that the equipment is properly wired and free from grounds.

Operation

When this equipment is shipped from the factory the pot contains only a small amount of metal and the first step is to melt down sufficient metal to fill the crucible. On this first heating standard ingots should not be used, but the pot should be filled by means of slugs or small flat pieces of metal that will fit down into contact with the heaters. These will melt down much quicker than ingots and with less possibility of over-heating the crucible heaters which are not designed for operation in air, but should be covered by type metal at all times when the current is on.

When the slugs are placed in contact with the units, turn the current on by turning snap switch *B* on the control panel, Fig. 4, to the *on* position and turn rheostat knob *W*-1 to moderate heat position. About one hour will be required to melt down and bring the metal up to operating temperature. After the first melting down, however, the pot should heat up to operating temperature in about fifty minutes from the time of turning on the current.

Starting up from cold, the contact lever *C* (Diagram No. 1) is touching contact *L*. When snap switch *B* is turned to *on* position a current passes through these contacts and through magnet switch coil *E*-4 which will immediately close magnet switch *E* connecting the crucible heaters to the circuit. The passage of current through the windings of the crucible heaters will heat the metal in the crucible. When the temperature of the metal reaches 535° F., contact lever *C* will leave contact *L* and move slowly toward contact *H* which it will touch when temperature has reached 550° F. When contact lever *C* touches contact *H* current passes through these contacts instead of through the magnet switch coil *E*-4 which permits magnet switch *E* to open. When magnet switch *E* opens it disconnects the crucible heaters from the circuit and the metal begins to cool. As the metal cools, contact lever *C* will leave contact *H* and move slowly toward contact *L*. Contact lever *C* will touch contact *L* when metal has cooled to 535° F. and this cycle is repeated as long as snap switch *B* is left in the *on* position.

With ordinary work and after the metal is at operating temperature the current will be on and the crucible heaters will generate heat about three minutes, then off, and not generate heat about twelve minutes, and will repeat this cycle as long as snap switch *B* is left in the *on* position.

The temperature control is normally set for a maximum of 550° F. and a minimum of 535° F., that is, with normal operation the temperature of the metal will always be between these limits. This is found to give the best all around casting results for average metal. In case it is desired at any time to change the operating temperature this can be done by turning adjusting screw *V*, Fig. 3, right handed for hotter metal and left handed for cooler metal. The head of this adjusting screw projects through the right hand side of the dynamic thermometer cover. We do not recommend that the individual control disks on *L* and *H*, Fig. 3, be changed, as they are properly adjusted before shipment.

If the dynamic thermometer is adjusted to keep the metal in the crucible at the proper temperature and the rheostat *W*, Fig. 4, adjusted to compensate for irregular voltage or for widely different output, no trouble will be experienced with imperfect slugs.

If the voltage is irregular and remains too high for some time or a speedy operator casts large slugs at a rapid rate continuously, the mouthpiece is apt to become overheated and the slugs will have hollow bottoms. In this case it will be necessary to turn rheostat knob left handed, but if the voltage remains low for some length of time or a slow operator casts small slugs slowly, the mouthpiece may become cold and the slugs will have poor faces, in which case rheostat knob should be turned right handed.

When casting large slugs in rapid succession the mold is apt to become heated, but attempting to regulate the temperature of the metal in the crucible to overcome the heating of the mold will fail because the electric pot is a heating unit only and will not cool the mold.

The disk contacts *L* and *H* and the tip of the contact lever *C* that are visible through the glass panel on the dynamic thermometer case should be kept clean. Corrosion or dirt is an insulator and if allowed to accumulate at his point will interfere with temperature regulations.

It is important that the pot never be filled with metal above the under side of the ring cast on the inside of the crucible. If the crucible is filled above this ring, metal may splash over into the heating insulating material and touch the electric terminals, grounding them.

It is also important that the crucible heaters be entirely covered with metal at all times. If they are not, that portion exposed to the air will get very hot and continued exposure will burn them out, destroying them.

Troubles–Testing

General Instructions

Few interruptions to continuous operation are likely to occur, but every abnormal condition that might develop will be described, together with the easiest method of detection and relief. For a definition of the various electrical terms used the reader is referred to Page 20.

The main electrical troubles that you will find are "opens," "grounds" and "shorts."

Before doing any work of any nature on any part of the electrical equipment always turn snap switch *B* (Fig. 4) to the *off* position.

When disconnecting any wiring always mark each wire and its corresponding terminal clearly so that it may be correctly replaced. Experienced electricians who are familiar with ordinary simple testing of this nature may devise their own means, but the inexperienced are strongly advised to closely follow these instructions.

The equipment necessary to make all electrical tests is inexpensive and ordinarily is at hand in an electrically lighted building.

The best method is to use a magneto when testing for grounds and a lamp in series when testing for opens and short circuits.

The Magneto

A hand operated magneto may be borrowed from your local power house. If the size of the installation justifies the expense, a magneto may be purchased for a few dollars.

Before testing with a magneto the two bare tips of the lead wires should be held together while the crank is turned briskly to see that the bell rings distinctly.

In testing for grounds with a magneto, hold one bare tip of a lead wire on a clean part of the metallic surface of the pot or unit being tested and touch the other bare tip of the other lead wire to an electrical connection of the part being tested; now turn the crank briskly and if the bell of the magneto rings, the part under test is grounded, and if the bell does not ring it is not grounded.

Care should be taken that the tips of the leads are clean and that they touch a clean metallic surface. Dirt or corrosion is an insulator.

The Lamp in Series

For testing for open circuits or short circuits a lamp in series is the best equipment. It may readily be made from an incandescent lamp of your regular voltage, a keyless lamp socket, a convenient length of ordinary lamp cord and an attachment plug.

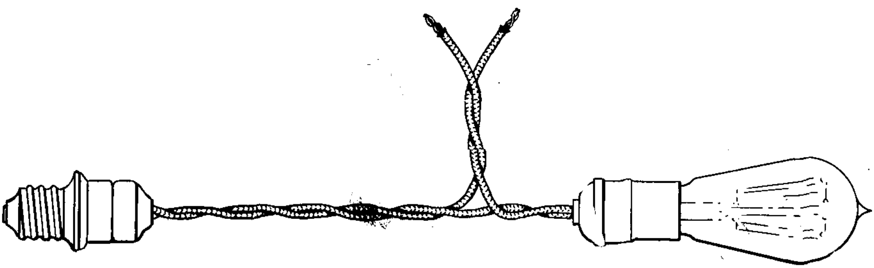


Fig. 5

Connect the lamp cord to the attachment plug and the keyless socket in the ordinary way, then cut one of the two strands of the lamp cord a few inches from the lamp socket. Remove the insulation for one inch from the two ends of this strand of the lamp cord and twist the wires tightly. (See Fig. 5.)

Before making a test with this equipment, screw the lamp firmly into the socket, connect the attachment plug to a convenient outlet and touch the two bare tips of these wires together. The lamp should now light.

When testing for opens, connect the two bare lamp cord wire tips to two different electric terminals of the units under test. If the lamp lights it indicates that the units are not open. When making the above test all interconnecting wires to the units being tested must be disconnected.

