a 30-em slug. If a new mouthpiece is to be applied, the score line can be transferred from the old mouthpiece to the new one.

Insert a file between the angular end of the mouthpiece gib and the pot crucible to prevent the gib from moving. Place the drift against the left end of the mouthpiece and strike the drift smartly with a three-pound hammer. One or two heavy blows should start the mouthpiece, then a few light blows will loosen it. When the mouthpiece has been moved sufficiently to the right, the gib can be withdrawn and the mouthpiece can be slid to the left off the crucible. The dross and oxide in the crucible throat can now be loosened with the crucible cleaner, which consists of a long blade with a row of teeth on each edge. The blade is curved to fit the shape of the crucible throat. After using the cleaner, place a metal pan or an ingot mold under the crucible mouth and work the plunger *slowly* by hand. The dross and oxide which has been freed by the throat cleaner will then flow out of the crucible with the type metal into the pan. After this operation, clean the surfaces of the crucible against which the mouthpiece bears with a wire brush. If the old mouthpiece and gib are to be used again, scrape all metal and oxide adhesions off the parts until they are bright and smooth.

Before replacing the old mouthpiece or a new one, it is advisable to grind in the mouthpiece and the crucible to insure a metal tight union of the parts. A small wooden block should be prepared for the purpose. Drive two headless nails about .060″ in diameter into the block about 24 ems apart. Place the mouthpiece centrally on the block with the nails projecting through two of the mouthpiece jets. Coat the inside bearing surfaces of the mouthpiece with No. 120 emery powder mixed with machine oil or use valve-grinding compound. Slide the mouthpiece on the crucible and move it back and forth in short strokes across the crucible lips. Be sure to hold the mouthpiece square with the crucible during this operation. Remove the mouthpiece and wipe the ground surfaces thoroughly, making sure that all of the abrasive is removed. Apply a very thin coat of white lead to the face of the crucible lips. Keep the lead away from the crucible opening, because the lead will eventually harden and might interfere with the passage of the type metal. Slide the mouthpiece on the crucible without disturbing the lead. Insert the mouthpiece gib and drive it to position, being careful that the mouthpiece does not move past the score lines made previously as a guide. The gib should not be driven in too tightly, since it is possible to spring the parts and cause a leakage of type metal. If a leak is not too serious, it can be remedied by applying a mixture of litharge and glycerin to the crucible lips and the mouthpiece and permitting the mixture to harden. A lock-up impression can now be taken with red lead or Prussian blue to determine the parallelism of the mouthpiece with respect to the mold. The pot leg adjusting screws should be adjusted until the mouthpiece is properly located for height and parallelism, as previously described.

Occasionally, it is necessary to open the mouthpiece jets and vents to remove small particles of dross and other accumulations. The jets can be opened with a No. 52 drill or a small broach, *but under no circumstances should the jet holes be enlarged.* The drill should be immersed in oil after each third or fourth jet and care should be taken that the drill does not break off. The mouthpiece vents can be cleaned with a small penknife or scriber. The vents should permit enough

metal to escape during the cast so that the sprues will be about half an inch long. The length of the sprues can be observed by stopping the machine just before the slug is trimmed by the back knife. If the sprues are not long enough, insert a knife blade or a fine chisel in the lower end of the vents and tap the blade lightly with a small hammer. Care should be exercised, however, that the vents are not opened too much, because this will result in leakage of type metal.

The Baffle Mouthpiece

The baffle mouthpiece recently developed by Intertype Corporation differs in several respects from the wedge mouthpiece. The chief differences are in its construction and in the method of fastening it to the pot crucible. The new mouthpiece incorporates the principle of a baffle, which is designed to mix the type metal and to facilitate the escape of air as the cast occurs. The baffle *2*, Fig. 69, is inserted in slots formed at the back of the mouthpiece *1*. The baffle projects partly into the opening of the mouthpiece through which the type metal passes. As the metal is driven up through the crucible throat into the mouthpiece, it meets the baffle and is agitated and deflected under pressure before it reaches the jets or holes at the front of the mouthpiece. The effect of agitating the metal is to prevent any hard particles or dross from being projected against the matrix characters. The deflection and agitation of the type metal result in a clear type face with sharply defined characters.

In addition to agitating the type metal, the baffle is designed also to pocket air in the crucible throat and to retard momentarily the flow of type metal so that any air driven into the mold can escape more readily. The projecting baffle creates an open pocket or a formed cavity behind the mouthpiece jets. When the type metal is driven into the mouthpiece, it is forced with continuous pressure against the baffle. The baffle agitates and skims the metal before it passes through the mouthpiece jets. These combined factors result in slugs of closer microstructure and uniformity.

The baffle mouthpiece is fastened to the crucible with screws instead of a gib. A number of screws at the front and top of the mouthpiece hold it firmly against the face of the crucible. The holes through which the fastening screws pass are enlarged slightly to permit sidewise adjustment of the mouthpiece. The baffle mouthpiece has a thicker body than the wedge type, as shown at *3*. This increased amount of steel in the baffle mouthpiece makes it possible to control its temperature accurately and uniformly.

Removal. To remove the baffle mouthpiece, it is necessary only to remove the screws which fasten it to the crucible. Since the screws are usually tightened securely, it is important to use a screwdriver of the right size. If any of the screws are too tight to be turned, they can usually be started by inserting a screwdriver with a solid shank in the screw slots and striking the tool with a hammer. When the mouthpiece is replaced, the screws should be coated with a paste made of linseed oil and graphite to facilitate their removal the next time. In replacing the mouthpiece, turn in the front screws until the mouthpiece bears lightly against the face of the crucible. Turn down the top screws so that the mouthpiece will seat on the ledge of the crucible, then tighten the front screws securely.

Removing and Packing the Gas Metal Pot

The metal pot should be removed from the machine at long intervals for purposes of cleaning and repacking. Although it is possible to repack the pot while it is in the machine, a cleaner and more thorough job can be done with the pot fully accessible. In removing the pot, the following procedure should be used:

Remove the plunger and ladle as much type metal as possible from the crucible. Turn off the gas and disconnect and remove the governor and burners. Run the machine ahead until the first elevator seats on the vise cap and before the mold disk moves forward. Push in the starting and stopping lever and turn off the motor. Lower the vise frame to second position, depress the mold cam lever handle, remove the ejector lever link and remove the assembled mold disk slide. Remove the mold disk shield, which is fastened to the face plate directly above the mold disk. Remove the pump stop bracket. Remove the two caps at the base of the pot legs and loosen the two front pot leg adjusting screws. Remove the pot lever, replace the pot lever shaft and tighten the set screw so that the shaft will not slip. Place a belt around the pot lever shaft.

