INSTRUCTION BOOK

CUTLER-HAMMER ELECTRIC LINOTYPE POT

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

INSTRUCTION BOOK

FOR THE INSTALLATION, OPERATION, AND MAINTENANCE OF THE

CUTLER-HAMMER ELECTRIC LINOTYPE POT

FOR USE WITH LINOTYPE MACHINES

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

AUGUST, 1923

MERGENTHALER LINOTYPE COMPANY

29 RYERSON STREET, BROOKLYN, N. Y.

SAN FRANCISCO CHICAGO NEW ORLEANS

Canadian Linotype Limited, Toronto

Cutler-Hammer
Electric Linotype Pot

Contents

Preface

The Cutler-Hammer Electric Linotype Pot was developed under the direction of and sold exclusively by the Mergenthaler Linotype Company. Several thousand equipments are in successful operation in nearly every part of the world, and many have been in continuous use for more than eight years.

These instructions are issued to enable our customers to obtain continued successful service from their equipments.

Repair parts for these equipments are sold exclusively by us, and are carried in stock at our several agencies. *Always give serial number when ordering parts.*

Recently we have developed the Linotype Electric Pot. It is built in our own factory, and differs from the Cutler-Hammer equipment only in its more convenient control and in various details of construction which eliminate the liability of grounding.

We still use the rugged, efficient *immersion* type heaters manufactured by the Cutler-Hammer Company, the sensitive but permanently adjusted dynamic thermometer, and the various other refinements that have for years made the electric pot equipment sold for Linotypes the best obtainable.

MERGENTHALER LINOTYPE COMPANY

The Cutler-Hammer Electric Linotype Pot

General Description

Sectional View

The electric pot P is shown in Fig. 1, page 8, in both a perspective sectional and a cross sectional view so that you may familiarize yourself with the disposition of the component parts.

The two terminal crucible heater F and the three terminal crucible heater M are inside the crucible 12 where they partially 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 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.

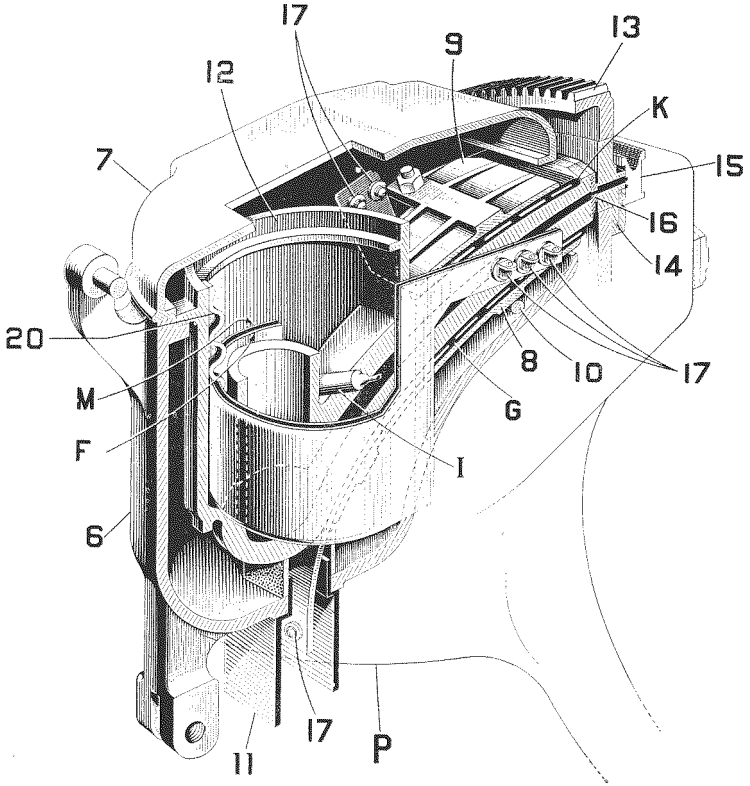
19 represents a quantity of effective heat insulating material entirely filling the large space between the pot jacket 6 and the crucible 12.

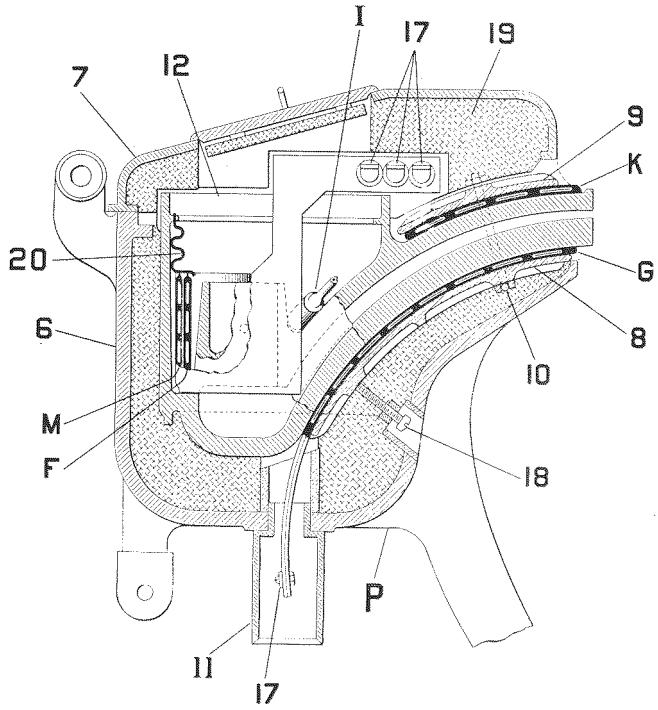
The pot cover 7 may be removed by removing four screws.

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.

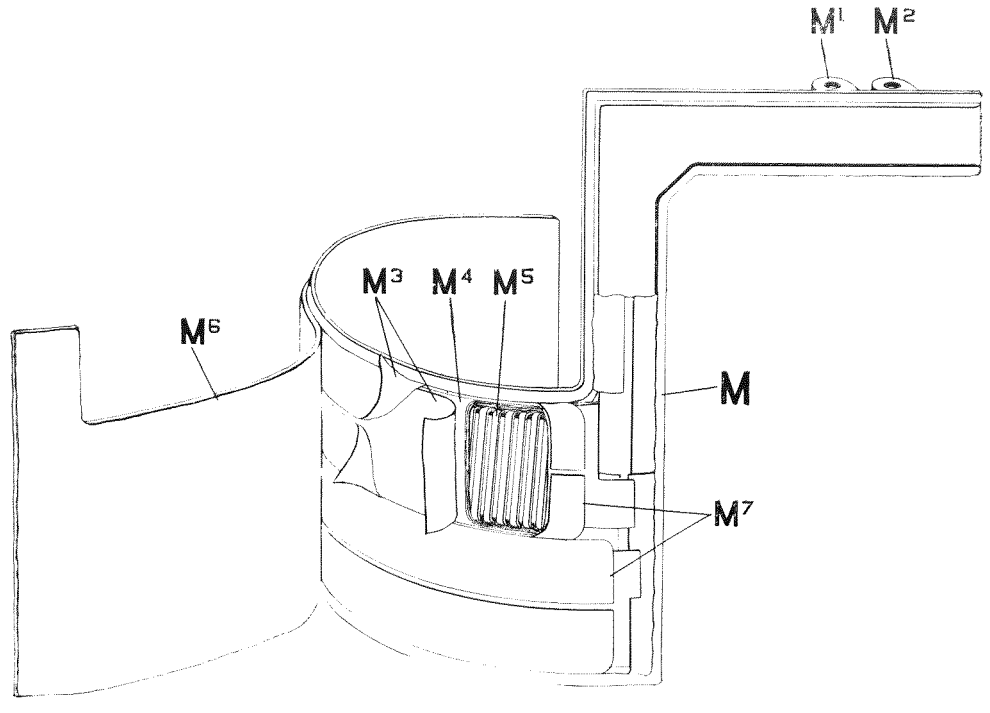
20 is a clamp for holding the two terminal crucible heater and the three terminal crucible heater in place.