Pot Will Not Heat Up

See that switch *B,* Fig. 4, is in the *on* position. Make sure that fuses *A*-1, Diagram No. 1, are intact. Test the line to make sure you have current up to fuses *A*-1. See that contact lever *C,* Fig. 3, touches contact *L* and that these contacts are clean. Note that magnet switch *E,* Fig. 4, closes when switch *B* is turned to the *on* position and falls open when this switch is turned to the *off* position. If the pot still does not heat, it indicates an open in the connecting wires or in the crucible heater units. Turn the current off by turning switch *B,* Fig. 4, to the *off* position, remove the pot terminal cover and test from terminal post No. 2 to terminal post No. 3. If your lamp testing outfit will not light between these two terminals it indicates that both crucible heaters are open and they must be removed and replaced. If the lamp does not light with above test it indicates that the wiring between the pot and the control box is open. This should be found and corrected. When making the above test if magnet switch *E,* Fig. 4, does not close when switch *B* is turned to *on* position it indicates that either magnet switch coil *E*-4 or resistance coil *O* is open. You should test these coils out in the same manner as the crucible heaters by connecting the lamp testing outfit to their respective terminals. They may easily be repaired or replaced.

Continued extremely high voltage may cause magnet switch coil *E*-4 or resistance coil *O* to open and *continued low metal in the crucible, exposing the crucible heaters to the air might cause them to burn out and open.*

Abnormally high pot temperature caused by dirty contacts *C, L* or *H,* Fig. 3, or grounded heater terminals, if permitted to continue will cause the crucible heaters to burn out.

The Pot Heats Slowly

On a 100 volt to 125 volt pot one of the crucible heaters may be open, the other one in good condition. One heater will melt the metal in sufficient quantity to operate at ordinary speeds but will require nearly three times the normal length of time to heat up. To locate the open crucible heater, remove the pot cover, disconnect the wiring from both heaters and test with lamp testing outfit. The open heater of course must be replaced.

Slow heating may be caused by improper adjustment of *V*, Fig. 3, for if the dynamic thermometer keeps disconnecting the heating units from the line before the temperature of the metal has reached 535° F. it will require a longer time for metal to reach operating temperature.

If the crucible heaters have been found correct, use a glass rod thermometer and adjust *V*, Fig. 3, until dynamic thermometer operates between 535° F. and 550° F.

Abnormally low voltage may cause the pot to heat slowly but this is very seldom the case. If the voltage of the line is 15 per cent. less than the voltage of the pot, it would require about 20 per cent. longer time to bring the metal up to operating temperature.

The Pot Overheats

If certain parts of the electric circuit become grounded the dynamic thermometer tube or bulb injured or the contacts *C* or *H*, Fig. 3, dirty or corroded, the dynamic thermometer may not control the magnet switch, and the temperature will rise to a dangerous degree.

If this overheating is caused by a ground you will usually see a considerable spark when contact lever *C*, Fig. 3, leaves contact *L* or *H*. This will soon pit and corrode the contacts and the spark may be severe enough to weld these contacts together when they touch. Under normal working conditions these contacts carry no current except at the instant they make contact or come together then a very small spark will be noticed. When these contacts break contact or leave each other, no spark should occur.

A ground in the pot circuit may be found by the magneto test. Turn switch *B*, Fig. 4, to the *off* position. Remove the pot terminal cover and the dynamic thermometer cover and attaching one magneto lead wire to a clean part of the pot, touch each terminal in succession with the other lead wire while the crank of the magneto is turned briskly. The magneto will ring when the grounded circuit is touched. If the dynamic thermometer tube or bulb has been injured the contact lever *C*, Fig. 3, will not be driven against contact *H* with the expansion of the mercury and the magnet switch will not be released when temperature has reached 550° F., therefore, the temperature will continue to rise.

The bulb may be punctured by jamming ingots of metal down upon it in the pot, or a sharp bend or kink in the tube may close the small hole in it.

If the pot has been overheated by a ground the dynamic thermometer bulb or tube are likely to be expanded by the expansion of the mercury to such an extent that the bulb or tube is permanently injured. Do not replace a damaged dynamic thermometer bulb and tube without first clearing up the ground. The new one will also be injured. If the contact lever *C* or contact *H* become dirty or corroded no current can pass through them when they touch each other, because dirt and corrosion are electrical insulators. The pot will continue to rise in temperature until the fuses are blown or the heaters burned out.

The Mouthpiece Will Not Heat

The mouth and throat heater circuit is separate from the crucible heater circuit. It is not automatically controlled by the dynamic thermometer but it is regulated by adjusting the rheostat mounted on the outside of the control cabinet. These two heaters, the mouth heater and the throat heater, are in series with each other, that is, current passes from the line through one and then through the other, back to the line. See wiring Diagram No. 6. If one is open, current cannot pass through either. The fuse protecting this circuit is shown as *N*, Fig. 4, Page 18. It should be tested first. If the crucible heater circuit is operating properly but the mouthpiece will not heat, proceed to test as follows: Touch one bare tip of the lamp testing outfit to terminal marked 1 and the other bare tip to terminal marked 4. If there is an open in the mouth or throat heaters in the rheostat or in the wiring that connects them, the lamp will not light. To determine whether it is the mouth heater or throat heater that is open, remove the pot cover and attach the test lamp tips to the mouthpiece heater terminals which you will find exposed to your view. If the mouth heater tests correct, the throat heater or connecting wires must be open.

Sometimes the mouthpiece seems too hot or too cold when the real trouble is that the metal in the crucible is too hot or too cold.

Mouthpiece Gets Too Hot or Too Cold

Rheostat *W*, Fig. 4, located on the outside of the control panel cabinet is intended to control the mouth and throat heater circuit, compensating for irregular voltages or differing output. Ordinarily this rheostat is turned to an intermediate position but if the voltage is high or a fast operator casts large slugs continuously, it may be necessary to turn rheostat knob *W*-1 to the left and if the voltage remains low or small slugs are cast slowly the rheostat knob may have to be turned to the right.

Do not confuse a hot mold with a hot mouthpiece. You cannot control the temperature of the mold by adjusting the temperature of the mouth and throat heaters. If you are casting large slugs continuously you should use a water-cooled mold disk.

The Fuses Blow—Grounding

If fuses *A*-1, Diagram No. 1, keep blowing it indicates that some part of the equipment's electric circuit is grounded or short circuited and it will be necessary to locate and rectify this condition before normal operation can be resumed.

Splashed metal is the cause of most grounds, and splashes are caused by careless operation.

Operating the pot with the molten metal above the ring on the inside of the crucible or dropping ingots of metal carelessly into the pot will splash the metal over the crucible walls into the heat insulation.

This splashed metal may ground the crucible heater terminals or mouth heater terminals by a direct splash or may follow the hot crucible down and ground the throat heater terminals which are located at the bottom of the pot.

Operating the pot with metal above the ring on the inside of the crucible, will sometimes cause the mouthpiece to drip molten metal, and if the mouthpiece end of the throat heater is not properly protected by cement this metal dripping down may touch the hot heater and following it down and ground the terminals.

The sheet metal envelope of the crucible heaters may become punctured by forcing ingots of metal down upon them or from other causes. They will immediately fill with molten metal, short circuiting the heater and grounding the pot.