One person should lift and support the pot at the back while another lifts the pot legs off the bushings. As soon as the legs are free, the pot should be lowered at the back while the legs are raised in the front. When the pot is in this position, it can be lifted and removed from the machine over the vise frame. The pot should be held high during removal so that it will not bump against any part of the vise mechanism. Take out the four pot cover screws and remove the cover. Any remaining metal in the crucible can be removed by tilting the pot over a metal pan. Loosen the asbestos packing between the jacket and crucible with a long screwdriver, invert the pot and tap the crucible loose with a lead hammer or a pig of type metal. Place the pot jacket on a box in an upright position with the pot legs resting on the floor.

Break up the asbestos in a pan and moisten it with water. The water should be added in small quantities in order to obtain as thick a mixture as possible. Apply about a half inch coat of the asbestos paste to the inside of the pot jacket. Place the crucible in the jacket and make sure that it seats firmly in position. *Asbestos must be kept out of the crucible well.* The well should be stopped up with some waste or cloth to prevent the entrance of asbestos. Fill any remaining space between the crucible and jacket with the asbestos and press it tightly in position with a stick of wood of suitable size. Clean all of the parts of the pot thoroughly and reassemble them by reversing the order of removal. Before the assembled pot is returned to the machine, turn the pot leg bushings until the lugs are straight up. The upper pot leg adjusting screws rest on these lugs when the pot is in position.

Pot Gas Burner and Governor

The burner and governor system applied to Intertype gas pots is designed to provide means for controlling separately the temperature of the type metal in the crucible and the heat of the mouthpiece. The pot gas burner *1*, Fig. 70, is supported under the crucible by a bracket rod *2* passing through holes in the pot jacket. This burner supplies heat to the crucible and keeps the type metal in a molten state. The pot gas mouth burner *3* is inserted in holes at the front of the

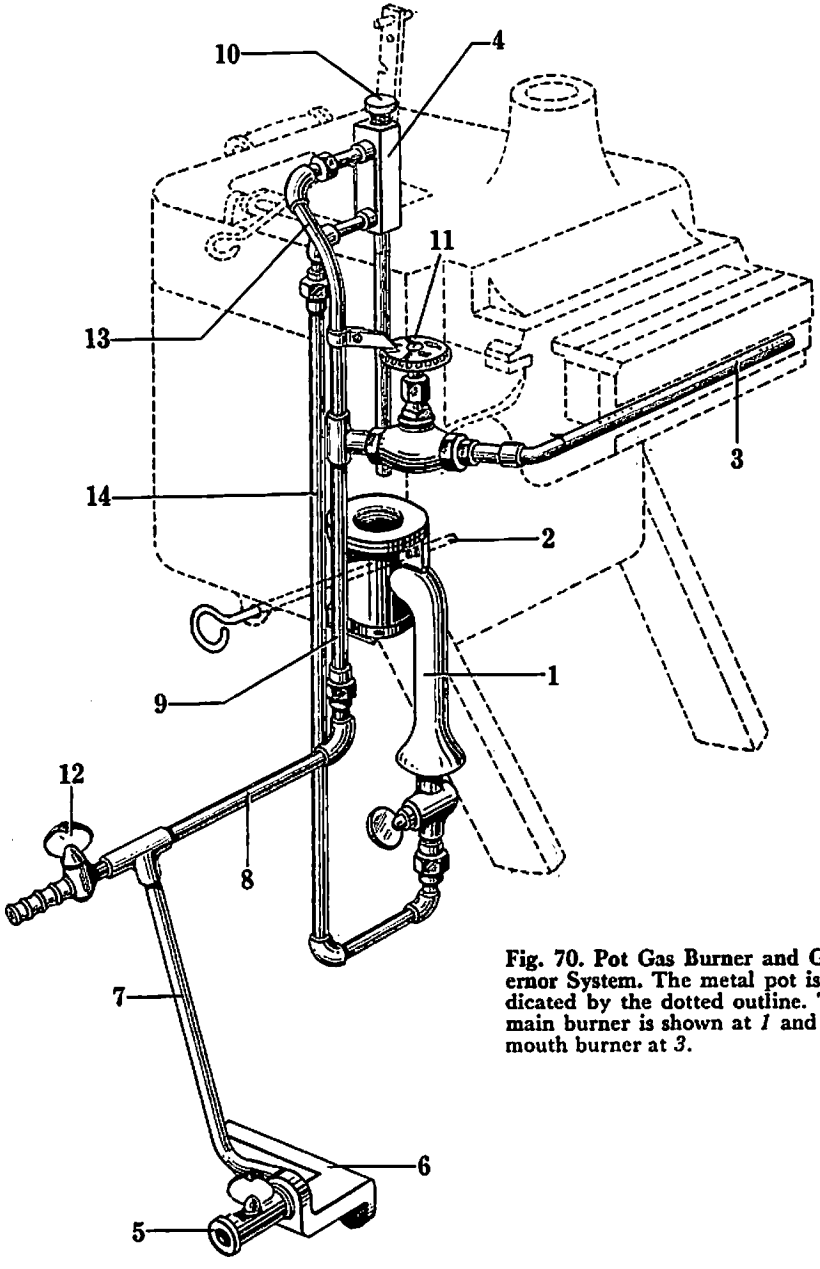

Fig. 70. Pot Gas Burner and Governor System. The metal pot is indicated by the dotted outline. The main burner is shown at *1* and the mouth burner at *3*.

pot crucible and rests directly beneath the mouthpiece. This burner controls the heat of the mouthpiece and can be regulated to suit variable casting conditions. Gas is fed to the two burners by a series of pipes leading to the pot gas governor *4*, which controls automatically the volume of gas supplied to the main burner *1*.

The pipe system which supplies gas to the burners has been simplified greatly, as shown in Fig. 70. The gas enters through valve *5*, which is used to shut off the gas supply from the burners when desired. The valve is threaded in a bracket *6* and is connected to pipe *7* by a nipple and elbow. This arrangement provides a swivel joint which permits pipe *7* and the rest of the gas burner system to move forward and backward with the metal pot. The gas passes through pipes *8*, 9 and *13* to the gas governor *4*, in which the supply of gas to the burner *1* is controlled by a regulating screw *10* and an automatic valve mechanism. The gas flows from the governor to the main burner through pipe *14*. The flow of gas to the pot mouth burner *3* is controlled directly by the valve *11*. The mixers used on the burners are of the Bunsen type and are designed to provide a properly proportioned mixture of oxygen and gas. It is essential that the mixture be correct in order to obtain the maximum heating effect from the gas. A faulty combination of air and gas will produce a yellowish instead of a blue flame and lamp black will accumulate around the surfaces touched by the flame. The sooty deposits act as insulation and more gas will be required to heat the mouthpiece and the type metal. The auxiliary valve *12* is provided for use with a hand torch. The torch is inserted in the free end of a rubber hose, the other end of which is fastened to the valve.

