CHAPTER XX

HEATING THE POT

Gasoline Burners

HARDING: These are capable of very hot flame, and where they are used one should use also a pot plug, described in *Pot Relief Plug Will Help Prevent Cracking,* page 156, to prevent a cracked crucible. Some gasoline burners feed by gravity, others by pressure. The operation is the same.

All burned-out parts should be replaced. The burner cap must fit squarely on the base.

In disconnecting, let a quart of gasoline flow from the pipe under pressure to expel sediment and water. Use extreme care when connecting the hollow wire tubing to the burner, for it is hard to repair the couplings; solder cannot be depended on.

In some, gasoline is filtered through a brass tube full of gravel. The other parts are the same.

Cleaning a Gasoline Burner

HARDING: 1, Disconnect the gasoline line with a wrench, not pliers.

2. Pull out the support rod and take out the burner.

3. Lift off the cap.

4. Remove the two screws from the feed pipe, to free the control and needle valves.

5. Loosen the mouthpiece burner set screw and pull off the mouthpiece burner.

Brush, wipe and punch out all soot and oxides. Run a very fine wire through the needle valve opening but do not enlarge it. If there is a bulge in the cap, replace the cap; also the needle valve if it is corroded.

The gravel tube, the two slotted screws in the ends of the gas tubes below the plate, and the two square head screws near the needle valve must be removed while hot. Always put grease graphite on these screws when replacing. Yellow litharge and glycerine should be used on joints.

Remove the gravel and wash it in gasoline. Blow through all gas passages. See that the needle point is sharp and the end smooth and straight.

Re-connect. Use wood alcohol to generate, to avoid soot. Adjust the needle valve for the best blue flame. Use the control valve to regulate the flame. Use only heating and lighting gasoline.

When gas escapes around the control valve, unscrew the bushing and wind a thin strip of rope asbestos around the rod.

Metal dripping from a minutely cracked crucible is invariably encountered on gasoline pots because of the intensely hot flame. Use the pot relief plug.

How a Gas Burner Should Work

LOOMIS: The following applies to either natural, artificial, or bottled gas. You want a blue flame. A *floating* blue flame indicates too much air. A yellow flame indicates too much gas. Bottled gas burner orifices must be smaller than those for natural gas. Bottled gas cannot be controlled in any other way.

Keep burners free from soot. The throat burners should be about 2″ long, bent toward the front, and the tops flattened to spread out the flame. Most pots require a baffle plate between main burner and throat burners to assure air to the throat. Be sure the baffle plate is in place that protects the mouthpiece burner from the throat draft, for his draft is oxygen-less and will not allow the mouthpiece burner to burn properly.

The crucible flues, one on each side of the throat at the top, must be open, and the top of the pot jacket must provide escape for the exhaust air that comes up these flues; otherwise the fires will be smothered.

Governors

HARDING: There are many types of main line governors. Your gas installation man will handle this. Let us be concerned with

Pot Governor or Thermostat

It is well to remember that there are two ways of making an expansion thermostat; you can have the expansion rod in a fairly stable case, or you can have a stable rod in expansion case. The only difference is that the adjusting screws work in opposite directions.

Even most older types of expansion thermostats will work well if cleaned, graphited, and adjusted.

The mercury thermostat is now obsolete. It gradually lost its expansive power and allowed the metal to overheat, which in turn further damaged the

mercury tube. Wherever this type has blinked out – usually shown by very slow responsiveness and consequent extreme variation of metal temperature – it should be replaced by F-3425 or a similar thermostat.

Electric Heaters

There are many types of electric heater. Books of instruction are still available for most of them.

As with all electrical equipment, when trouble occurs, look for blown fuses, loose connections, bare wires, dirty contact points, or misadjustment of the thermostat.

LOOMIS: I am very fond of a bell-tester if the trouble gets complicated. With a bell-tester you can detect rather small grounds by connecting one terminal to the machine and the other to various wires (sometimes necessary to try this with the machine in motion); you can also ascertain if an element is still working or if it too has a ground – in other words, if juice is leaking through it.

Most of the trouble in electric pots seems to come from grounds. These are small leaks, not serious enough to become shorts but nevertheless destructive of the efficiency of the heating equipment. *These cannot be located with a lamp tester.* There must be a ground tester such as a bell box (old style telephone box with a magneto turned up by hand). A neon tester will show smaller grounds, but I have been unable to rely on it.