The dynamic thermometer terminals may become grounded, caused by a break down of the insulation. This will ground the pot.

A slight ground on some parts of the pot will not prevent its satisfactory operation, but a heavy ground or short circuit will prevent its operation and blow the fuses.

Most commercial lighting and power circuits are permanently grounded on one side at the generating station or transformer and the pot frame is usually grounded by the line wiring connections.

If the accidental ground occurs on the same side of the wiring that is purposely grounded, it will cause no harm but if it occurs on the opposite side, the fuses will be blown, therefore some serious grounds may be eliminated simply by interchanging the line wires where they are connected to the fuse block *A*, Diagram No. 1.

In testing for grounds switch *B*, Fig. 4, should be turned to the *off* position and the pot terminal cover should be removed. Touch one lead wire from the magneto to a clean part of the pot, (paint or rust is an insulator) and the other lead wire to each of the wire terminals in succession. If the magnet does not ring when the crank is turned briskly the pot is not grounded. If the pot is grounded, which is indicated by the magneto bell ringing with the above test, it will be necessary to locate the particular part of the system grounded. In most cases you should remove the pot cover and ring out the different heaters separately. Disconnect the wiring and test from the frame of the pot directly to the terminals on the heaters. If the heaters are grounded they will ring.

If each heater itself tests free of grounds and the pot is still grounded you must test each lead wire inside the pot separately. Metal splashed into the heat insulation surrounding the crucible will sometimes burn through the electrical insulation on these wires grounding the pot.

In disconnecting any wiring, be sure that it is properly marked so that it may be reconnected in exactly the same way. When fuses are replaced, care should be taken that they are of the same ampere rating as the ones removed. Fuses *A*-1, Diagram No. 1, are for 100-125 volt equipments, two 20 ampere and for 200-250 volt equipment, two 10 ampere.

Fuse *N*, Fig. 4, is in the mouth and throat heater circuit only, and if this fuse blows, it indicates a ground on this circuit. The heaters, their terminals, the rheostat or the lead wires may be grounded and must be located and replaced or repaired, by proceeding as in locating a ground in the crucible heater circuit. Fuse *N*, Fig. 4, for 100-125 volt equipment is 5 ampere rating and for 200-250 volt equipment is 3 ampere rating. Never use fuses above these ampere ratings.

Humming Switch

On alternating current the magnet switch always makes a slight humming noise but it is usually not objectionable. The working surfaces of these switches are ground flat and true to permit close fitting and should be kept clean.

If corrosion or dirt collects on these ground surfaces, they will not come into close contact when the switch closes and the humming noise will be increased. If this noise becomes objectionable insert a strip of fine sand paper between these working surfaces and holding the switch closed, pull the sand paper back and forth until the metal parts are clean.

Fluttering Switch

If the pot leg bushing or pot lever shaft are not properly fitted and the metal is slightly cold when the mouthpiece leaves the mold, the pot has a jerky action and if the brake *C*-3, Fig. 3, is not properly adjusted, the contact lever *C* may act like a pendulum and swing back and forth making and breaking contact with *L* or *H*, Fig. 3, each time the pot breaks away. Make sure that the insulated pin *Y*, Fig. 3, bears against both spring leaves, *C*-5 and *C*-6 and that these spring leaves touch contact lever *C* at their lower ends. Contact *E*-3, Fig. 4, should be kept clean. It maintains the circuit through magnet switch *E* after contacts *C* and *L* are released of carrying current and if it is not clean, the switch will not remain closed and will flutter in and out.

The small plunger and spring in the end of this contact post should be inspected and if the spring has set it should be renewed.

Testing Control Panel

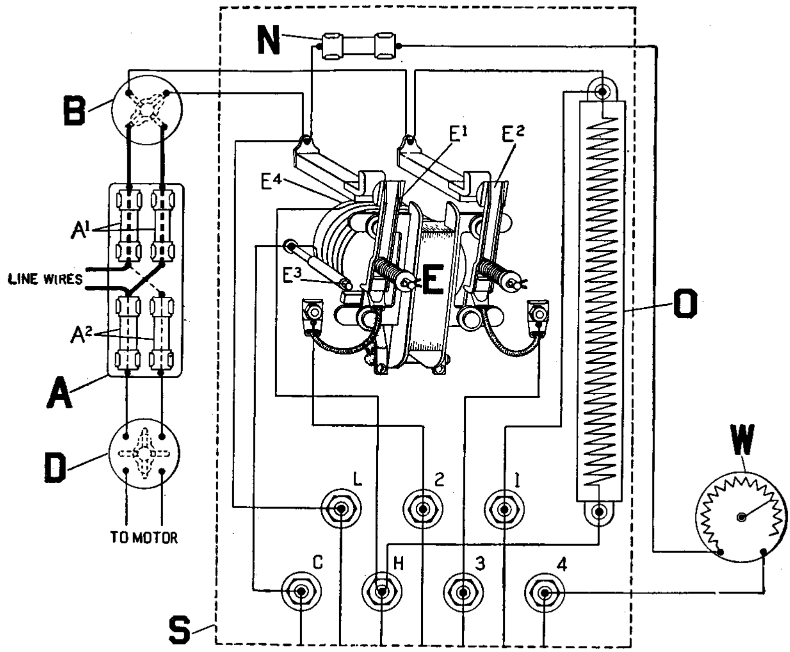
Fig. 6 is a diagram of the control panel only, showing the wiring and the electrical connections. The lines on this diagram represent the wiring on the back of the slate panel. The wires are here shown running straight and parallel or at right angles for clearness sake but the actual wires on the panel are usually run the shortest distance between connections.

In making a test for correct wiring and proper operation of a control panel a "lamp in series" testing outfit should be used as described and illustrated on Page 27 (Fig. 5).

Disconnect all outside wiring from the panel and turn switch *B* off. Test between terminal *H* and terminal *C*; if the lamp lights the magnet switch coil *E*-4 is in operating condition. See that this coil is correct for your current.

Test between terminal *H* and terminal No. 1; if the lamp lights the resistance coil *O* is in operating condition. Be sure that this resistance is correct for your current.

Test between terminal No. 4 and terminal *L* and if the lamp lights the rheostat *W* and fuse *N* are in operating condition. Be sure that this rheostat is marked for your proper voltage.



Control Panel Wiring, Fig. 6

The lamp should light between terminal No. 2 and the upper left hand contact on the magnet switch. Between terminal No. 3 and the lower right hand contact on magnet switch. Between terminal No. 4 and the lower left hand contact on magnet switch. Between terminal No. 1 and the upper right hand contact on magnet switch.

If you have available a circuit of the same voltage and frequency as marked on the control panel, connect to fuse block *A* in the ordinary way, be sure your fuses are O. K., close switch *B* and touch terminals *C* and *L*, with a piece of metal. The magnet switch should close and remain closed until you touch terminals *C* and *H* with a piece of metal, when it should drop open.

Replacements

Occasionally some of the parts that have been subjected to abuse or neglect such as the heaters, dynamic thermometer or wiring inside the pot must be replaced.