Pot Gas Governor. The Intertype gas governor is simple in construction and highly efficient from the standpoint of uniform temperature control. Its operation is controlled by the difference in the rate of expansion and contraction of aluminum and steel. The governor consists mainly of a governor tube *1*, Fig. 71, a valve rod *2*, a valve *3* and a valve spring *4*. The aluminum tube *1* is inserted in a guard *5*, which is surrounded by the molten type metal in the crucible. The aluminum tube lengthens by expansion as the temperature of the type metal approaches the maximum degree of heat for which the governor has been set. The tube shortens by contraction as the temperature of the type metal approaches its minimum degree. When the aluminum tube lengthens, valve rod *2* falls away from valve *3*, permitting spring *4* to move the valve closer to the gas outlet and against screw *6*. This action decreases the volume of gas supplied to the main burner, screw *6* permitting just enough gas to flow through the outlet to keep the burner flame from being extinguished. The diminished volume of gas will continue to flow until the type metal begins to cool, at which point the aluminum tube *1* will start to shorten by contraction. The contraction of the tube raises rod *2* against valve *3*, moving the lower end of the valve away from the gas outlet. This action increases the volume of gas flowing to the main burner and automatically increases the temperature of the type metal until it reaches its maximum degree of heat. The average casting temperature of the type metal is from 525 degrees F. to 550 degrees. Variations in slug sizes require modification of the mouthpiece temperature. When casting 5 point slugs for an extended period of time, for example, the mold does not receive as much heat from the type metal as would be received when casting large display slugs. Since the

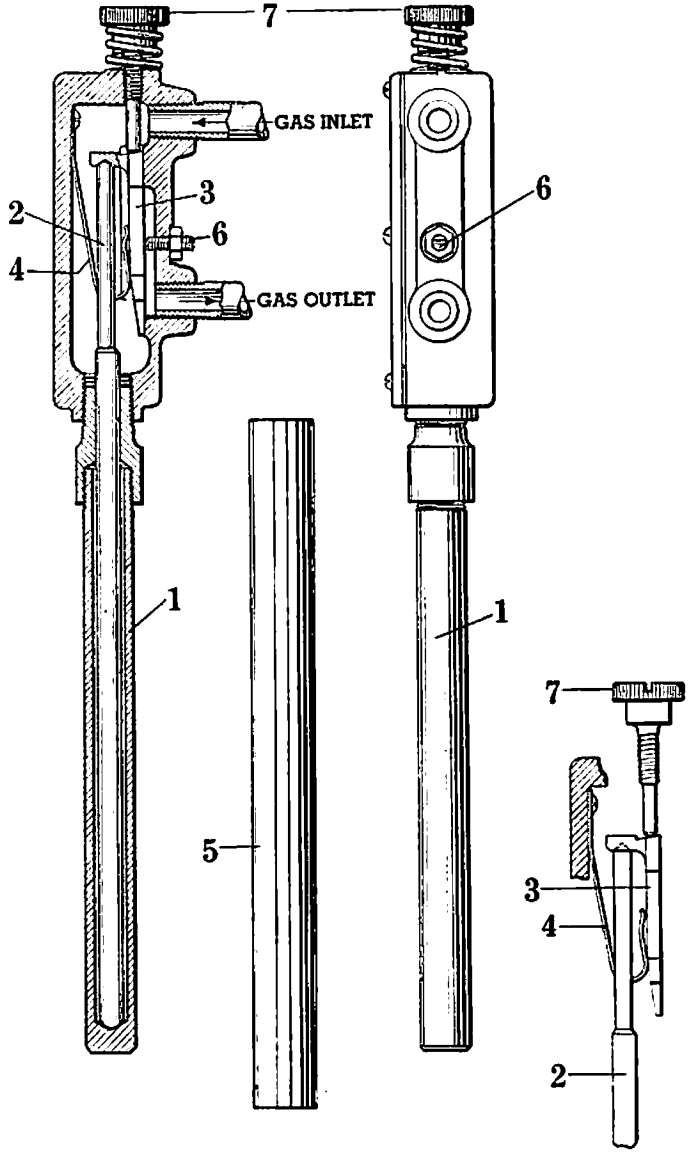

Fig. 71. The Intertype Gas Governor is simple in construction and highly efficient in maintaining uniform temperature control. The governor operates on the principle of the sensitivity of an aluminum tube to variations in heat. The governor at the left of the illustration is shown partly in section.

mold is cooler when casting the smaller sizes of slugs, it tends to draw some of the heat from the mouthpiece each time a lock-up occurs. The mouthpiece requires a greater heat input for this reason when small slugs are being cast. When casting large display slugs, the heat input into the mouthpiece should be decreased somewhat to compensate for the greater heat in the mold.

Adjusting the Governor. The volume of gas supplied to the main gas burner is controlled by the regulating screw *7*, Fig. 71. Turning the screw clockwise (down) will increase the flame and raise the temperature of the type metal. Turning the screw counter-clockwise will have the opposite effect. The full result of the adjustment will not appear immediately. A number of minutes should be allowed between each adjustment to insure completion of the changes.

The valve adjusting screw *6*, as stated previously, permits just enough gas to flow to the main burner to prevent the flame from being extinguished when the type metal has reached its maximum temperature. The screw should be set for this condition and the lock nut tightened securely. The valve adjusting screw should not be used to adjust the temperature of the type metal. This adjustment, as described previously, is made with the regulating screw *7*.

Maintenance. The pot gas burner *1*, Fig. 70, and the mouth burner *3* should be removed from the machine once every five or six months for cleaning. Soot and dirt tend to accumulate on the burners and affect the heating power of the flames. If these foreign substances are not removed, the heating efficiency of the burner system will be impaired and regulation of the type metal temperature will be difficult. The burners are attached to the pipes with small unions which make removal easy and convenient. The main burner and the mouth burner should be cleaned thoroughly with a wire brush. The holes in the mouth burner can be cleaned with a small drill or wire. The opening in the main burner can be scoured thoroughly with a wire brush by removing the regulating nut and spring from the burner cap and taking the cap out of the burner body. When the burner is replaced, it may be necessary to raise or to lower the burner cap by means of the regulating nut to secure a flame of the proper intensity. The detent spring under the regulating nut prevents the nut from moving after it has been set. The burners should produce a steady blue or greenish-blue flame at all times. A yellow flame indicates that the regulators on the air mixers are not adjusted sufficiently to produce the proper mixture of oxygen and gas. Occasionally, it is necessary to remove the gas governor in order to clean the chamber in the valve case. The case is fitted with a steel cover held in place with several screws. When screws are replaced, coat them with graphite grease to facilitate removal the next time.