Sectional View, Fig. 1

F—Two terminal crucible heater.
G—Throat heater.
I—Dynamic thermometer.
K—Mouth heater.
M—Three terminal 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.



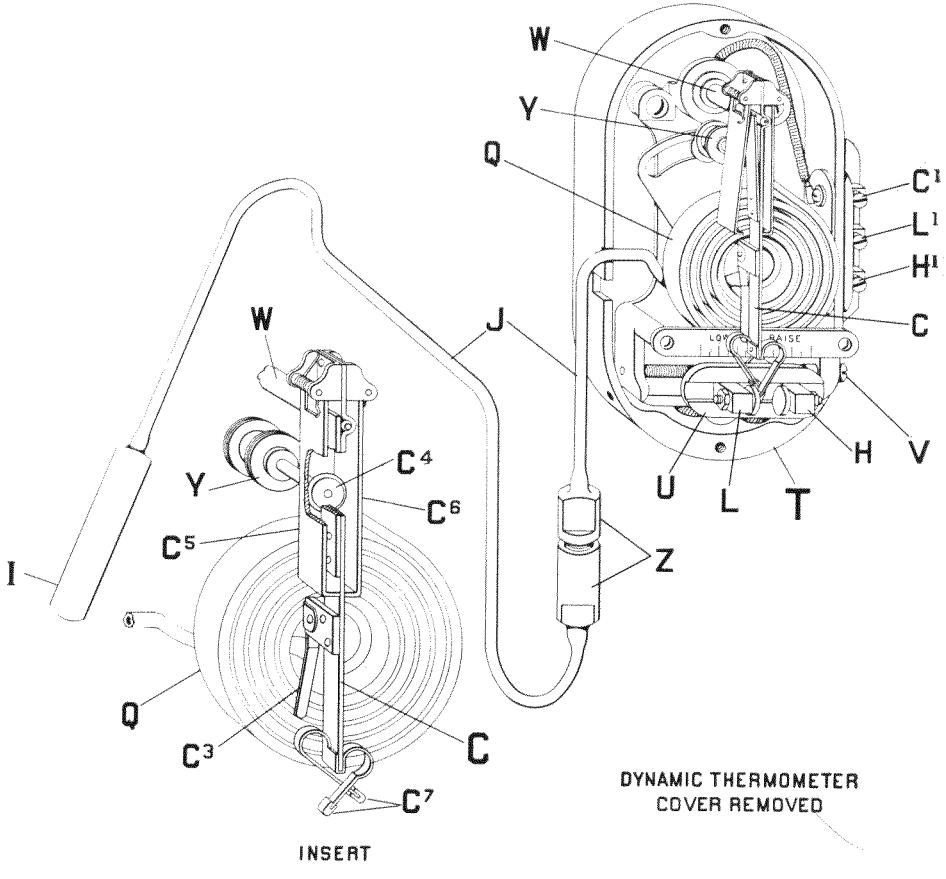
Heating Units, Fig. 2

M-1 } Electric terminals.
M-2 }
M-3—Sheet metal, protecting the resistor.
M —No. 2 crucible heater.
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.

The Heaters

There are four heaters in each pot. A three terminal crucible heater, a two terminal crucible heater, a mouth heater and a throat heater. The three terminal crucible heater and the two terminal crucible heater are immersed in the type metal and closely surround the pump-well, where they are in the correct position to heat the metal that is actually being used. The three terminal crucible heater has two resistor windings or circuits instead of one as in the two terminal crucible heater. One is the heating circuit, similar to the one in the two terminal crucible heater and the other circuit is used as an added resistance in the mouth and throat heater circuit when snap switch D, Fig. 4, is on low.



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 } Spring leaves.
C-6 }
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.
Y —Insulated pin.
Z —Tube coupling.

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 back squirts 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 pot.

An examination of wiring diagram No. 1 will show that the heating elements of the two and three terminal crucible heaters are connected in parallel, that is, each is a distinct circuit of itself and if one should burn out the other will continue to heat the metal but at a slower rate. The same diagram will also show that the mouth heater and throat heater are connected in series, that is, current passes from the line through one heater and then through the other heater and back to the line. If either the mouth heater or throat heater is burned out current cannot pass through any part of this circuit and no heat will be produced at the mouthpiece.

The Dynamic Thermometer

The dynamic thermometer, Fig. 3, automatically controls the heating of the type metal in the crucible, maintaining it at all times 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 Q 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 coiled spring tube Q 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 coiled spring tube Q expands or contracts. The bulb I is immersed in the type metal near the pump-well and as the temperature of the metal rises the mercury in bulb I expands causing coiled spring tube Q to unwind driving the contact lever C toward contact H. Contact H is located in such a position that contact lever C will touch it when the temperature of the metal has reached about 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 bulb I contracts allowing the coiled spring tube Q to wind up slightly and resume its former position driving contact lever C toward contact L. Contact L is so located that contact lever C will touch it when the temperature of the metal falls to 535° F.

Now follow wiring diagram No. 2 and note that when contact lever C touches contact 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 glass rod thermometer should always be used when adjusting screw V Fig. 3 for proper heat. You cannot get best results by guessing at the heat of the 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 first touches 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.

The dynamic thermometer does not control the mouth and throat heaters. Their heat is regulated by turning the switch D mounted on the side of the control panel cabinet shown in Fig. 4.

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 heating units burned out, or the dynamic thermometer permanently injured. On the other hand when the metal has cooled to 535° F., and contact lever C touches contact L if owing to dirt or corrosion no electric contact is made, magnet switch E, Fig. 4, will not close and the metal will continue to cool until it cannot be used.

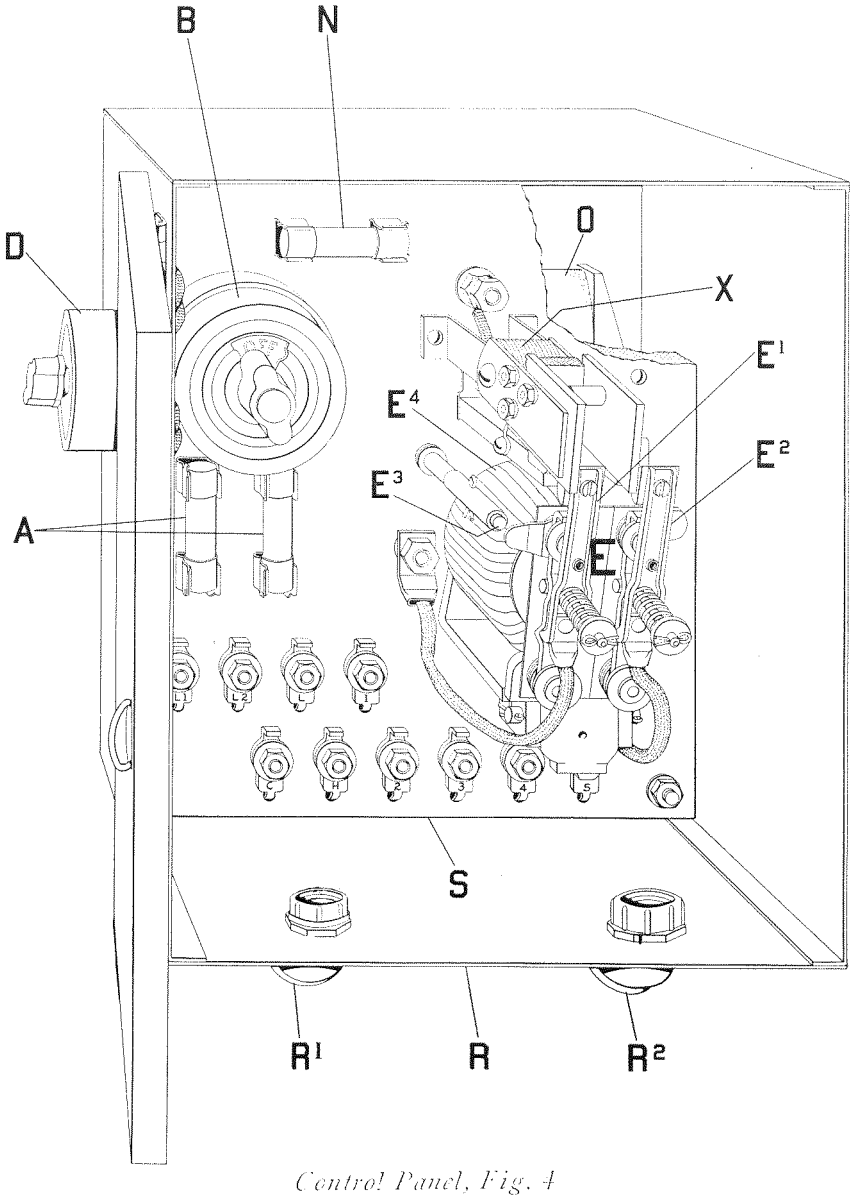
Care should be taken that the small tube J is not injured when dropping in an ingot of metal or that no sharp bends be made in it. The hole in this tube connecting the bulb I to the flattened coiled spring Q is very small and sharply bending the tube or flattening it will close this hole and interfere 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.