It is seldom that both crucible heaters will be burned out at the same time, so if your pot is a 100-125 volt equipment and one of the crucible heaters tests open or grounded, and must be removed and replaced, the metal in the crucible may be heated by the crucible heater that is in good condition. If the defective heater is grounded you must disconnect it from the circuit because if you do not it will continue to blow fuses.

If your equipment is 200-250 volt and one crucible heater burns out or otherwise becomes damaged, disconnect it from the circuit and then connect a line from a 110 volt lighting circuit to the remaining heater, or, after you have disconnected the defective heater, connect the new one (the one you intend using to replace the damaged one) in series with the one that tests correct. This new heater may be laid upon the floor, protected by sheet iron or asbestos, or any place where there is a free circulation of air.

No. 2 Crucible Heater

To Remove—Heat the metal to operating temperature and dip the molten metal out of the crucible until the tops of the heaters are exposed. Make sure that the current is turned off and remove the pot cover 7, Fig. 1, and the crucible heater clamp 20 which holds the heaters in place. Disconnect the wiring to the heater and with a screw driver and a pair of pliers the heater may be removed by carefully prying up with the screw driver and pulling up with the pliers. Immediately replace with a new heater before the metal cools.

To Replace—First warm the new heater somewhat with a torch or by other means, so that it will not cool the metal when placed in the crucible, then it may be forced into place by careful use of a piece of fibre or soft wood and a small mallet.

When in its proper place reconnect the wiring exactly as it was before and replace the crucible heater clamp. Replace the pot cover and cement around the mouthpiece.

No. 1 Crucible Heater

To Remove—The No. 1 crucible heater cannot be removed alone. The No. 2 crucible heater must be removed with it even if it is not defective. Proceed as in the case of the No. 2 crucible heater but pry out both heaters together.

To Replace—Proceed as in the case of the No. 2 crucible heater, replacing both heaters in the crucible at the same time.

Mouth Heater

To Remove—Turn switch *B,* Fig. 4, off—Refer to Fig. 1. Take off the pot cover 7. Remove the two nuts from the upper end of clamp bolt 10 and remove mouth heater clamping plate 9. Disconnect the wiring and lift out the heater.

Be careful that clamp bolt 10 is not pushed down out of its guides when the heater is removed.

To Replace—Place the new heater in position observing carefully that there is no insulating material or dirt between the heater and the crucible casting. It is important that all metallic surfaces be clean and free from dirt and that they come in close contact when clamped together. See that there is good contact between the edge of the heater and the rear of the mouthpiece. Replace the mouth heater clamping plate and tighten the two nuts on clamp bolt 10. After the pot cover is replaced the space around the front of the mouthpiece should be cemented up.

Throat Heater

To Remove—Turn switch *B,* Fig. 4, off. Refer to Fig. 1 and remove the throat heater terminal cover 11 and the asbestos cloth which protects the throat heater terminals 17 and disconnect the wiring. Take the cover off the pot and loosen (do not remove) the nuts on the upper end of clamp bolt 10. Loosen (do not remove) throat heater clamp screw 18 which is accessible from the front of the pot. Remove the insulating cement from the bottom of the mouthpiece and with a mallet tap the heater from the bottom and grasp it with a pair of pliers as it appears through the front of the pot. It may then easily be withdrawn.

To Replace—Carefully force the new heater into the space between the throat heater clamping plate 8 and the under side of the crucible throat taking care that no dirt is between the new heater and the crucible casting. Tighten the throat heater clamp screw 18 and the nuts on the clamp bolt 10. Reconnect the wiring and replace the asbestos cloth. Replace the pot cover and cement around the mouthpiece.

Dynamic Thermometer

To Remove—Heat the metal in the crucible to operating temperature and then turn switch *B*, Fig. 4, off. Disconnect the wiring and dip out the metal to below the level of the dynamic thermometer bulb *I*. Take off the pot cover and remove the two screws fastening the dynamic thermometer case to the bracket. Grasp the dynamic thermometer case with the hand and the bulb *I* with a pair of pliers and raise up and out. Replace the new dynamic thermometer while the crucible is still hot.

To Replace—Place the new dynamic thermometer in position with bulb *I*, laying on top of the throat casting, extending to the left of the well. See that the bulb does not project out from the casting so as to interfere with the insertion of ingots of cold metal. Press the tube firmly but carefully into place over the edge of the crucible being careful not to injure it. Fasten the case to the bracket and reconnect the wiring.

Wiring

To remove and replace a damaged wire in the pot fasten another wire securely to one end of it, grasp the other end with a pair of pliers and pull. The new wire will be pulled in as the old one is removed.

Note: Rubber covered wire or slow burning wire is not satisfactory. A special wire with a special grade of insulation should be used.

Text matter of this book set in Linotype 11 Point Franklin Old Style, captions in Linotype Caslon Old Face.

PRINTED IN U. S. A.