The worst job I ever got into was in a flour mill, with an Intertype electric pot. The heating began to go haywire. It was tested by every electrician in the country, with no result. I went over and spent eight hours. Still no result. Finally the plant electrician and I got together on it. At the end of twelve hours of exhaustive tests, I discovered the fault, entirely by accident. An invisible film of matter had settled on the slate panel board out of the air, so that it would ground any juice that came into it. A neon tester touched to the board, with the other contact grounded, would show a faint glimmer. We put on a new board and the trouble was over.

Linotype Heaters

On most machines these are four: two main pot, one throat, one mouthpiece. The throat and mouthpiece must be bought for the proper voltage; the pot elements are always stamped 110; they are connected parallel for 110 and in series for 220.

The first Linotype heaters were high-low-and-medium. Then came the rheostat, then the dynamic thermometer (mercury tube), now the mechanical thermostat.

A Linotype will run on one pot element, but it takes two or three hours to melt down. If either throat or mouthpiece element burns out, you cannot get a slug.

Mouthpiece elements with the terminals at the bottom of the pot most often give trouble because metal has run down around the terminals.

On pots of long usage, look for metal touching wires or terminals under the pot top. Especially look for wires with broken insulation. These wires near the crucible have a special asbestos insulation; any other kind will crumble in a few days.

The crucible must be removed to install a throat heater, and on most pots there is a hole under the throat through which you can reach the head of a screw that must be loosened before the heater can be removed.

The very earliest Linotype throat elements were removed from the bottom without taking out the crucible.

The Linotype mouthpiece element is held in place above the mouthpiece by a clamp, and can be readily removed after the pot top is off.

To Remove the Crucible

LOOMIS: This may take some doing. Loosen the set screw at the left of the mouthpiece — although the pot jacket will spring considerably. Pry up a little near the left front lug with a screwdriver. Use penetrating oil on all lugs, especially the back one, which generally is the hardest to break loose. Sometimes you will have to pry on both sides at the front at the same time. When you get the front end out of the lug sockets, put 6-point slugs under the lugs to hold them up. Now tackle the back one.

With a very large screwdriver, try to pry up the lug, working between the jacket and the crucible. Don't be tempted to do much hammering to loosen it. Those lugs are only cast iron. It may be necessary to run a fairly heavy wire in under the lug and make a loop through which to use a three-foot crowbar for lifting. Then, while you lift with one hand, pry and work the crucible with the other. This is sometimes stubborn but not difficult. Just don't break the lugs or the pot jacket.

To Remove Linotype Crucible Heaters

Remove the pot top. Disconnect the wires. Sometimes these heaters are solidly imbedded in dross, and you may have to pry them loose, a little here, a little there, with a big screwdriver — but gently, so as not to puncture the envelopes. One of these heaters probably is still good.

If the pot is frozen over: If 220, connect the good element to 110-volt circuit; it will take two or three hours but it will do the job.

You can completely melt down the pot with a blowtorch on top, if necessary.

In taking out elements, dip the metal as low as possible. Let the heaters get hot but not red hot; your thermostat rod, not being immersed, will not turn off the current, so watch it. Some heaters will quickly become red hot. This isn't good. With the metal hot, turn off the juice, disconnect wires, lift the elements clear of the metal. Dip out all metal promptly.

Clean out the dross. If there was a clamp holding the elements in place, we presume you loosened it. If there was not, put one on. This is held by an 8x32 screw, and no doubt you will have to drill and tap the hole — or at least tap it. Tapping can be done with the crucible in the pot; drilling *can* be done, but takes patience and ingenuity. Some m-o's use a drill in a small hand chuck. Use cutting oil too.

When you put in the two good elements, be sure they are held firmly in place by the clamp.

New Linotype Mechanical Thermostat for Electric Pots

This also can be applied to outstanding pots, and is very successful. There are varying opinions as to whether or not the bugs are all out of the Micro-Therm, but the mechanical thermostat is truly a dandy. In replacing a mercury type, you will need a pot top also. Be sure the expansion rod does not touch the bottom of the pot. Washers usually are needed. The old pot top can be used, but it is a lot of monkey business to get it drilled.

For maintenance, see that the wires are firmly screwed down, the contacts and roller reasonably free from pitting and corrosion. These can be removed and filed with a magneto file and ground on a smooth stone. If improperly installed, the expansion apparatus may become bent, and should be straightened.

There are two adjustments. Take off the cover.

1. Turn the top adjusting screw so the two levers are separated about 1/16". With the metal at normal heat, set the lower adjusting screw so the roller is about in the middle. Now you can use the upper screw for finer, periodical adjustment.