Insert Fig. 3, page 10, 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 and 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 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.

This dynamic thermometer was adopted only after long trial and is superior to any type of heat control made for these temperatures. It will give uninterrupted service without attention unless some accident happens to the pot itself. The failure of the dynamic thermometer is usually caused by a "grounded" pot.

Before replacing a dynamic thermometer be sure to test the pot for grounds.



Control Panel, Fig. 4

A —Main line fuses.
B —Main line snap-switch.
D —Three heat switch for mouth and throat circuit.
E —Magnet switch.
E-1—Pole of magnet switch controlling crucible heaters.
E-2—Pole of magnet switch controlling mouth and throat heater resistance.
E-3—Maintaining contact.
E-4—Magnet switch coil.
N —Mouth and throat heater circuit fuse.
O —Resistance coil.
R —Sheet metal cabinet.
R-1—Pipe connection to line.
R-2—Cable connection to pot.
S —Slate panel.
X —Magnetic blow out coil.

is made at E-3 which short circuits the dynamic thermometer contacts C and L as in diagram No. 3 and the current flows through E-3 instead.

The purpose of this maintaining contact E-3 is to prevent the dynamic thermometer contacts carrying current while the magnet switch is closed and also to prevent these contacts arcing when they leave each other as the metal cools.

Snap switch D mounted on the outside of the cabinet controls the mouth and throat heater circuit. This switch is of the three heat type and can be turned to high, medium and low or off position. It is used to compensate for a fluctuation of voltage or different output and is usually operated on medium.

If snap switch D is turned to high position, the mouth and throat heaters will receive the full line current and produce maximum heat. Closely follow diagram No. 6 to clearly see this connection.

If snap switch D is turned to medium with magnet switch E open, diagram No. 7 shows that the three terminal crucible heater resistance circuit F-1 diagram No. 7 is also in the mouth and throat heater circuit and the heating effect will be reduced but if the magnet switch E is closed diagram No. 8 shows that the mouth and throat heaters are receiving full line current and will produce maximum heat.

When switch D is turned to low position diagram No. 9 will show that the three terminal crucible heater resistance F-1 is in the mouth and throat heater circuit. This added resistance will prevent maximum current passing and reduce the heat effect.

Turning the switch D to the off position prevents any current from flowing through mouth and throat heater circuits and no heat will be produced.

Terminals L-1 and L-2 are for connection to the outside circuit. Terminals C-1, L-1 and H-1 are for the dynamic thermometer circuit and the other five terminals are for connecting to the same numbered terminals on the pot.

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

Wiring Diagrams

A wiring diagram will be found on the inside of the control panel cabinet cover but for those of our customers who are not familiar with electrical diagrams, the sheet of simplified diagrams inserted between pages 16 and 17 is offered.

The heavy lines show circuits carrying current. Arrows are used to assist in following the circuits.

Direct current magnet switches are fitted with magnetic blow-out coils (See X Fig. 4) but in order not to complicate our diagrams the coils are not shown on them.

This equipment 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 three heat switch on the outside of the control panel.

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

Operation

When the 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 if ingots are used 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 metal is placed in contact with the units, turn the current on by turning the snap switch B on the control panel Fig. 4 to the on position and the three heat switch D on the outside of the control panel cabinet to the high 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 temper-

ature 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 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 generating heat about three minutes then off and not generating heat about twelve minutes and 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 contact discs 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 switch D Fig. 4 which is in the mouth and throat heater circuit, adjusted to low, high or medium to compensate for irregular voltage or for widely different output, little 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 backs. In this case, it will be necessary to turn switch D on the outside of control panel to low position 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 switch D should be turned to high position.

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 and the tip of the contact lever 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 this 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 heat 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 that is exposed to the air will get very hot and continued exposure will burn them out, destroying them.

Troubles—Testing

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.

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 costing only a few dollars may be borrowed from your local power house, when the size of your installation does not warrant the purchase of one.

Before testing with a magneto, the two bare tips of the lead wires should be held together while the crank is briskly turned 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 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. 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. 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 glows it indicates that the units are not open.

When making the above tests 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 are intact. Test the line to make sure you have current up to fuses A. 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 refuses to 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 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 lowmetal in the crucible, exposing the crucible heater 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

One of the crucible heaters may be open, the other one in good condition. One heater will melt the metal in sufficient quantities to operate at ordinary speed 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. If the dynamic thermometer disconnects the heating units from the line before the temperature of the metal has reached about 535° F., it will require a longer time for metal to reach operating temperature. If the crucible heaters are 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 will require about 20 per cent longer 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 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 holding 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 briskly turned. 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 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 and 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, or the new one will also be injured. If the contact lever C or contact H becomes dirty or corroded no current can pass through them when they touch each other, because dirt and corrosion act as an electric insulator. The metal 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 three heat switch D Fig. 4 located on the outside of the control panel 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. 5. If one is open, current cannot pass through either one. 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 and throat heaters 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.

Mouthpiece Gets Too Hot or Too Cold

Switch D Fig. 4 located on the outside of the control panel cabinet is intended to control the mouth and throat heater circuit, compensating for irregular voltage or differing output. Ordinarily this switch is turned to the medium position, but if the voltage is high or a fast operator casts large slugs continuously, it may be necessary to turn switch D to low position and if the voltage remains low or small slugs are cast slowly the switch may have to be turned to high position.

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.

If the mouthpiece gets too hot when switch D is on high and gets too cold when this switch is turned to low or the temperature seems to vary greatly when on medium, it indicates that the three terminal crucible heater resistance F-1 wiring diagram No. 6 is burned out. You will see by this diagram that this resistance is in series with the mouth and throat heaters when switch D is turned to medium and the magnet switch E Fig. 4 is open.

If this resistance is open you can see that the current cannot pass through the mouth and throat heater circuit and it will not heat as long as magnet switch E remains open. When magnet switch E closes, due to the decrease in heat of the crucible metal, diagram No. 7 shows you that the current does not flow through this resistance but through the mouth and throat heaters direct, therefore, if the three terminal heater resistance is burned out or open the mouthpiece will get too hot when the switch D is turned to medium and the magnet switch E is closed and will get cold when magnet switch E is open. If switch D, Fig. 4. is turned to high, diagram No. 6 will show you that the mouth and throat heater circuit receives current direct from the line even if this three terminal crucible heater resistance F-1 is open and the mouthpiece may get too hot. Diagram No. 9 will show you that if switch D is turned to low and the three terminal crucible heater circuit resistance F-1 is burned out no current at all can get to the mouth and throat heater circuit and the mouthpiece will get too cold. If this three ter-

minal crucible heater resistance F-1 is burned out or open the entire three terminal crucible heater must be removed and replaced.

The Fuses Blow—Grounding

If fuses A Fig. 4 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. When fuses blow, always clear up the ground before inserting new fuses.