SIMPLIFIED
WIRING DIAGRAMS
FOR
LINOTYPE
ELECTRIC POT

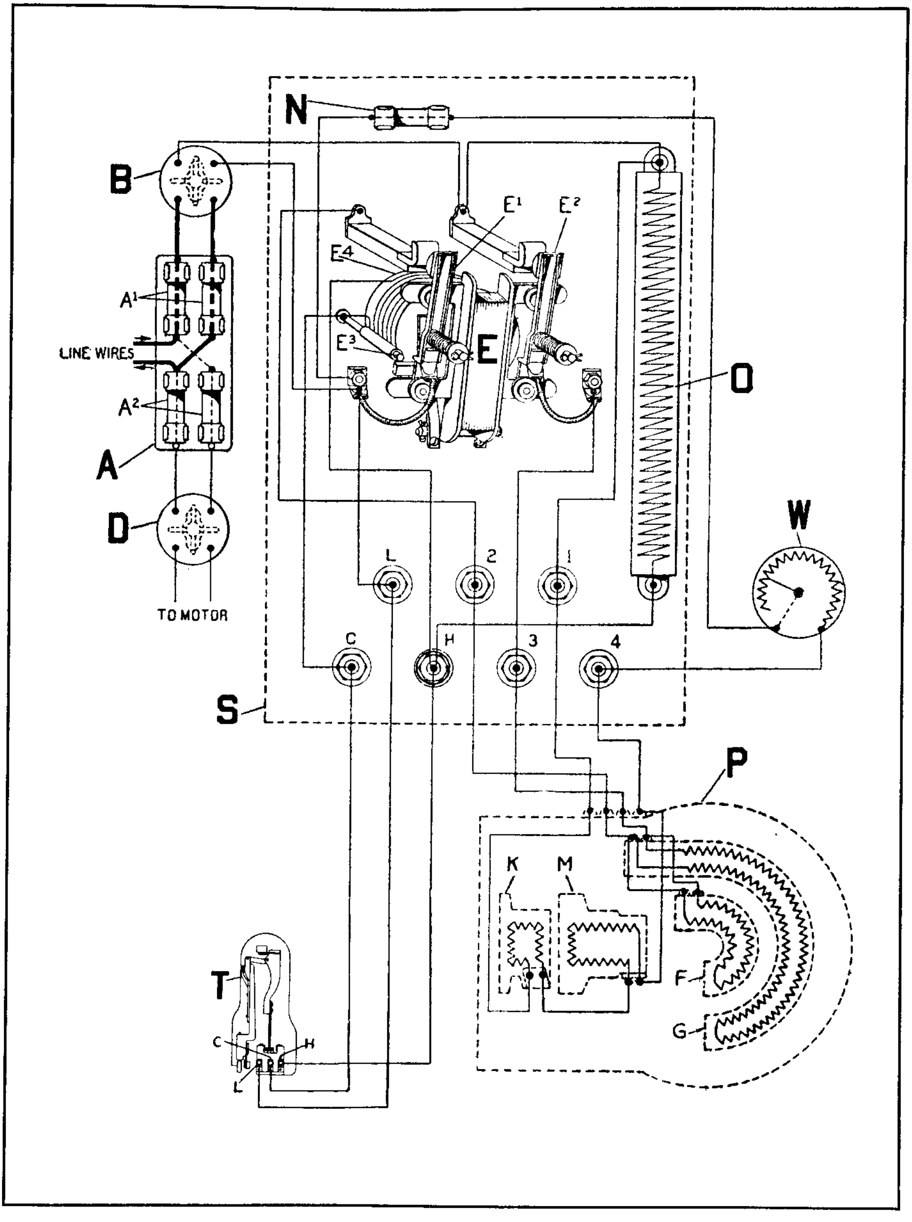


DIAGRAM No. 1

This diagram shows the electric connections of the pot with the pot control switch *B* turned to *off* position and the Linotype metal cold. Current cannot pass switch *B*, therefore the whole pot is dead. Note that the temperature control roller contact is now touching contacts *C* and *L*.

If switch *B* is turned to the *on* position, current will pass through the temperature control and magnet switch circuits, as shown in diagram No. 2.

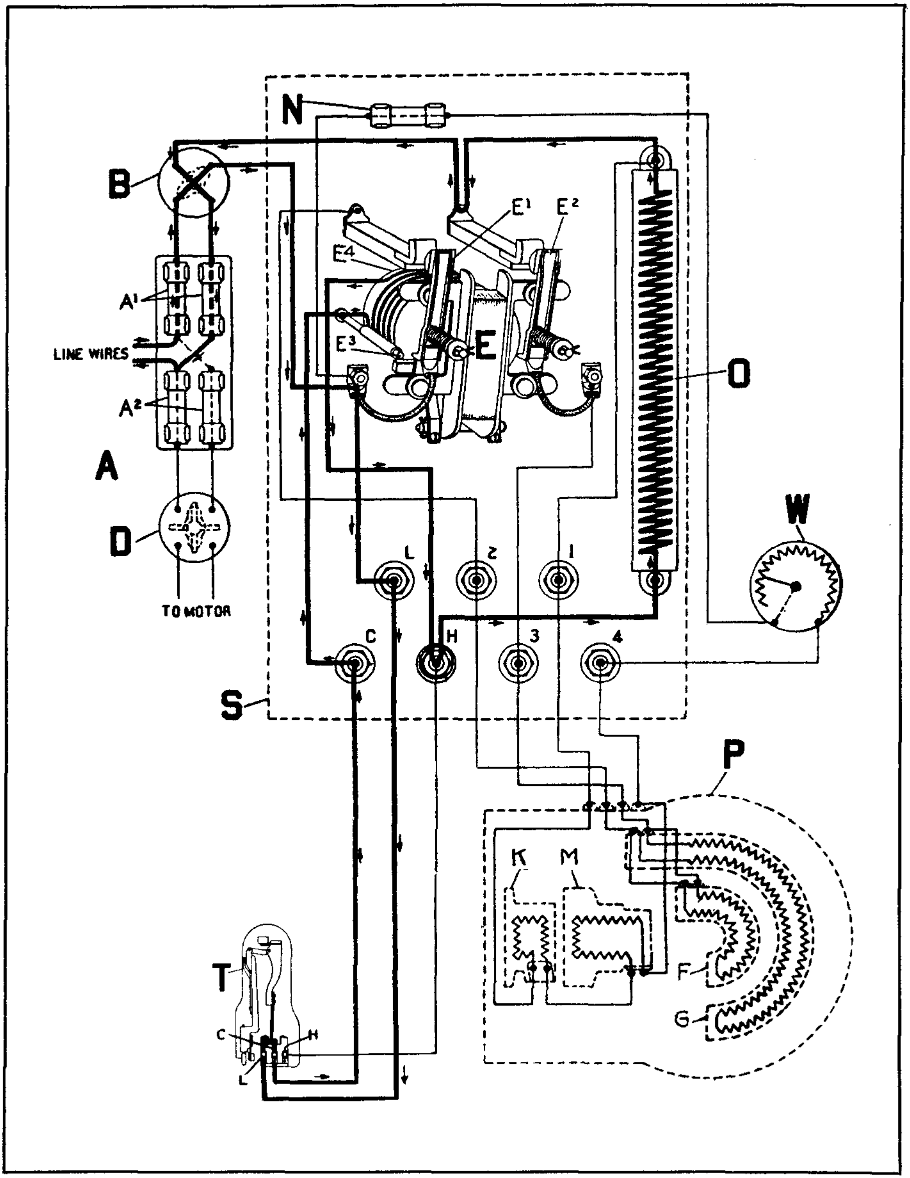


DIAGRAM No. 2

This diagram shows switch *B* turned to the *on* position. Current immediately flows from the line through switch *B* to terminal *L* on the panel and then to temperature control contacts *L* and *C* and back to terminal *C* on the panel, then through magnet switch coil *E*-4 to terminal *H* on the panel. Current then passes through the resistance coil *O*, and then directly back to the opposite side of the line through switch *B*.

As soon as the circuit is complete, as above, the magnet switch *E* immediately closes, connecting the crucible heaters *F* and *G* to the line and also making a contact at *E*-3 as shown on diagram No. 3.