The Intertype Electric Metal Pot

The construction of the electric pot proper is similar in all basic respects to that of the gas pot. The electric pot, like the gas pot, consists principally of the pot jacket, the pot crucible and the pot jacket cover. These parts have been described already in the general section dealing with the metal pot and need not be repeated here. The chief difference between the two types of metal pots is that the openings provided in the gas pot for the burners are covered in the electric pot with plates and are filled with asbestos.

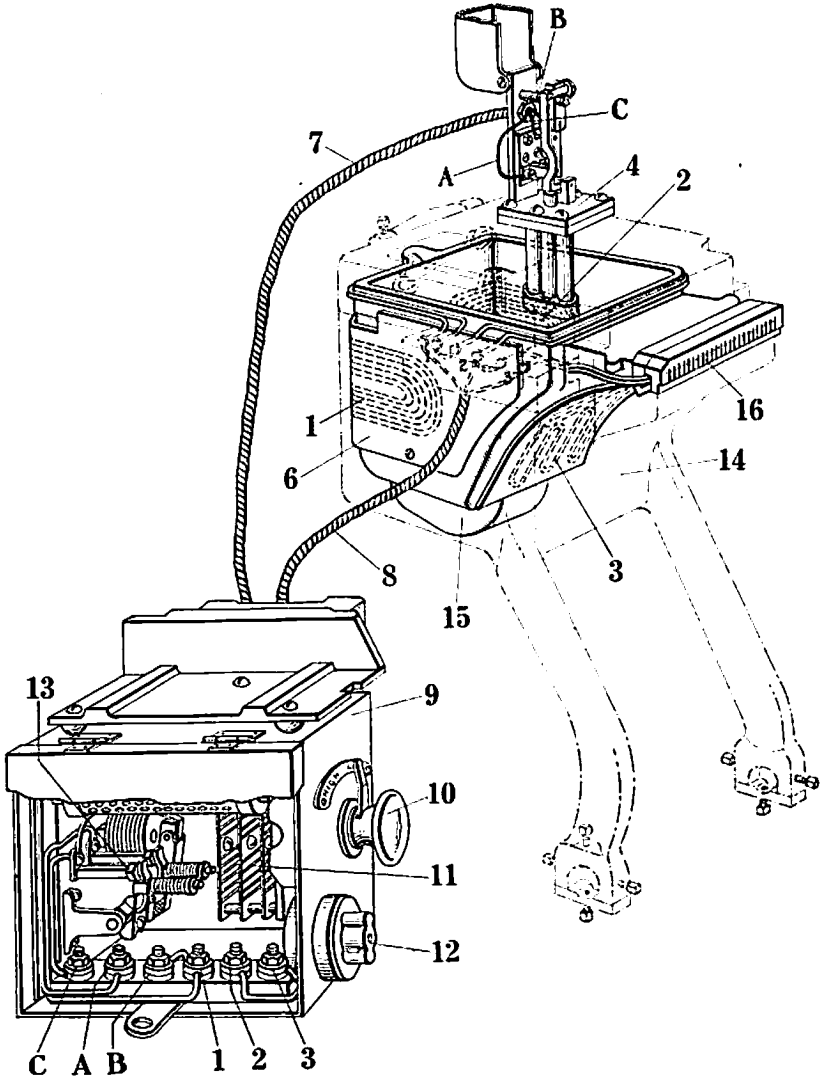

Fig. 72. Perspective View of the Electric Pot and Heating Equipment. The heaters are shown at *1*, *2* and *3*. The thermostat *4* is fastened on top of the pot cover and the control box *9* is mounted on the left side of the machine base. The thermostat regulates the temperature of the type metal automatically by controlling the current passing through the side heaters *1* and *2*. The rheostat knob *10* controls the temperature of the crucible throat and of the mouthpiece *16* by regulating the current passing through the throat heater *3*.

A perspective view of the electric pot with its heating equipment is shown in Fig. 72. The heating system may be regarded as composed of three main groups:

1. **The Heaters,** which supply heat to the crucible and the mouthpiece;

2. **The Thermostat,** which automatically controls the temperature of the type metal by regulating the current passing through the heaters;

3. **The Control Box,** which contains mechanism suitable for closing and opening the electrical circuit automatically and for regulating the heat of the mouthpiece and crucible throat.

The Heaters

The three heaters applied to the electric pot are shown in dotted outline at *1, 2* and *3,* Fig. 72. The heaters are placed around the crucible and are held in contact with the crucible casting by covers, one of which is shown at *6.* These covers also separate the heaters from the asbestos and prevent the formation of hot areas, which occur only when asbestos comes into contact with a heater and makes it impossible for the heat to be dissipated at that point. The two side heaters *1* and *2* surround the body of the crucible *15* and keep the type metal at the proper temperature. The throat heater *3* keeps the crucible throat and the mouthpiece *16* at a temperature corresponding to that of the molten type metal so that the metal will not be chilled or overheated as it is delivered to the mold. The heaters are made of sheath wire surrounded with a layer of magnesium oxide and encased in a steel tube. The tube is made of a special alloy so that it will withstand the continuous heat. A sectional view of the heaters showing this construction may be seen in Fig. 68. The ends of the heaters are located in a terminal box at the left side of the pot *14,* Fig. 72, where they are clamped in position and connected with wires leading from the control box. The terminal box cover, which protects the connections, should always be kept in position.

The same side heaters are used for low voltage (100-125) as for high voltage (200-250). The heaters are connected in *parallel* or *multiple* for low voltage installations and in *series* for high voltage installations. The part numbers of the side heaters are as follows:

U-1143 (right-hand heater), for currents ranging from 100 to 125 volts or 200 to 250 volts.
U-1146 (left-hand heater), for currents ranging from 100 to 125 volts or 200 to 250 volts.

The throat heater is *not* universal and can be used only on the current specified. The part numbers of the throat heaters are as follows:

U-2813, for currents ranging from 100 to 125 volts.
U-2814, for currents ranging from 200 to 250 volts.

All three of the pot heaters can be used for both direct and alternating current installations.

Other parts for the electric pot are illustrated and listed with specifications in the Intertype Parts and Supplies catalogue.