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

Operating the pot with the metal above the ring cast 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. These splashes may ground the crucible heater terminals or mouth heater terminals by a direct splash or may follow the pot crucible down and ground the throat heater terminals which are located at the bottom of the pot.

Operating the pot with the metal above the ring cast on the inside of the crucible, will cause the mouthpiece to drip 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 follow it down and ground the terminals.

The steel 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 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 leading to the control panel L-1 and L-2 Fig. 4.

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 insulation) and the other magneto lead wire to each of the wire terminals in succession. If the magneto does not ring, when the crank is briskly turned 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, Fig. 4, 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 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 120-125 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

An alternating current magnet switch always makes a humming noise but it usually is 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 bushings 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 relieved of carrying current and if it is not clean, the switch will not remain closed and will flutter in and out.

Testing Control Panel

The lines shown on the diagram, Fig. 5, page 27, represent the wires on the back of the control panel. The electric circuit and the connections may be easily traced by following these lines. You see the lines here running straight and parallel or at right angles but the actual wiring on the panel is usually run the shortest distance or the most convenient way.

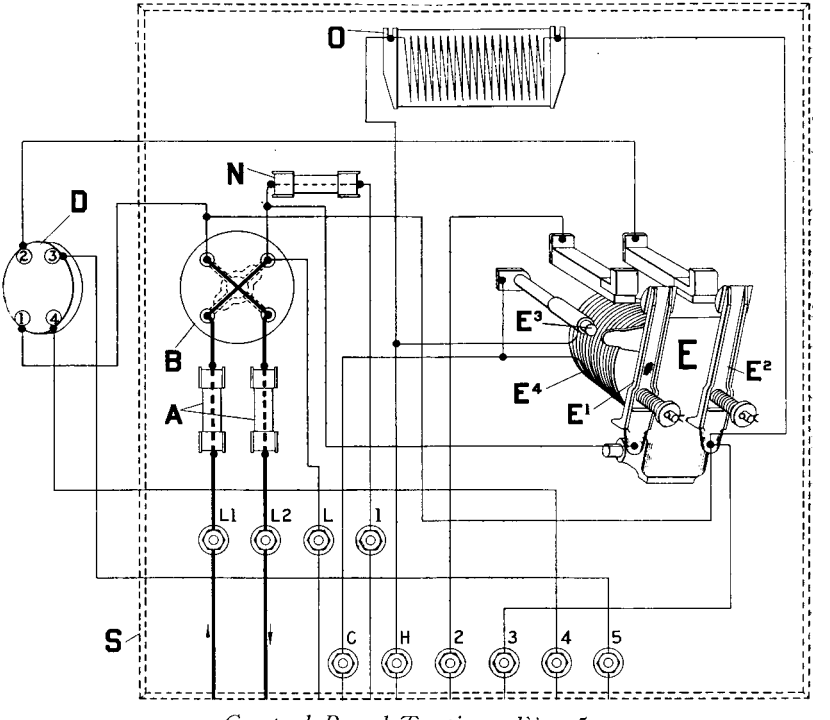
A control panel may be tested to determine its operating condition by using a "lamp in series" as follows: Turn switch B to on position and remove its cover. If lamp lights between terminals L-1 and the upper right hand contact on switch B; between terminal L-2 and the upper left hand contact on switch B and from terminal L-1 to terminal No. 1 it shows that switch B, all fuses and wires leading to them are correct.

If the lamp lights between terminal H and terminal C, the magnet switch coil E-4 is correct. Between terminal L-2 and terminal H, the resistance coil O is correct. Between terminal C and terminal L-2, the magnet switch coil E-4 and the resistance coil O is correct.

The following four tests will show that the three heat switch D is properly connected. Remove the cover of this switch and if the lamp lights between No. 1 contact on switch D and terminal L-2 on panel; between contact No. 2 on switch D and the top contact of the right hand pole of magnet switch E; between No. 3 contact on switch D and terminal No. 5 and between No. 4 contact on switch D and terminal No. 4, switch D is properly connected.

The lamp should light between No. 2 terminal and top contact of the left hand pole of magnet switch E; between No. 3 terminal and L-2 terminal and between terminal C and auxiliary maintaining contact marked E-3 on the diagram.

If the control panel being tested is on a Linotype, the line wires and also the wires leading to the pot should be disconnected from their terminals.



Control Panel Testing, Fig. 5

If you have available a circuit of the same voltage and frequency as marked on the control panel, connect up to terminals L-1 and L-2. If switch B is in on position and you touch both terminals C and L with a piece of metal the magnet switch will close and remain closed until you touch both terminals L and H with the same piece of metal when the magnet switch will 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 that when one of these heaters tests open or grounded and must be removed and replaced, the metal in the crucible may be heated by the heater that is in good condition.

Two Terminal Crucible Heater

To remove—Refer to Fig. 1. Heat the metal to operating temperature with the three terminal crucible heater F. Turn switch B Fig. 4 off, dip the metal out of the crucible until the top of the heater is exposed, remove the pot cover 7 and the crucible heater clamp 20 which holds the heaters in place, then 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.

Three Terminal Crucible Heater

To remove—The three terminal crucible heater cannot be removed alone. The two terminal crucible heater must be removed with it even if it is not defective. Proceed as in the case of the two terminal crucible heater but pry out both heaters together.

To replace—Proceed as in the case of the two terminal heater replacing both heaters in the crucible at the same time.

Both Crucible Heaters

To remove—It very rarely occurs that both crucible heaters are defective at the same time but if they both must be replaced, the metal must be melted with a blow torch or by other means. Then proceed in the same way to remove and replace as described under the Three Terminal Crucible Heater.

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 the 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. 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.

Instructions for Attaching Rheostat Control to Cutler-Hammer Electric Linotype Pot

The mouth and throat heater circuit of the Cutler-Hammer Electric Linotype Pot is controlled by manually adjusting a "three heat" snap switch which is located on the outside of the control panel box.

It is sometimes desirable or necessary to use a rheostat instead of this "three heat" switch in order to secure a greater range of heat regulation or to compensate for abnormal voltage fluctuations.

You can secure a suitable rheostat and have your electrician or machinist install it. No expert advice is necessary. Simply be guided by the following instructions:

The first section of the diagram shows the equipment as originally wired. It is the regular diagram found on the inside of the panel box, with the addition of the letter "A," denoting the "three heat" switch, and the letters "B," "C," "D" and "E," denoting the four wires leading from the panel board to the switch. Two of these wires, "B" and "C" will not be used with the rheostat control, and are shown crossed out.

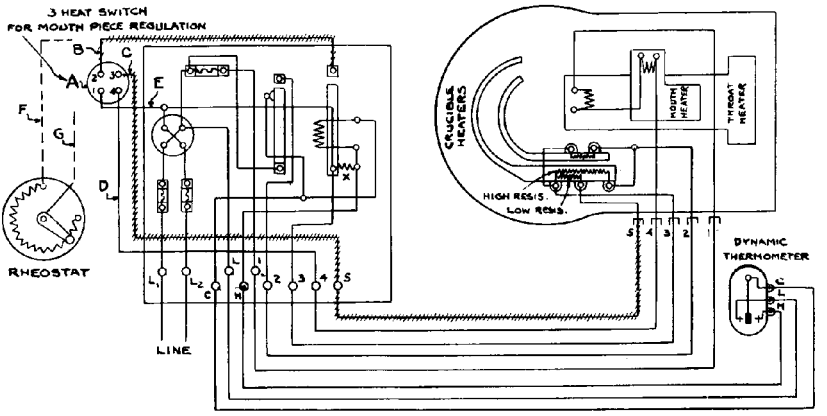
Wire "B" runs from No. 2 terminal on the "three heat" switch to the top terminal of the magnet switch. Wire "C" runs from No. 3 terminal on the "three heat" switch to No. 5 terminal on the control panel and then to No. 5 terminal on the pot.

Two additional wires "F" and "G" are necessary to connect the rheostat and are shown by dotted lines.