Linotype Control Panel and Fuses

HARDING and LOOMIS: There is one horizontal fuse (5 amps for 110 volts, 3 amps for 220 volts) inside the panel box to protect the mouth and throat circuit. There are four fuses outside of the box (20 amps for 110, 10 amps for 220). A neon tester is the easiest and safest instrument to use on fuses. Touch one contact to one end of the fuse, the other to the box (or to your finger; it may tingle but it won't hurt). With the juice on, you should get a glow (from the neon bulb, I mean). If the fuse is good, you'll get a glow from either end.

If the fuse is blown, one end will light but the other won't. Of the four fuses, the upper two usually lead to the pot, the lower two to the motor.

The clapper switch is either on or off. It should of course be free on its hinge pin. The contacts on the clapper switch should come up evenly and contact the fixed posts at the same time. The contact arms can be bent to secure this.

The contacts should be reasonably free from corrosion. If necessary, remove them entirely and grind new surfaces on a fine wheel. Finish with fine emery cloth. *Do not use emery cloth in the box,* as it sheds material that is a conductor; use sandpaper instead, unless you have removed the contacts from the box entirely.

At the lower left of the clapper switch is a small plunger which makes contact with a brass extension from the switch. These contacts also should be clean, and they should definitely make contact when the switch closes. The brass can be bent. Sometimes the plunger or the brass tube wears to bind the plunger. The brass tube comes off by unscrewing the nut at the rear, which also provides an adjustment. The plunger slips in from the rear.

On alternating current there is always a hum, which sometimes reaches an annoying level. This can be controlled somewhat by tightening the screws in the bottom of the clapper switch where the hinge pin goes through; some operators slip on washers made of copper or brass thin spaces. I have had best luck with a brass thin space fastened down by one of these screws and bent at right angles to bear against the right side of the lower end of the clapper switch. Just be sure, no matter what you do, that the clapper switch falls freely of its own weight.

The long, round resistance coil at the right of the box is either good or no good. Take it out and test it with a bell tester.

The field coil, around the core that closes the clapper switch, is either good or no good. If you suspect it, take it out. Lay it on the bench and hold a large screwdriver firmly on the bench through the hole. Connect wires to the two terminals; plug in one to a live circuit, and *barely* touch the other one to the ground wire. If the coil is good, it will jump upward around the screwdriver. (This test courtesy of Lawrence Morris.) *Do not* maintain a circuit through the coil, or you will burn it out.

Other things than a burned-out coil can cause failures of the clapper switch, however – and usually do. In 99% of the cases it will be a failure of the thermostat, which we shall take up a little later.

The Linotype Rheostat

This is the round thing which has an adjustable dial. It is made of one fixed contact and a series of buttons of varying resistance. One button can burn out and the others be all right. To locate the burned-out button, test the lead-in

wires with one contact of a neon tester on the screws, the other on a finger; the live one will glow. Disconnect the other. Turn off the juice. Take off the rheostat so you can see the buttons. With the lead wire not grounded anywhere, turn on the juice. Use the neon tester to find out where the glow suddenly quits, and this is the burned-out button. Solder a piece of copper wire to connect the posts on either side, so it will not interfere with the rheostat arm. Order a new rheostat.

Remember, this controls only the throat and mouthpiece.

Micro-Therm Heater

HARDING: This does away with thermostat and panel box. The rheostat is quite small, and includes both a manual and an automatic control. This equipment may be applied to outstanding machines, but the four heating elements also must be replaced. They look different but are cared for and tested the same. The controls are operated by a non-volatile liquid, and in severe cases of overheating are subject to damage the same as the old mercury control.

For care and adjustment of the Micro-Therm, write to Mergenthaler Company for their literature. This is readily available.

Intertype Heaters

HARDING: Intertype pots have one element for mouthpiece and throat, two for the main pot (these fit on the outside of the crucible). These latter two are wired in series for 220, parallel for 110, as on Linotypes.

Intertype Electric Thermostat

HARDING and LOOMIS: The first type has two contact points at the top, and a lever pivoted on two ball bearings. Most trouble arises from broken fiber insulating washers (often none at all), and from installing the lever cold and tightening it too much. Cold, it should have at least 1/32″ play between the ball bearings. Check it as the thing heats up.

Adjust the screws to allow about 1/32″ between the contact lever and the post against which it is not resting.

The newer style thermostat is turned upside down, but is essentially the same. The fiber washers have been eliminated, which is an improvement. These are both good thermostats if they receive half-way adequate care.

Watch for distortion of the expansion rod — as on any thermostat of this type.

Testing Intertype Heating Elements

If the throat element or rheostat is inoperative, the machine will not cast a slug. If a side crucible unit is open, the metal on that side will stay solid. They can be tested with a plugged-in light bulb or a bell tester.