The Lever Type Thermostat

The thermostat, as stated previously, controls the temperature of the type metal automatically by regulating the current passing through the two side heaters. The thermostat is shown in assembly with the rest of the pot electrical

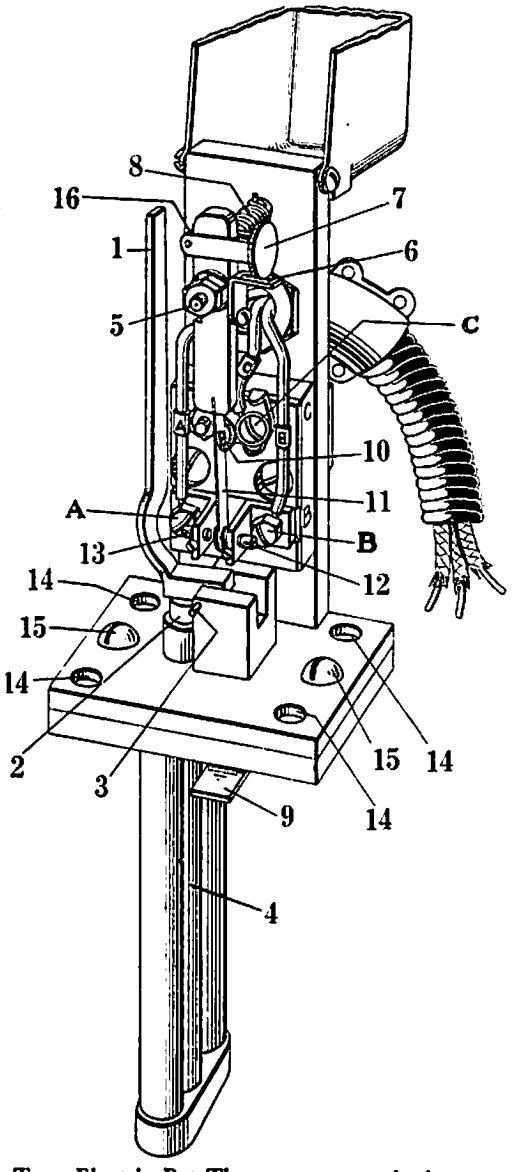

Fig. 73. The Lever Type Electric Pot Thermostat controls the temperature of the type metal automatically through the expansion and contraction of expanding rod *4*, which is immersed in the molten type metal. As the type metal approaches its maximum temperature, rod *4* lengthens by expansion, causing end *2* to bear against the lower end of lever *1* pivoted on pin *3*. Lever *1* bears against roller *16* on contact arm *11*, causing the lower end of the arm to contact screw *13* in the *A* terminal. This action opens the relay in the control box and the current ceases to flow through the side heaters. As the type metal approaches its minimum temperature, expanding rod *4* shortens by contraction and releases the pressure of end *2* from lever *1*. This leaves the arm free to follow spring *8*, which moves the arm until it contacts screw *12* in the *B* terminal. The relay in the control box is thereby closed and current flows again through the two side heaters, raising the temperature of the type metal until it reaches its maximum degree of heat.

equipment in Fig. 72. The thermostat *4* is fastened on top of the pot cover and the control box *9* is mounted on the left side of the machine base. Three wires inside cable *7* are fastened at each end to *A*, *B* and *C* contact screws in the control box *9* and the thermostat *4*. Three wires inside cable *8* are connected to the ends of the heaters in the terminal box and lead to terminals *1*, *2* and *3* in the control box *9*. This wiring system connects the thermostat with the relay mechanism, which closes and opens the electric circuit and causes current to flow or to cease flowing through the side heaters. The closing and opening of the circuit is controlled by an operating lever in the thermostat, which is operated by an expanding rod immersed in the type metal. The knob *10* controls the amount of current passing through the throat heater *3* by cutting resistance in or out of the rheostat units *11*. *The throat heater circuit is entirely independent of the side heater circuit* and the operation of either circuit in no way affects that of the other. Adjustment of the type metal temperature is made by means of a regulating screw in the thermostat *4* and adjustment of the throat and mouthpiece temperature is made by means of the rheostat knob *10*. This double method of heat control provides an exceedingly flexible system which is adaptable to all conditions under which slugs are cast. The snap switch button *12* is used to turn the current on and off when desired.

The closing and opening of the circuit, as stated previously, is controlled by an operating lever and a contact arm in the thermostat, which are operated by an expanding rod immersed in the type metal. The contact arm *11*, Fig. 73, is pivoted on post *5* and is connected by wire *10* to the *C* terminal. The arm is moved between contact screw *13* in the *A* terminal and contact screw *12* in the *B* terminal by operating lever *1*, which bears against and withdraws from a roller *16* on the arm as the temperature of the type metal rises and falls. These movements are caused by the aluminum rod *4*, which is more sensitive to heat changes than the two steel rods. As the type metal approaches the maximum temperature for which the adjusting screw has been set, the expanding rod *4* lengthens by expansion and the end *2* of the rod bears against lever *1* pivoted on pin *3*. The operating lever *1* presses against roller *16*, causing the lower end of arm *11* to contact screw *13* in the *A* terminal. This action opens the relay in the control box and current ceases to flow through the two side heaters. As the temperature of the type metal decreases and approaches its minimum degree of heat, expanding rod *4* shortens by contraction and releases the pressure of end *2* from lever *1*. Arm *11* is then left free to follow the movement of spring *8*, which moves the arm until its lower end contacts screw *12* in the *B* terminal. This action energizes the relay coil in the control box, causing the relay to close and current to flow through the side heaters. These actions are entirely automatic and it is necessary only to set the thermostat for the temperature desired.

Adjustments. The temperature of the type metal is regulated by screw *7*, Fig. 73. Turning the screw clockwise will lower the heat of the type metal and turning the screw counter-clockwise will raise the temperature. Friction clamp *6* prevents the adjusting screw from moving after it has been set. The average casting temperature of the type metal is from 525 degrees Fahrenheit to 550 degrees. The difference between the on and off position of the thermostat contact arm should *not* exceed 25 degrees. Accuracy in setting the type metal tempera-