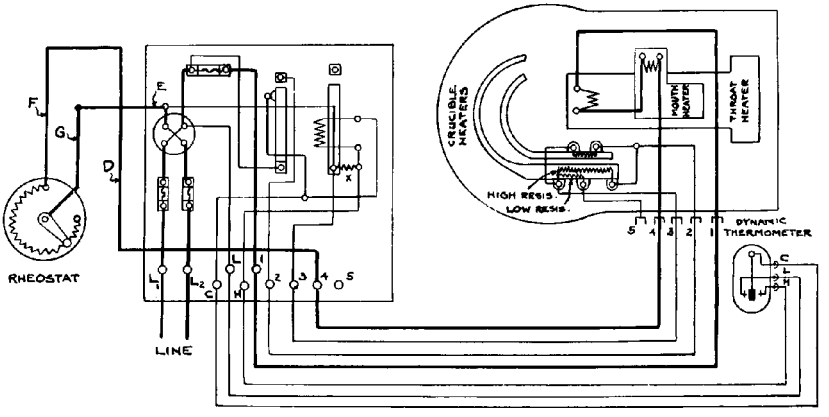
The second section of the diagram shows the equipment as it should be wired for rheostat control.

Remove wires "B" and "C" entirely, or disconnect them at both ends and tape them out of the way.

INSTRUCTIONS
FOR ATTACHING
RHEOSTAT CONTROL TO CUTLER-HAMMER ELECTRIC LINOTYPE POT



FIRST SECTION



SECOND SECTION

Connect wire "D" to wire "F," and the other end of wire "F" to one connection on the rheostat. Connect wire "E" to wire "G" and the other end of wire "G" to the other connection on the rheostat.

You now have a circuit as shown by the heavy lines in the second section of the diagram.

The rheostat may be placed at any convenient location. It is not necessary that it be attached to the control panel box. Turn rheostat knob to the right for an increase of heat at the mouthpiece, and to the left to lower the heat at the mouthpiece.

For this installation you will require: One Cutler-Hammer rheostat, our part number F-3204 (give voltage), and sufficient No. 14 R. C. wire to connect rheostat to location.

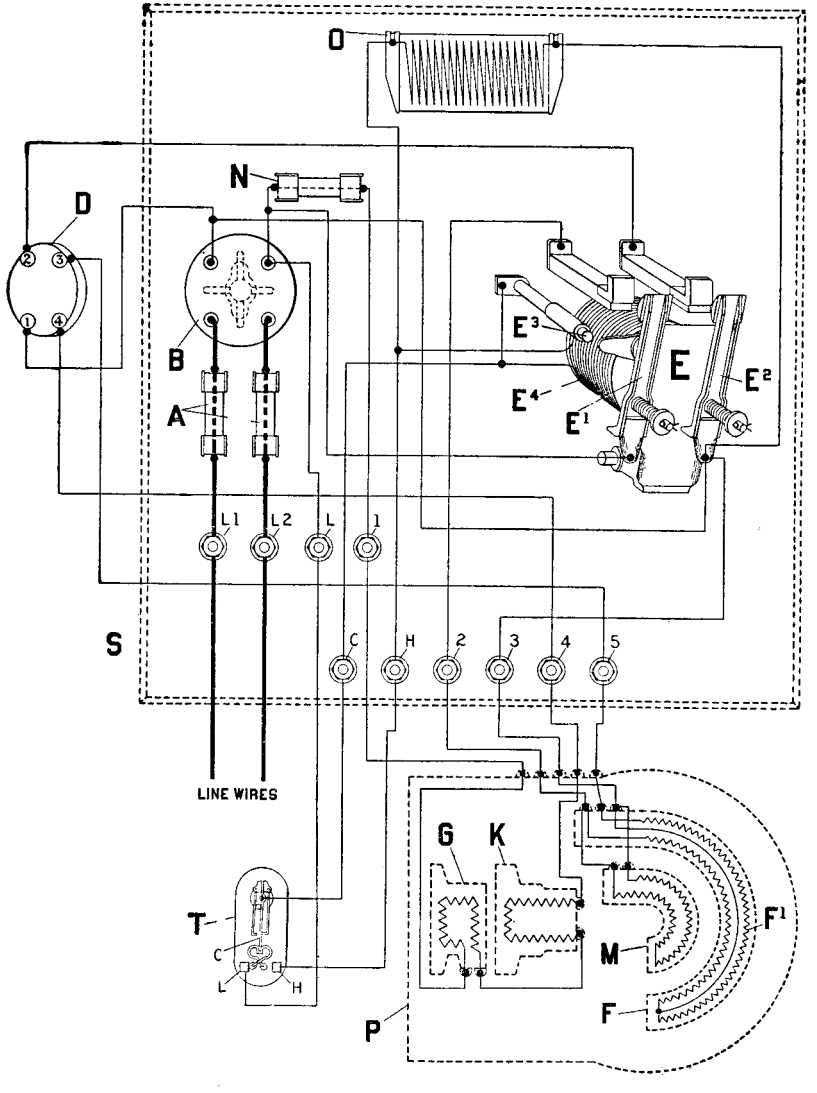


DIAGRAM No. 1

This diagram shows the electric connections of the pot with the snap switch B turned to the off position and the type metal cold. No current passes switch B, therefore, the whole pot is dead.

Note that the dynamic thermometer contact lever C touches contact L.

If switch B is turned to the on position current will pass through the dynamic thermometer and magnet switch circuit as shown in diagram No. 2.

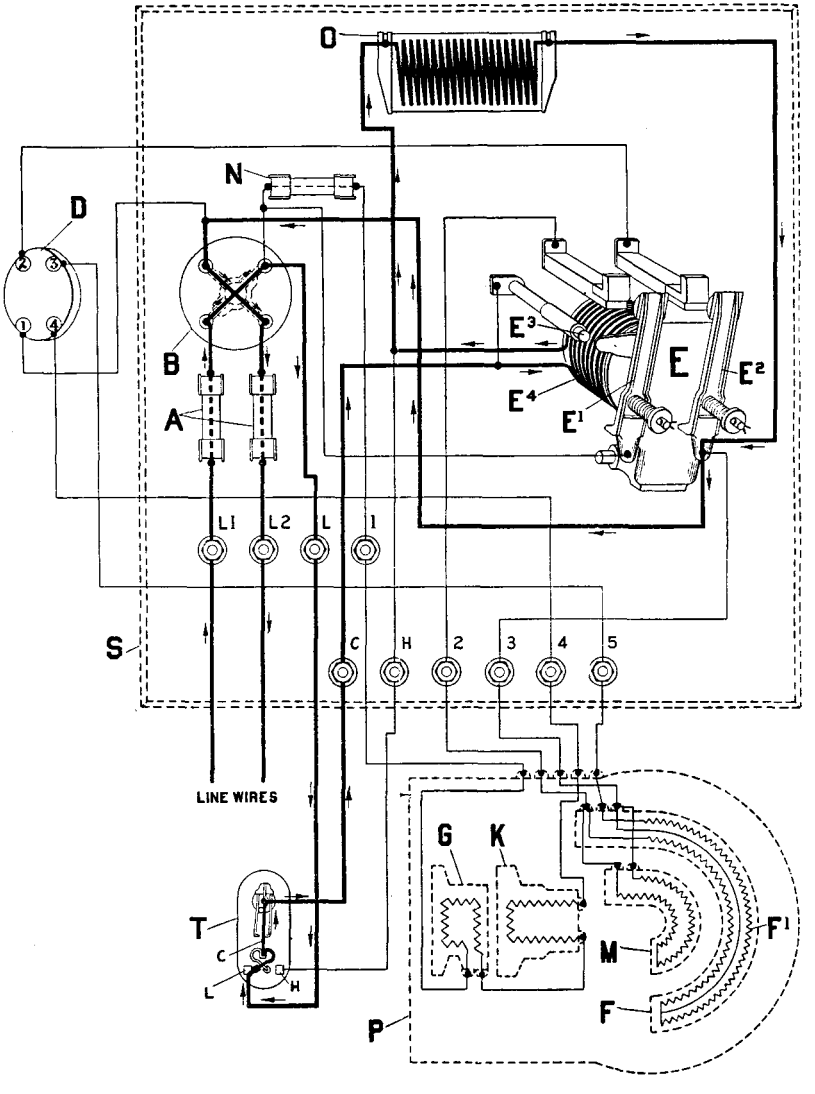


DIAGRAM No. 2

This diagram shows switch B turned to the on position. Current flows from line L-1 through switch B through the thermometer contacts L and C, magnet switch coil E-4 resistance O and back to the opposite side of the line L-2 through switch B.