Intertype Control Panel

HARDING and LOOMIS: This also has a clapper switch very similar to the Linotype switch. As on the Linotype, the opening and closing coils carry current only at the instant of contact; the movement of the clapper switch shunts the current away from the coil.

Closing Coil Control Springs in Intertype Old Style Panel Box

A stud or shaft passes through a split bearing in the rear end of the notched contact arm. When the circuit is open, the stud presses against the springs; when it is closed there should be 3/16″ clearance between springs and stud, secured by bending the springs. See that the stud makes contact with both springs.

To Remove Intertype Throat Heater

Disconnect the three thermostat wires. Remove four screws from corners of the thermostat base, and two at the sides, and the thermostat can be removed. Remove the pot top. If the plunger is frozen in the well, you will have to disconnect the plunger spring, remove the pump stop bracket and the whole pump bracket assembly. Remove terminal cover and clamp, disconnect the lead wires, and pull out the element.

To Remove an Intertype Side Element

Disconnect the thermostat and remove. Remove the two flat-head screws at the sides of the expansion rod. Take off pot top. If plunger is frozen in, same as above. Remove terminal cover and clamp, disconnect lead wires, pull out element.

Lower Pot Thermostat on Monomelt Equipment

To adjust, remove the large screw cap from above the expansion rod and turn anti-clockwise for less heat. There is another finer adjustment in the small make-and-break control box. Use a 1/16″ pin punch or similar small rod to turn the screw head at the bottom. Turn to the left for more heat. Don't touch other metal with your turning instrument or there will be fireworks. A round toothpick is safe and therefore easier to use if the screw is not too tight.

To Remove a Dynamic (Mercury) Thermostat

Engage contacts L and C. Remove the pot top, turning off the current when you lift it. Turn current on again and through L and C, heat the metal to about 650°. Dip out enough metal to expose the thermostat bulb. With the power off, disconnect the three wires and label them. Remove the two screws behind the thermostat coil and lift out the thermostat.

Elements that Squirt Metal Upward

Occasionally on immersed elements there will be a "hot spot" that causes metal to splash over the machine, sometimes on a very high ceiling. Throw a handful of loose slugs on top of the metal at the spot where the break-through usually occurs, before melting down.

To Remove Thermostat From a Frozen Pot

This is not difficult. Disconnect lead wires. Remove screws from base of thermostat, then remove screws from the base that holds the thermostat on the pot top. On an Intertype, the screws that hold the thermostat to the expansion rod must come off. On a Linotype, the thermostat is held to the rod by a nut.

Monomelt Upper Pot Adjustment

Remove the cover. The adjustment screw is at the right side and bears directly on the expansion rod, which in this case lies horizontally.

When Pot Fails to Heat

HARDING: Be sure the switch is "on."

Use the neon tester to ascertain that current is reaching the panel box.

Test fuses.

Look for a loose connection at the thermostat.

Be sure contacts at the thermostat are clean.

Be sure the thermostat contact lever is working.

Test coils and elements, and test for a ground or an open circuit.

When Metal Overheats

HARDING: Generally this is a failure of the thermostat.

See that all contacts are clean, especially the brass projection that touches the spring plunger at the left side of the linotype clapper switch, and the thermostat contacts. See that clapper switch and thermostat contact lever move freely.

Test for a ground, which will produce a larger-than-usual spark as the contact lever of the thermostat makes or breaks contact. Such a spark may spot-weld the contacts.

Mouthpiece Does Not Heat

Sometimes a burned-out throat or mouthpiece element, either of which will open the circuit. Sometimes metal shorts out the wires or contact points. More likely, however, it's in the rheostat. Try turning it to a different spot.

Testing for Grounds

HARDING: For some reason this is often puzzling to electricians, but I favor the bell tester used by Loomis. First touch the two wires together as you crank briskly, to be sure the bell is working. Then put one terminal on the machine and touch the other to various electrical parts — wires, terminals, element jackets, thermostat frame, etc. Watch to see that you get a ring when you should, and not when you shouldn't.

Fluttering Switch

If the thermostat contacts do not make or break positively, you will get this. On the mercury thermometer there is a flat spring on the back side of the contact lever, which should have enough tension to prevent the lever from vibrating, but not enough to prevent free movement of the lever.

In the new style Linotype, have enough tension on the spring wire that carries the roller to prevent vibration. It should go over the middle contact and stay put.

The spring plunger at the left side of the clapper switch must make firm contact.

On Intertype, check the 1/32" space between thermostat contacts; if it is not there, you may get fluttering. The short coiled push spring may be defective. And the space in the panel box (old style) between the diagonal closing coil contact springs and the horizontal stud below must be 3/16" when the switch is closed.