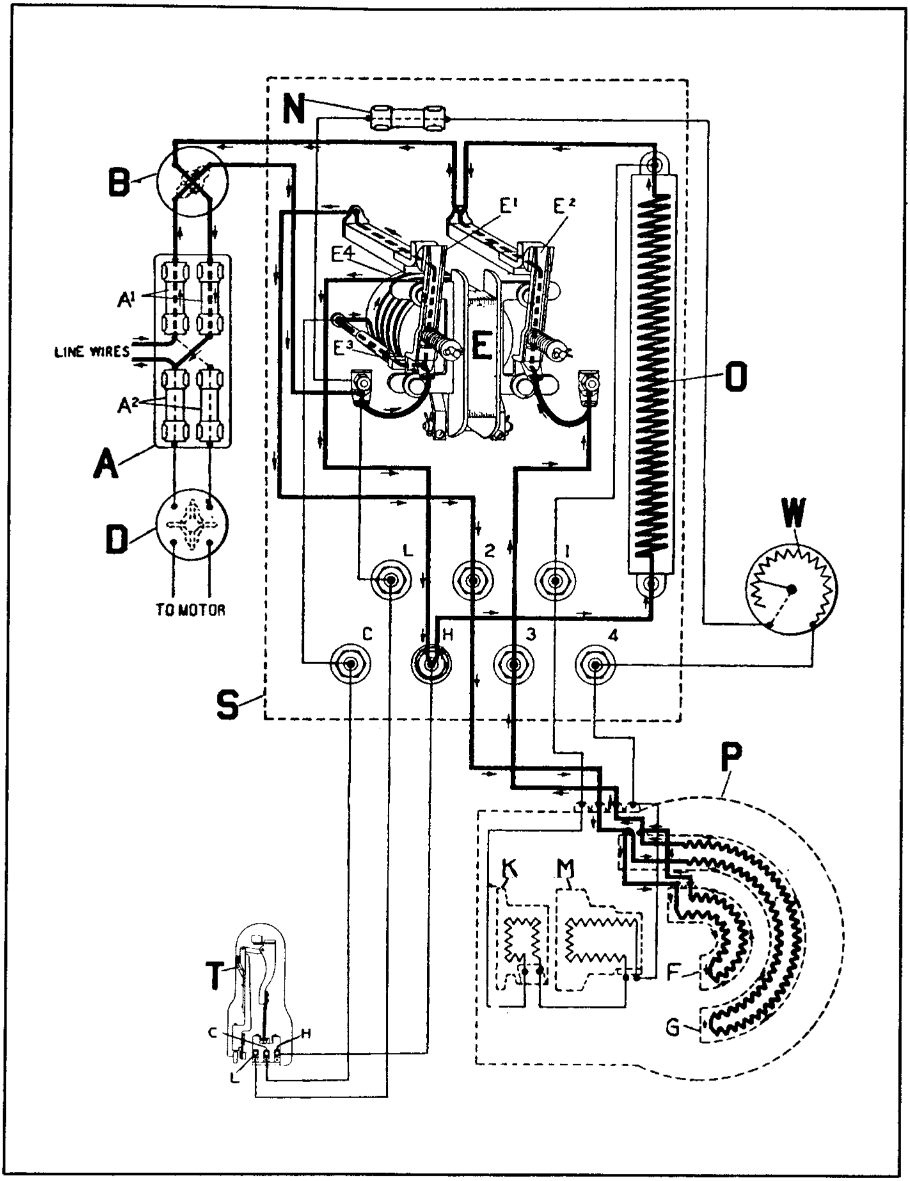


DIAGRAM No. 3

When magnet switch *E* closes, the contact that is made at *E*-3 short circuits the temperature control circuit and relieves it of carrying current. A circuit is still maintained through coil *E*-4 by contact *E*-3, which holds the magnet switch *E* closed.

The crucible heaters *F* and *G* are now connected to the circuit and will begin to heat the metal. When the temperature of the metal rises to about 550° F., the temperature control roller contact will leave contact *L*, pass over contact *C* and make a circuit between contacts *C* and *H*, and the circuit will be as in diagram No. 4.

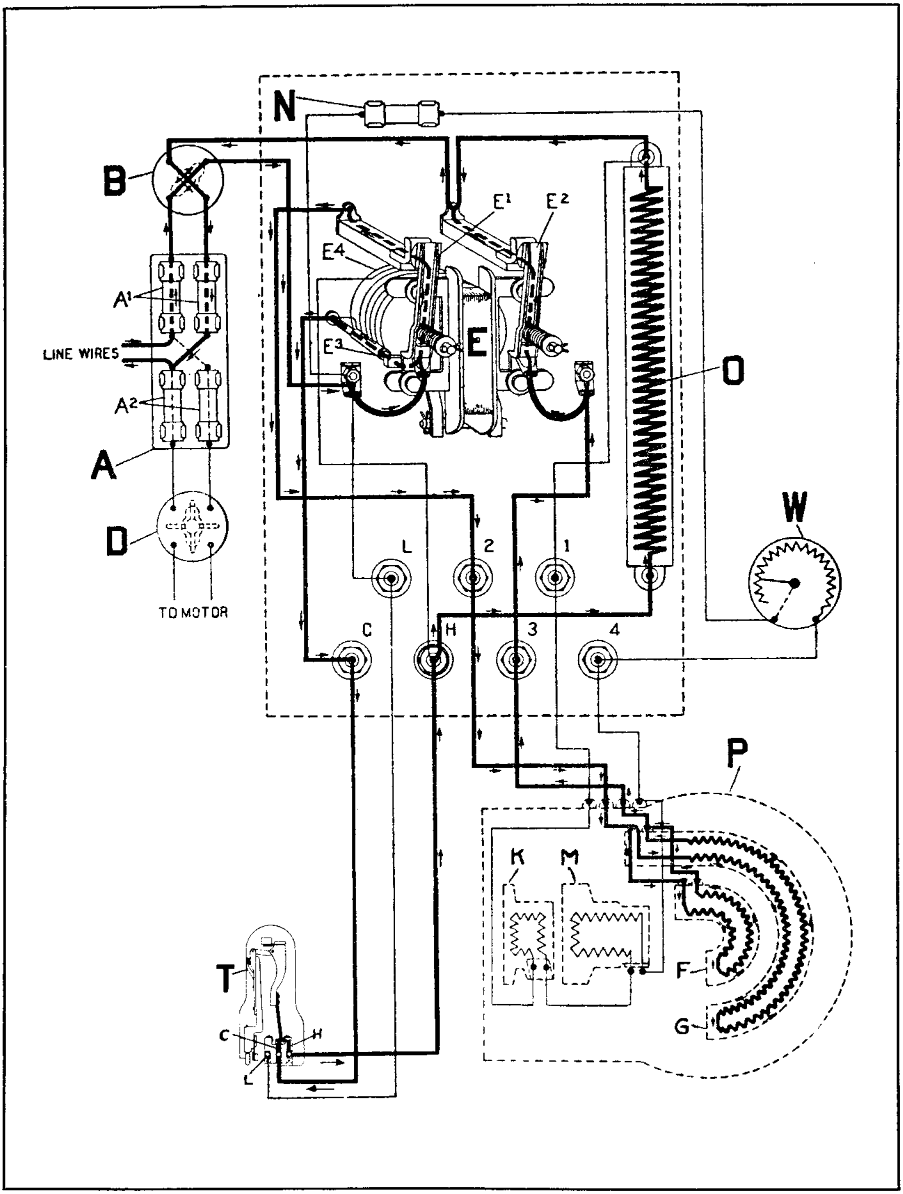


DIAGRAM No. 4

This diagram shows the current when the temperature of the metal has just reached 550° F. Note that the temperature control roller contact is touching contacts *C* and *H*, which short circuits magnet switch coil *E*-4. No current will pass through the magnet switch coil, because the path of least resistance is through the thermostat contacts. The magnet switch *E* immediately opens, disconnecting the crucible heaters *F* and *G* from the line and also interrupting the temperature control circuit as shown in diagram No. 5.