As soon as the circuit is completed as above, the magnet switch E immediately closes, connecting the crucible heaters M and F to the circuit and short circuiting the dynamic thermometer circuit as shown in diagram No. 3.

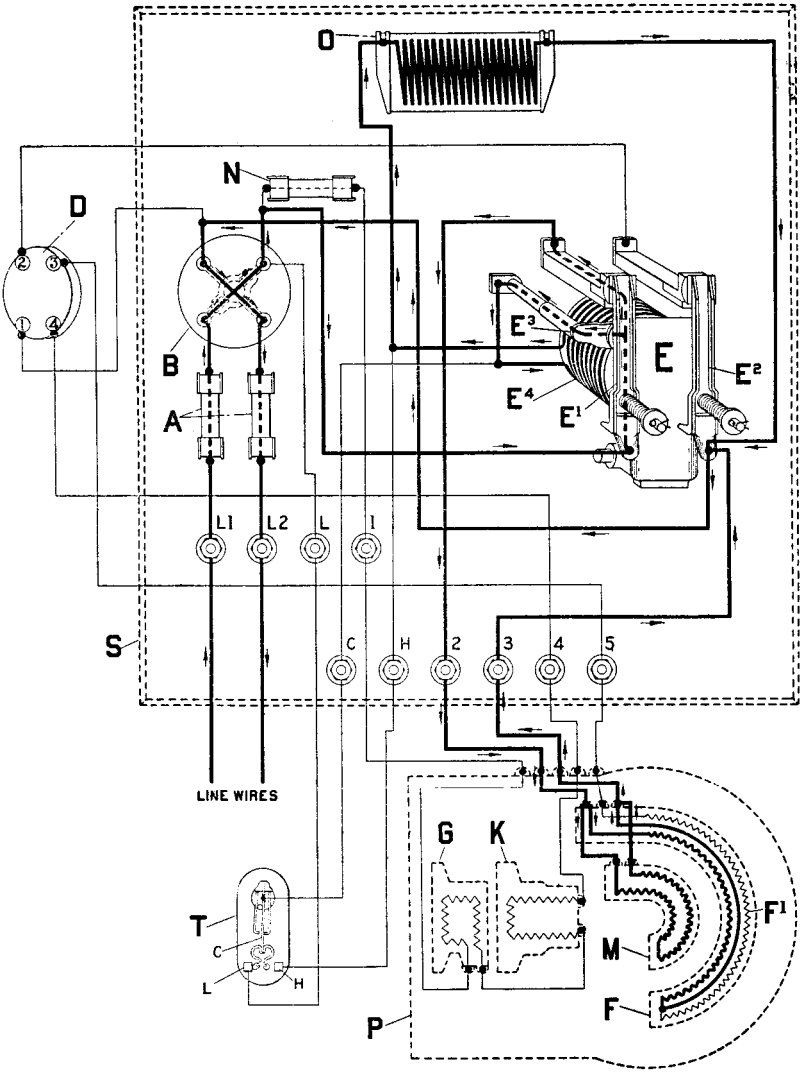


DIAGRAM No. 3

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

The crucible heaters M and F are connected to the circuit and will now heat the metal. When the temperature of the metal rises to about 535° F. contact lever C will leave contact L and begin to travel slowly toward contact H which it will touch when the temperature reaches about 550° F. and the circuit will then be as in diagram No. 4.

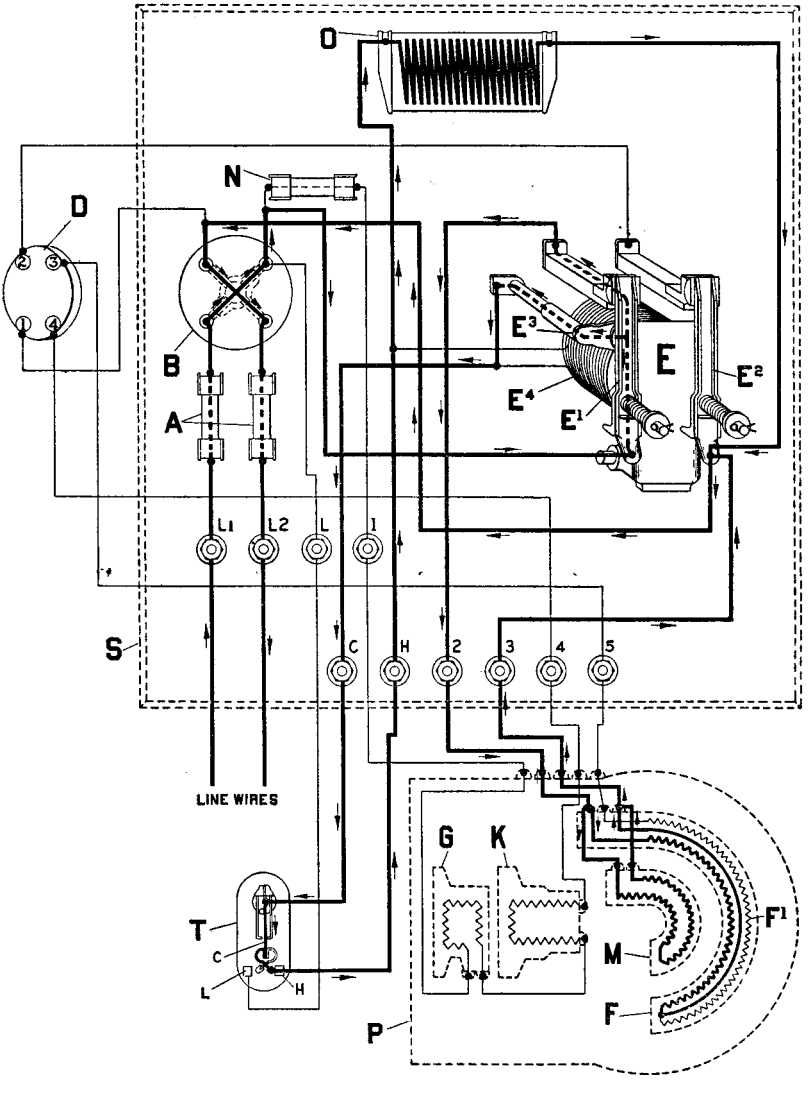


DIAGRAM No. 4

This diagram shows the circuit when contact lever C is touching contact H.

Magnet switch coil E-4 is short circuited and no current will flow through it because the path of least resistance is through the dynamic thermometer contacts C and H.

The magnet switch E immediately opens disconnecting the crucible heaters M and F from the circuit and also disconnecting the dynamic thermometer circuit, as shown in diagram No. 5.