When Resistance Coil Burns Out

HARDING: A temporary substitute is a 150-watt light bulb.

Electric and Gas Pots Interchangeable

These are freely interchangeable.

Packing the Crucible

Electric pots are packed with dry asbestos, gas pots with wet. On either type, the mouthpiece at the last is packed firmly with wet asbestos to prevent squirts from going inside.

Use good flake asbestos, preferably mixed with a little Portland cement or magnesium sulphate if it is to be used wet.

On an Intertype electric, the Company recommends turning the pot upside down and packing as much as possible, then finishing right side up. At any rate, on either, fill all the loose space with asbestos.

(LOOMIS: Don't tell on me, but I generally use wet asbestos to form a protective shield over the terminals under the pot top. Of course this will short circuit if the juice is turned on before it dries. But once dry, it protects the terminals from stray metal.)

A gas pot is packed differently. Make a thick paste. Remove the crucible and pat into place about ½" of wet asbestos all around. (LOOMIS: I personally leave an open space around the top of the crucible, but some fill this in.) Put the crucible in place. Check to see that the two flues, one on each side of the throat, are unobstructed. Also, in front of each flue you will need an opening about the size of a pencil to act as a chimney for fumes from the mouthpiece burner. A really good packing job, done wet, requires a couple of days, for the asbestos shrinks and needs repatting into shape as it dries. But you can do it at one fell swoop if you have to.

Pack also the pot top, seeing that you leave space for the fumes that arise from around the crucible and from the two flues. Finish by putting on the top and packing around the throat top and bottom, to isolate the mouthpiece.

Be sure the deflecting shield is in place to protect the mouthpiece burner from the waste gas from the main burner.

When first melting down an empty electric pot, try to keep slugs flat against the heating elements, or fill the pot with shavings from the saw, to avoid operating the heaters in open air.

Pot Heat Creeps

QUESTION: I get my heats all nicely set at 525°. Then next week they are back up to 550° — and this happens invariably. What is wrong? — M.C.J., Lawrenceburg, Tenn.

HARDING: First, there must be space between the bottom of the expansion rod and the bottom of the pot. However, all pots creep. This applies, I think, to any type of thermostat, gas or electric. If the thermostat is the expanding-case type, the heat will creep up; if the rod is the expander the heat will creep down. It is very seldom that you find one that does not change.

LOOMIS: I would say never.

Can Mercury Tubes Be Repaired?

QUESTION: The heat range on my pot sometimes is almost 100°, and I understand this is because mercury has escaped from the tube. Can this be repaired? — L.K., Heron Lake, Minn.

LOOMIS: It cannot. Replace it with the mechanical type thermostat.

To Remove the Metal Pot

HARDING and LOOMIS: Occasionally this becomes desirable for the small-town m-o. This can be done without removing the mold slide, but for one without experience it will work out better to remove the mold slide. These are the steps:

1. Dip the metal from the crucible, remove the plunger, and turn off the heat.

2. Remove the thermostat, disconnect and tag the wires. If a gas pot, disconnect the thermostat and remove the burner.

3. Turn the machine until the pot moves forward, and pull out the pot balancing spring, then allow the machine to move around to normal, and far enough to let the elevator head barely rest on the vise cap.

4. Lower the vise to second position (have you disconnected the link and the vise closing link?).

5. Remove the splash shield.

6. Remove the ejector link.

7. If a water-cooled disk, disconnect the pipes. If air-cooled, unfasten the blower pipe. If not cooled, relax.

8. If a Linotype, set the blade at 12 picas and take out the long screw; drop the controller.

9. Lower the mold cam lever handle and pull out the mold disk and slide. Watch the ejector slide if it is old style.

10. Tie the metal pot forward to the face plate.

11. Loosen the set screw in the pot lever shaft (Linotype) or remove the screw from the center of the shaft (Intertype) and remove the shaft. Note exact position of washers on Linotype shaft.

12. Remove the pump stop bracket.

13. Loosen the front pot leg adjusting screws and remove pot leg caps.

14. Replace the pot lever shaft for use as a handle.

15. Get an old main drive belt; run it between the pot legs and over your shoulder. You can now lift the pot while somebody steadies the legs; move the pot forward and out.

In replacing the pot, put hard oil on the nipples of the pot leg bushings. Be sure the nipples go into their proper holes in their pot legs. Watch out for fingers. When you get all through you should have ten.

Some m-o's take off the mold cam arm, but that should not be necessary. Others take off the pot plunger bracket, but that involves several operations, and the pot can be maneuvered out without it.

LINECASTING OPERATOR-MACHINIST

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