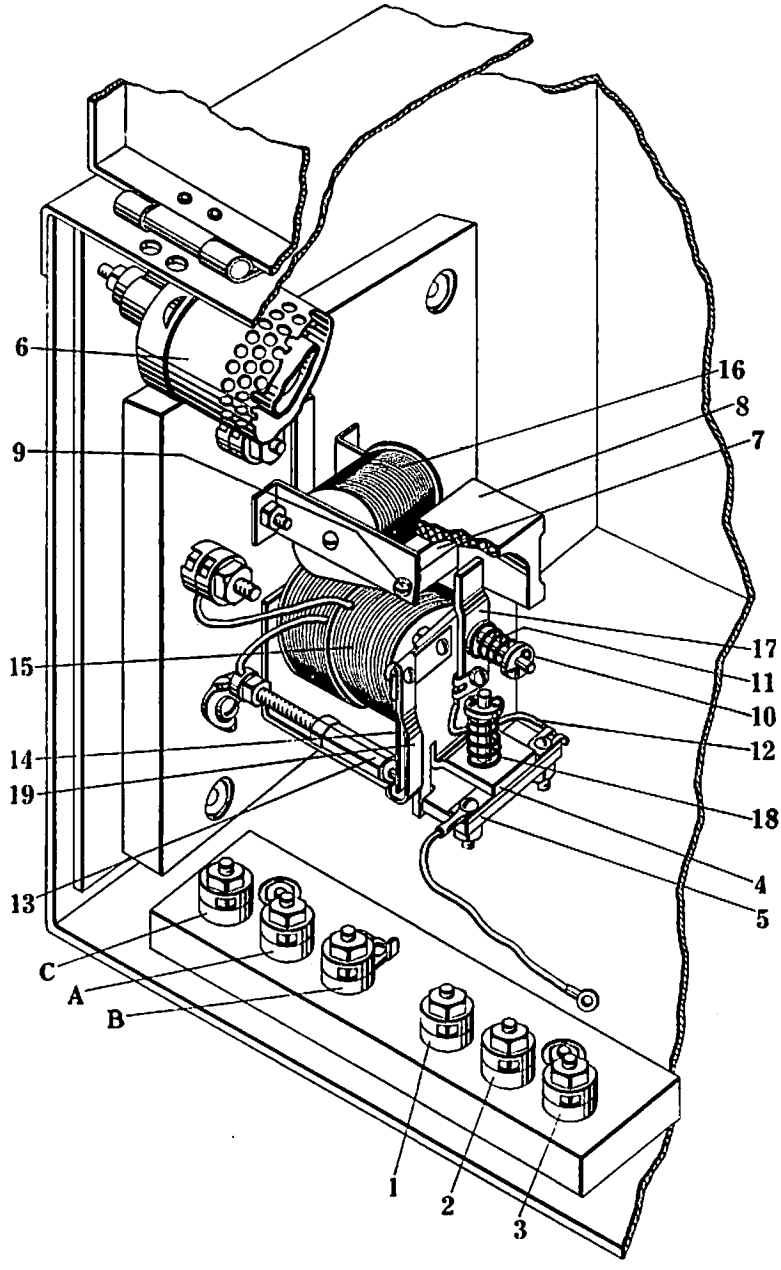

Fig. 74. The Direct Current Relay, which closes and opens the electrical circuit as the thermostat contact arm moves from the *A* to the *B* terminal.

ture requires the use of a reliable thermometer. Intertype Corporation carries in stock a thermometer (W-88) intended specifically for this purpose.

The contact screws *12* and *13* should be adjusted so that there is approximately 1/32″ space between the lower end of arm *11* and one contact screw when the arm is touching the other screw. The small locking screws should be tightened after the contact screws are set.

Removal of Thermostat. To remove the thermostat when the type metal is frozen, simply remove the four holding screws *14* and the two frame screws *15*. This will release the thermostat frame from the base and the assembled upper section of the thermostat can be moved aside. If the pot cover is to be removed, take out the two flathead screws which hold the thermostat base to the stem and lift off the base. This will leave the thermostat stem in the metal and the pot cover can be removed from the jacket. Spring *9* provides a yielding contact between the thermostat and the pot cover and prevents loss of adjustment when the type metal freezes around the thermostat stem.

Maintenance. The contact studs at the lower end of arm *11*, Fig. 73, and the inside ends of contact screws *12* and *13* should be kept clean and smooth so that the parts can establish full contact. These parts should be cleaned occasionally with a piece of fine-grained emery cloth. It is essential that the contact arm *11* move freely on the post *5*. If the arm is removed, make sure that the two fastening nuts do not bind it in position when it is replaced. The three thermostat wires *A*, *B* and *C* should be kept away from the arm so that they will not interfere with its movements. While the parts of the thermostat are made as durable as possible, they can be damaged if they are not handled properly. Bent or scored parts should be replaced with new ones to insure efficient operation of the device.

The Control Box

The control box, mentioned previously as the third division of the electric pot equipment, contains the mechanism necessary for controlling the current passing through the three pot heaters. This mechanism consists of two major groups:

1. **The Relay and Resistor,** which close and open the electrical circuit as the thermostat contact arm is moved between the *A* and *B* terminals by the expanding rod in the type metal;

2. **The Rheostat,** which is used to raise or to lower the heat of the crucible throat and the mouthpiece. Incidentally, of course, the throat heater has an effect upon the heat of the type metal in the crucible.

The Relay Mechanism

The D.C. Relay. Although the direct and alternating current relays vary in mechanical construction, they perform similar functions and operate on the same principle. The direct current relay is shown in Fig. 74. The relay is connected in series with the resistor unit, which is enclosed in a cage *6* in the control box. The relay mechanism consists chiefly of the relay coil *15*, the relay contact tip *17*, the contact post *13* and the contact spring *14*. When the contact arm in the thermostat touches the screw in the *B* terminal, the relay coil *15* is energized