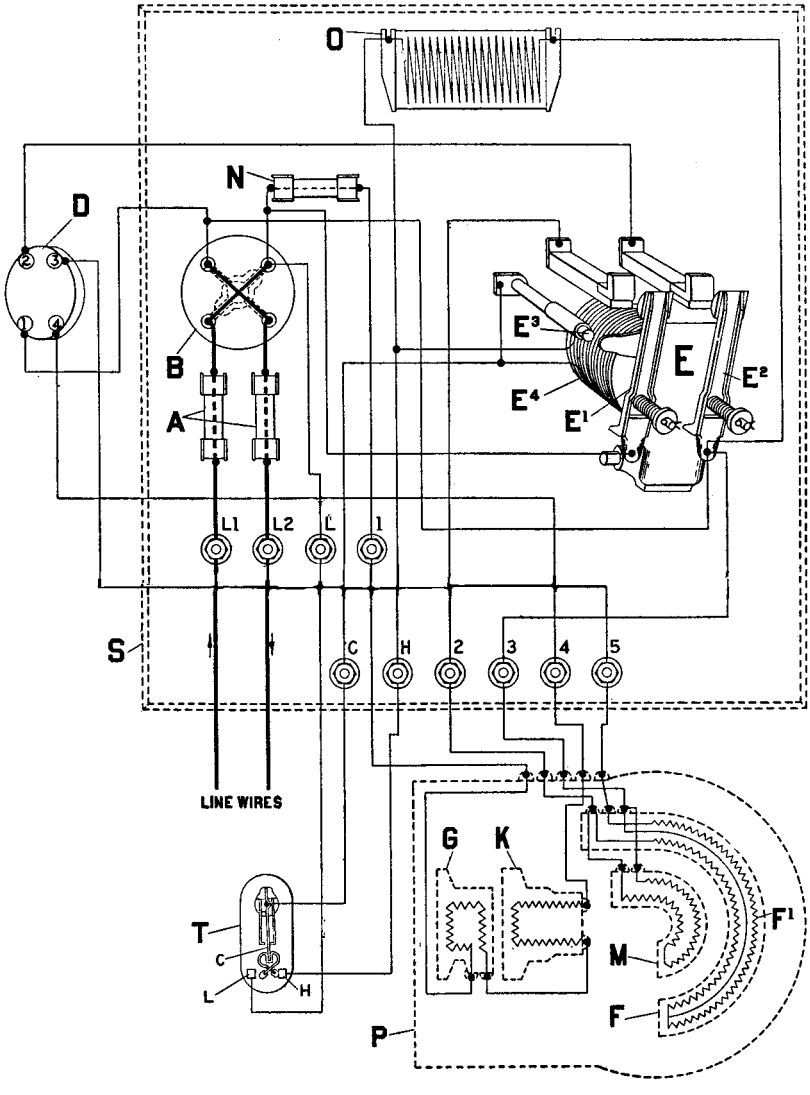


DIAGRAM No. 5

When magnet switch E opens it disconnects the crucible heaters M and F from the circuit and the temperature of the metal begins to fall.

This diagram is like diagram No 1 except that switch B is shown in the on position and contact lever C is touching contact H instead of L.

As the temperature of the metal falls contact lever C will leave contact H and slowly approach contact L, when the temperature of the metal falls to 535° F. contact lever C will touch contact L and again complete a circuit as shown in diagram No. 2. This cycle is repeated as long as equipment is in operation.

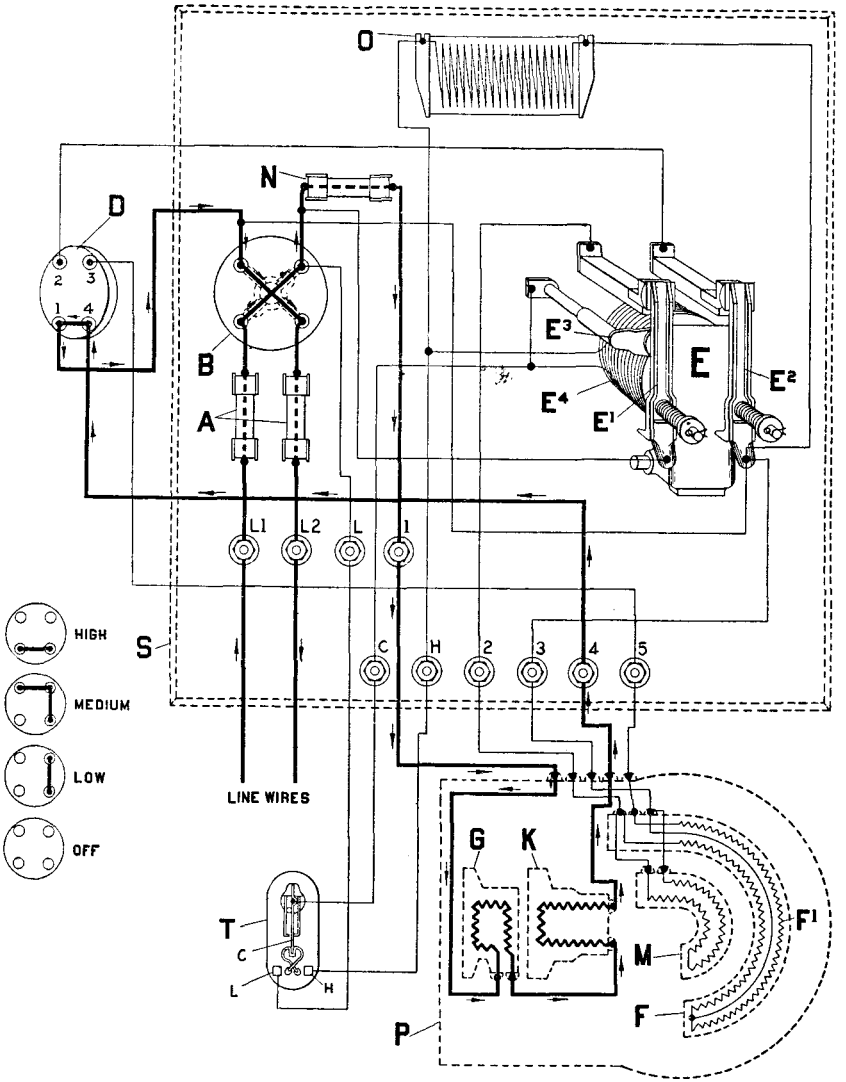


DIAGRAM No. 6

The next four diagrams explain the mouth and throat circuit only and do not consider the crucible heater circuit.

When the three heat switch D is turned to the high position the mouth and throat heater circuit can be traced from the line L-1 through the snap switch B, fuse N, throat heater K, mouth heater G, three heat switch contacts 4 and 1 back through switch B to the line at L-2.

The mouth and throat heaters K and G are in series and connected directly across the line, with this connection they produce maximum heat in the mouthpiece.