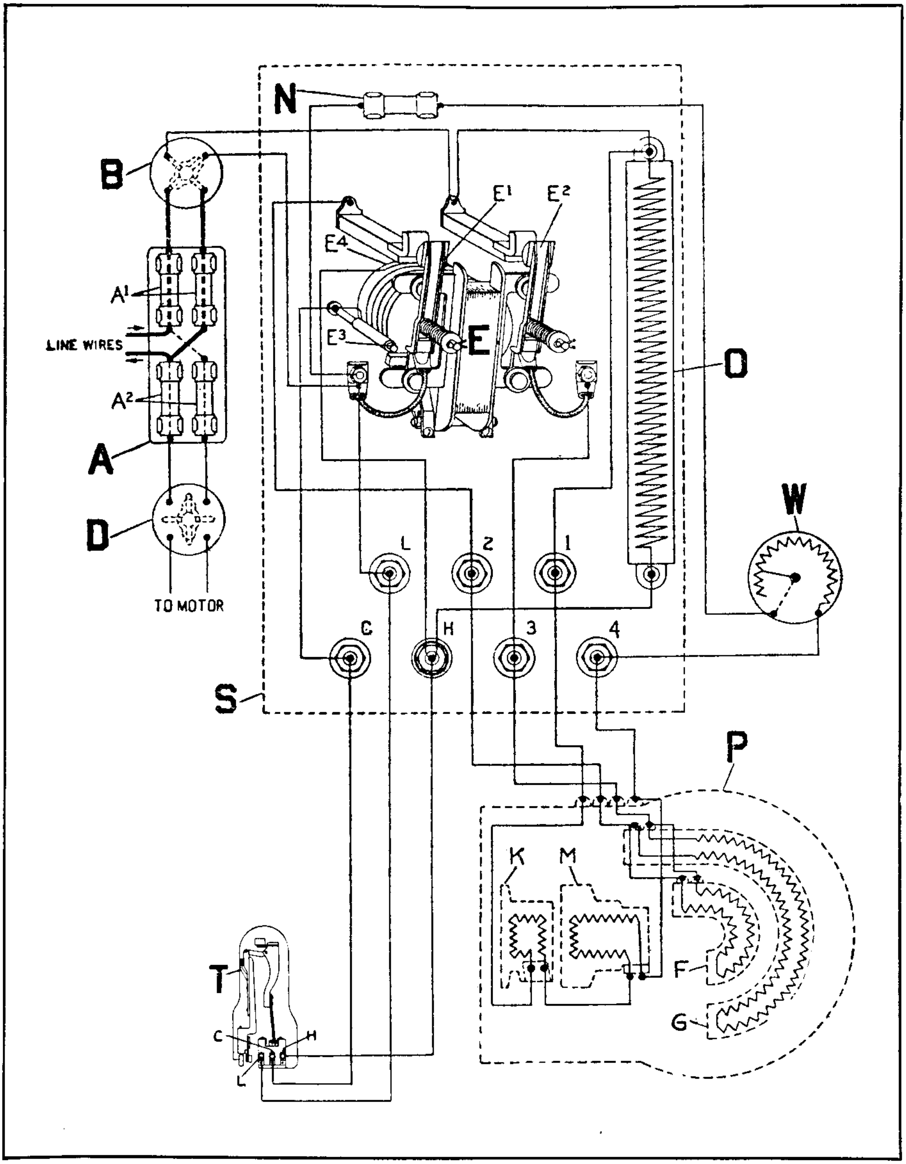


DIAGRAM No. 5

When magnet switch *E* opens, it disconnects the crucible heaters *F* and *G* from the circuit and the metal begins to cool. This diagram is like Diagram No. 1 except that switch *B* is shown in the *on* position and the temperature control roller contact is touching contacts *C* and *H* instead of contacts *C* and *L*.

When the temperature of the metal has fallen to about 535° F. the temperature control roller contact will leave contact *H*, pass over contact *C* and make a circuit between contacts *C* and *L*, which again completes the circuit as shown on diagram No. 2.

This cycle is repeated as long as equipment is in operation.

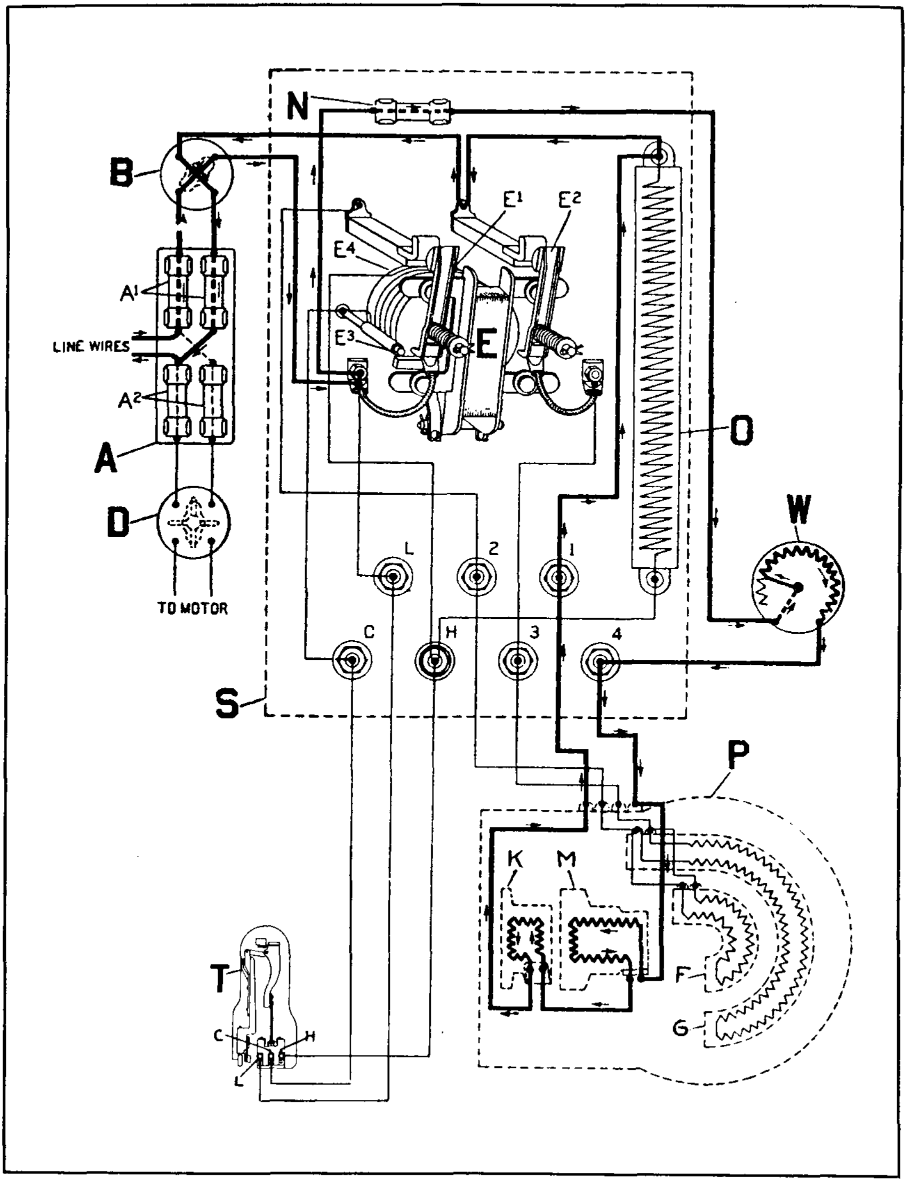


DIAGRAM No. 6

Diagram No. 6 explains the mouth and throat heater circuit only. Note that this circuit does not pass through the magnet switch *E*, and, therefore, the heating of the mouth and throat of the pot is not controlled by the action of the temperature control *T* or the position of magnet switch *E*. The heat in this circuit is controlled by manually adjusting the rheostat *W* which is placed on the outside of the control panel cabinet.