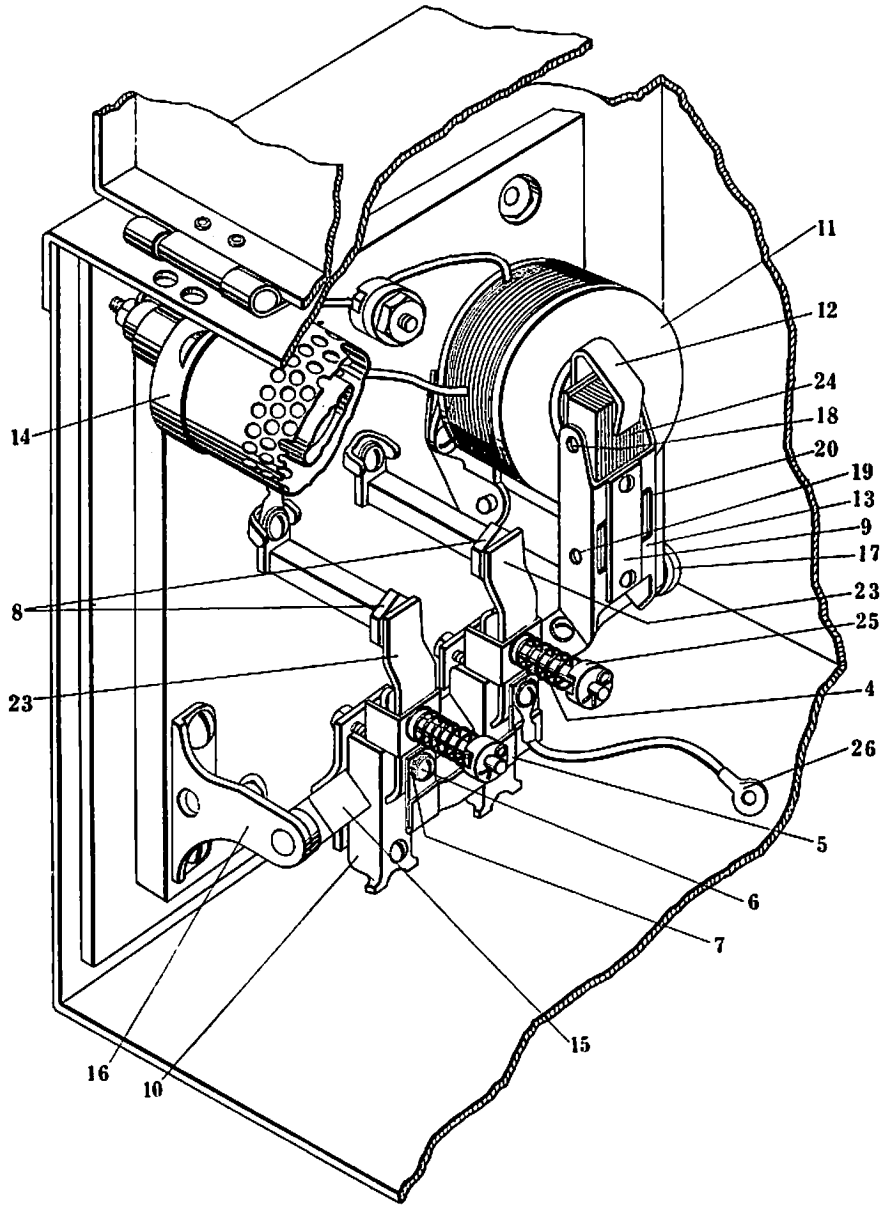

Fig. 75. The Alternating Current Relay fulfils the same function as the direct current relay. The alternating current relay closes and opens the circuit and causes current to flow and to cease flowing through the two side heaters.

and contact tip *17* closes against contact piece *7*. At the same time, contact spring *14* is moved forward until it establishes contact with post *13*. As soon as the relay closes, the circuit is formed through the *relay, the resistor and the thermostat,* causing current to flow through the two side heaters. As the temperature of the type metal rises, the thermostat contact arm is moved from the *B* terminal to the *A* terminal. While the arm is moving toward the *A* terminal, the relay is held in contact with its coil by contact spring *14* on finger *19*. This causes the current to continue to flow through the two side heaters, even though the thermostat contact arm is no longer in contact with the *B* terminal. This type of circuit is known as a maintaining circuit. As soon as the arm touches the *A* terminal in the thermostat, however, a by-pass circuit is established, causing contact tip *17* to fall away from contact piece *7* and contact spring *14* to fall away from post *13*. The blowout coil *16* prevents an arc or flame from being given off when tip *17* is drawn away from piece *7* through action of spring *18*. These parts will remain inoperative until the contact arm in the thermostat touches terminal *B* again, energizing the relay and causing current to flow through the two side heaters.

Adjustment. The contact post *13,* Fig. 74, should be adjusted so that spring *14* contacts the post slightly before tip *17* contacts piece *7*. The post can be turned closer to or further away from the spring after the lock nut is loosened. The contact post and the spring establish a maintaining circuit which holds tip *17* against piece *7* while the thermostat contact arm is moving toward the *A* terminal.

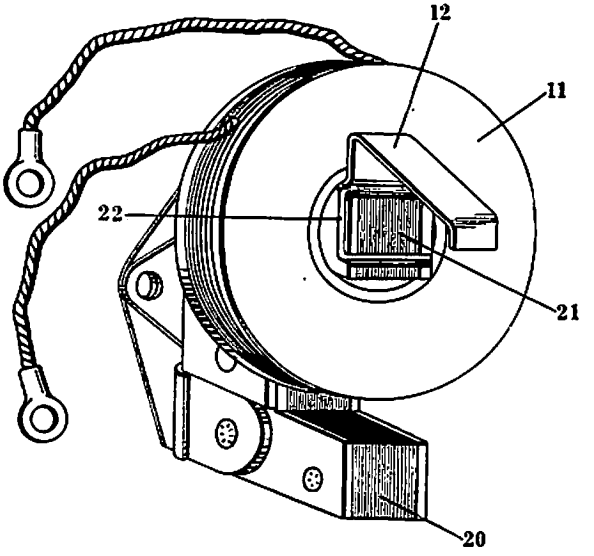

Fig. 75a. Showing a detail view of the pot relay coil used on alternating current installations. The relay laminated field is drawn against pole faces *20* and *21* when the coil is energized. It is essential that these surfaces be kept clean and smooth. A copper band or pole shader *22* is fastened around the upper face *21*. The shader should always be seated firmly in its grooves in the pole face.

Removal of Parts and Maintenance. The maintenance of the control box consists chiefly in keeping the connections tight and the contact surfaces clean. From time to time inspect the nuts which hold the connecting wires to their posts and make sure that they are tight. With the current off, work the relay by hand occasionally to see whether the armature *4*, Fig. 74, is free in the frame *5*. To remove contacts *17* and *7*, first remove arc chute *8* by pulling it out horizontally to the right. The contact tip *17* can then be removed by pulling out the cotter pin *10* and unfastening the shunt *12*. The contact piece *7* can be removed by turning out screw *9*. When these parts are replaced, clean their contact surfaces with a piece of fine emery cloth. Occasionally, it is necessary to renew the contact spring *11* if it becomes weakened. The spring should exert about two pounds pressure against piece *7* when armature *4* is closed as far as it will go.

The A.C. Relay. The alternating current relay differs mechanically from the direct current relay but operates on the same principle. The alternating current control switch is of the magnetic type. The relay mechanism is mounted on a shaft *15*, Fig. 75, which is supported on each side by a bracket *16* and *17*. The laminated field *24* and the two contact tips *23* are fastened on the shaft *15*. When the magnet is energized, current passes through resistor tube *14* into the relay coil *11*; the current then passes through contacts *8* and *23* to the shunt *26* and then out into the line wire. The laminated field *24* is thereby drawn against two poles on coil *11*, causing contact tips *23* to close against contact screws *8*. Pins *18* and *19* hold the field loosely in its bearing and limit the movement of the field. When the field closes against the poles, current flows through the two side heaters and the temperature of the type metal rises. When the type metal reaches its maximum temperature, the thermostat contact arm touches the *A* terminal. This by-passes the current passing through the relay coil and causes tips *23* to fall away from screws *8*. Armature stop *12* limits the open position of laminated field *24* and tips *23*.

Maintenance. The contact surfaces of tips *23* and screws *8*, Fig. 75, should be cleaned regularly with a piece of fine-grained emery cloth. The laminated field *24* closes against two pole faces, which are shown at *20* and *21*, Fig. 75a. The contacting areas of the field and the faces should be kept clean and smooth to prevent excessive humming of the parts when they are closed. Occasionally, inspect the copper pole shader *22* around the upper face *21*. If the shader becomes disconnected or broken, the laminated field and the pole faces will become hot during operation. To remove the contact tips *23*, Fig. 75, pull out the cotter pins holding the cup washers *25* and the springs *4* and remove shunt *26*. Springs *4* should have enough tension to exert about one-half pound pressure against the screws *8* when armature *9* is closed all the way. If the springs are weak, they should be replaced with new ones. When the contact tips are replaced, make sure that screw *6* and lock washer *7* are turned up tight and that the contact tips are free in the supports *10*.