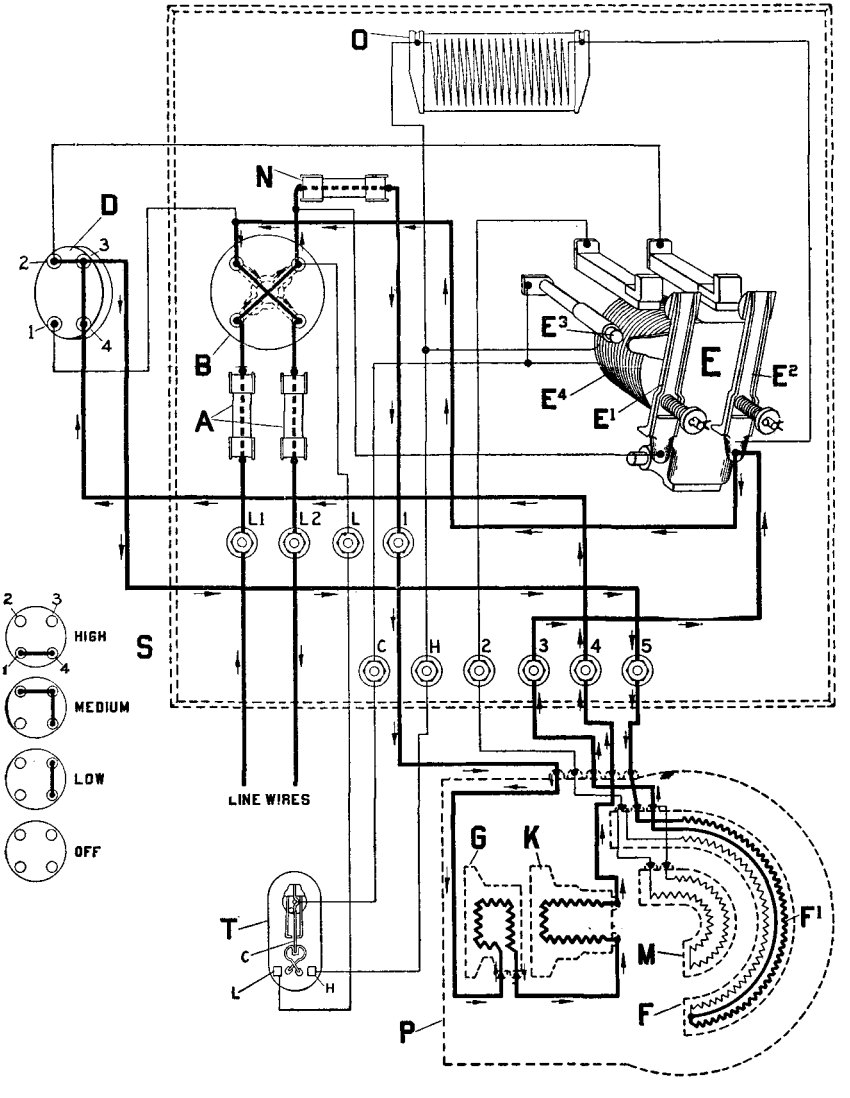


DIAGRAM No. 7

The three heat switch D is turned to medium and the magnet switch E is open. The circuit can be traced through the mouth and throat heaters G and K and then through the three terminal crucible heater resistance F-1 in series with them. This reduces the current somewhat and the heat of course is less at the mouthpiece.

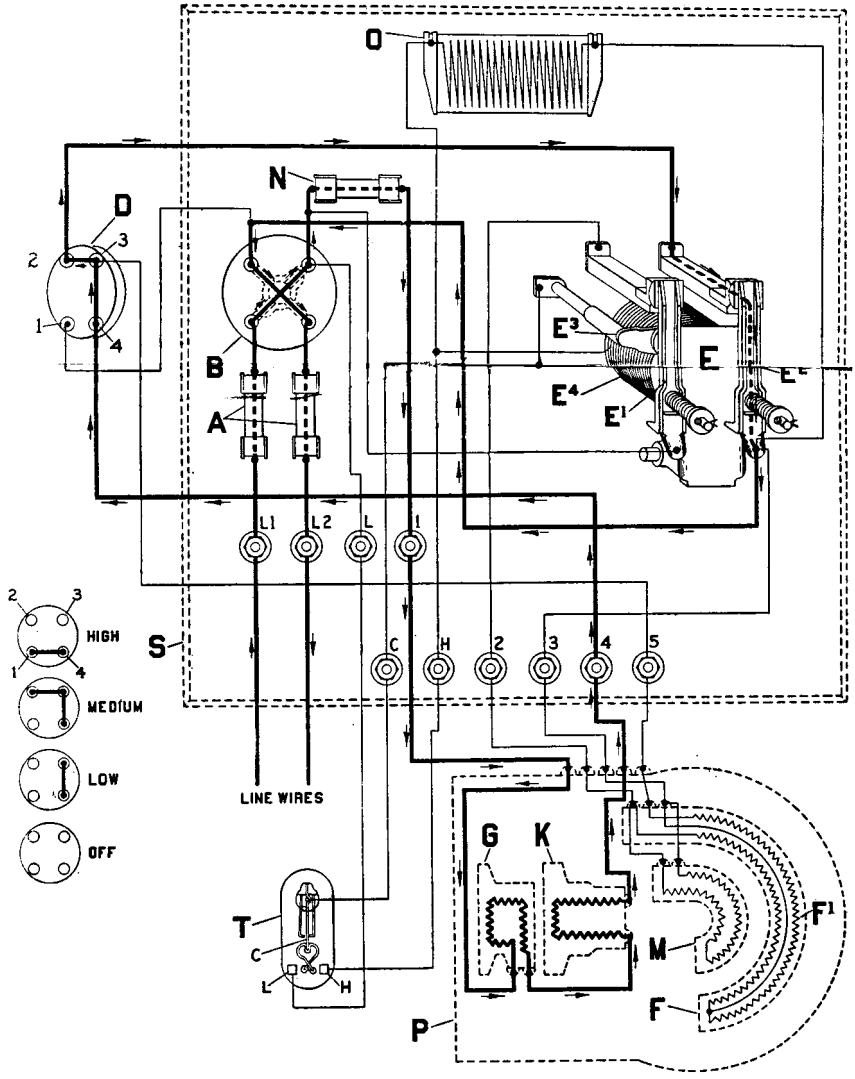


DIAGRAM No. 8

The three heat switch D is on medium and magnet switch E is closed. Closing the magnet switch short circuits the three terminal crucible heater resistance F-1 and as current follows the path of least resistance it will flow through switch E direct and then through the mouth and throat heaters G and K.

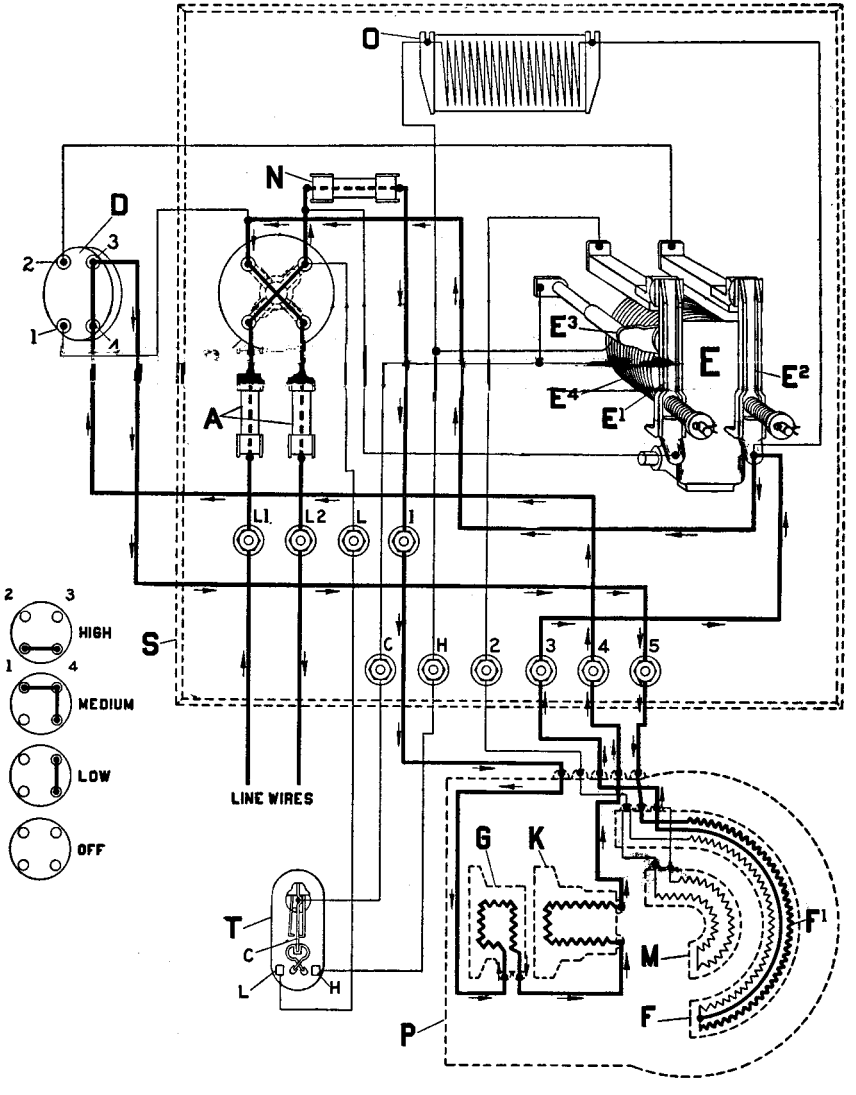


DIAGRAM No. 9

The three heat switch D is turned to the low position and magnet switch E is closed. The three terminal crucible heater resistance F-1 is in series with the mouth and throat heaters G and K which reduces the current and of course the heat.

Turning the three heat switch to off would prevent any current from passing that switch and therefore mouth and throat heaters would not produce heat.