Turning rheostat knob right handed increases the heat at the mouth and turning it left handed will diminish the heat.

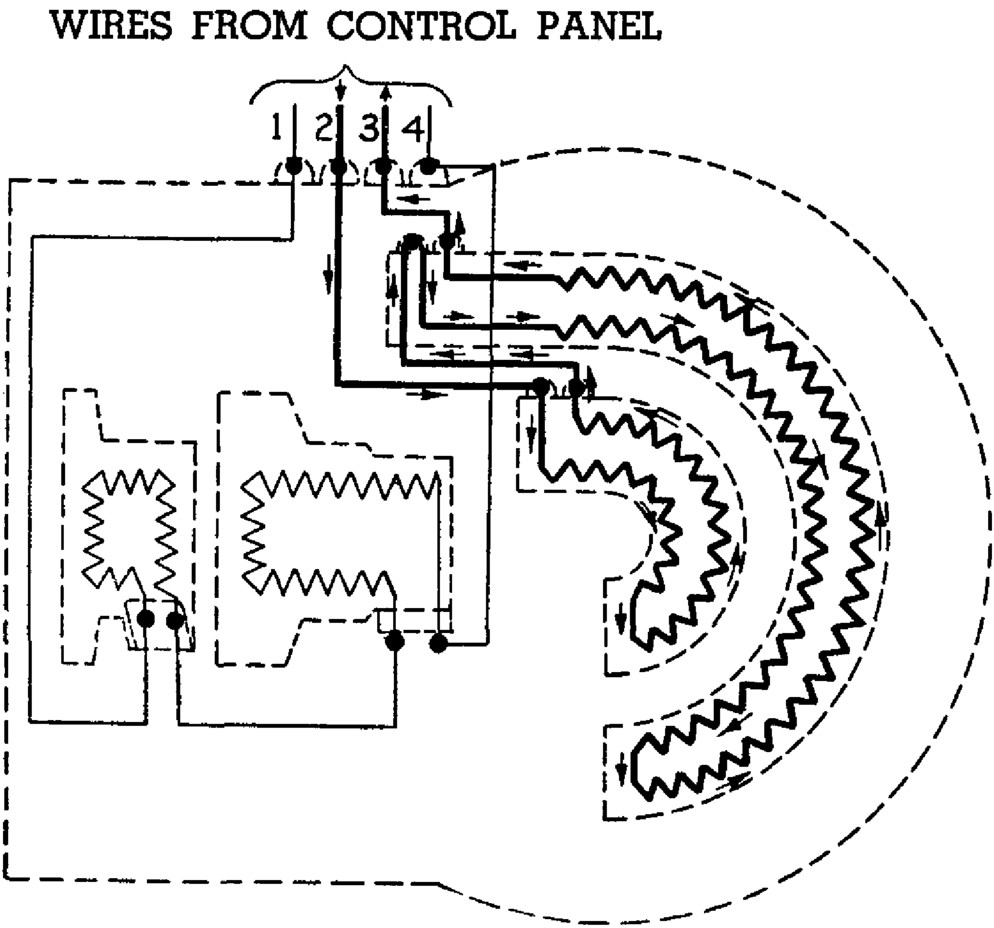


DIAGRAM No. 7

Diagram No. 7 shows the crucible heaters as connected in a 200-260 volt pot. The heaters are in *series*. Following the arrows shows the current entering at terminal *No. 2*, passing through one heater and directly into the other heater, through that heater and back to the line through terminal *No. 3*.

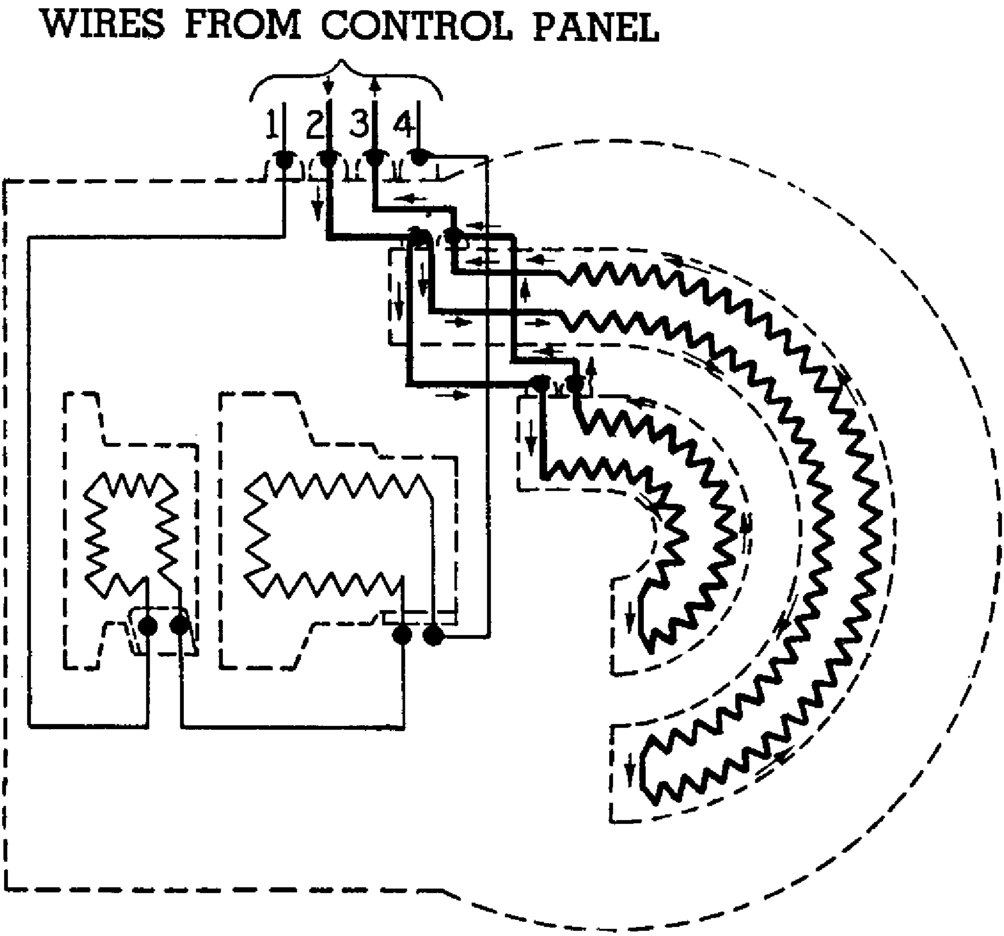


DIAGRAM No. 8

Diagram No. 8 shows the crucible heaters wired as in the 100-130 volt pot. The heaters are in *parallel*. Following the arrows, you find that the current enters terminal *No. 2*, flows through each heater separately and then back to the line through terminal *No. 3*.