The Rheostat

The rheostat is used to raise or to lower the heat of the crucible throat and the mouthpiece. Manipulation of the rheostat, as stated previously, has no effect upon the operation of the side heaters — the two control systems are entirely

independent of each other. The rheostat mechanism is shown in Fig. 76. The rheostat units *2* are mounted on studs and are held apart by spacers. The assembled units are fastened to a base which is held in position by four holding screws *1*. The rheostat knob *10* is mounted outside the control box. When the knob is turned, a lever attached to the knob inside the control box moves contact shunt *4* from one contact button *3* to another. If the rheostat knob is moved toward the "High" position, resistance is cut out and more current will flow through the throat heater and the temperature of the crucible throat and of the mouthpiece will rise. Turning the knob toward the "Low" position will have the opposite effect.

Removal and Maintenance. If it is necessary to replace a rheostat unit, the

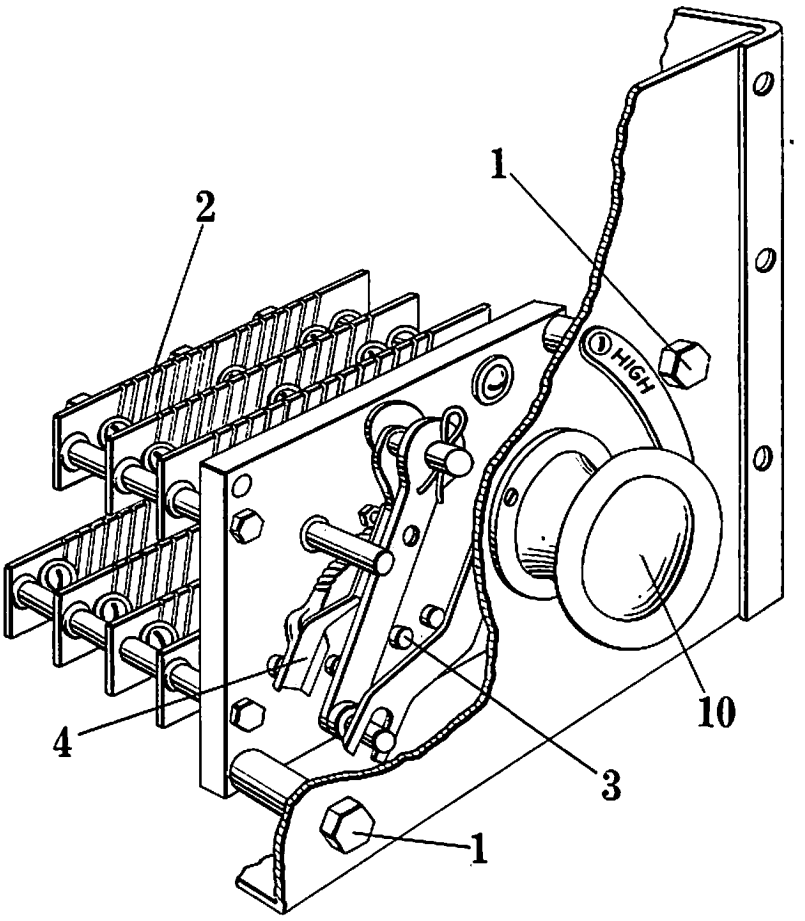

Fig. 76. The Pot Rheostat controls the current passing through the throat heater and regulates the temperature of the crucible throat and of the mouthpiece. Knob *10* moves shunt *4* across a number of buttons *3*, causing more or less current to flow through the heater. This is accomplished by cutting resistance into the resistor units to lower the temperature, and by cutting resistance out of the units to raise the temperature.

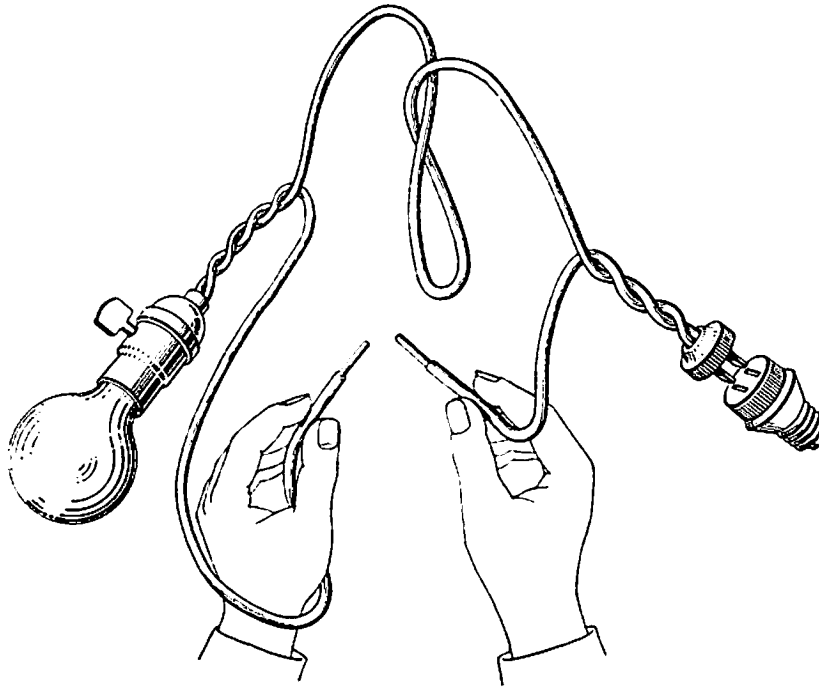

Fig. 77. Showing the lamp in series, which is used for testing open circuits and short circuits

assembled rheostat should be removed from the control box. Disconnect the main insulated wires attached to the rheostat, remove the four holding screws *1*, Fig. 76, and lift out the rheostat. See that all the tap nuts are tight. Examine the wire connectors to make sure that they do not touch one another. Inspect the flat resistor ribbon carefully for breaks. If a rheostat unit is defective, it can be replaced easily with a new one. It is necessary only to remove the unit studs, nuts and spacers which hold the unit in position. It is essential that the new unit bear the same part number as the old one. When reassembling the parts, make sure that the connecting wires are separated and that the tap nuts and screws are tight.

Testing the Rheostat. The rheostat can be tested with a lamp in series before it is returned to the control box. The test lamp and its connections are shown in Fig. 77. Connect the lamp in series with the rheostat and move contact shunt *4*, Fig. 76, back and forth across the contact buttons *3*. The lamp should remain lighted on each button. If the lamp goes out on any of the buttons, it indicates that the resistor unit or the connecting wire for the button is defective or that a connecting screw or nut is loose. When the lamp remains lighted on all buttons and the connections have been restored to their original positions, return the assembled rheostat to the control box.