THE LUDLOW MANUAL OF INSTRUCTIONS

with

PRICE LIST OF PARTS

NUMBER

3

LUDLOW TYPOGRAPH COMPANY

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Contents

Manual of Instructions

Price List of Parts

Foreword

There is nothing difficult about the operation of the Ludlow Typograph. It is simple in the extreme. Any hand compositor can quickly acquire a familiarity with the details of the operation. No particular skill is necessary, as, for instance, is demanded for the successful operation of a keyboard machine.

Although this is true, the Ludlow like a keyboard machine is a mechanism, and in common with all mechanism, needs care and attention.

This book is written for the purpose of enabling Ludlow operators everywhere to meet all possible conditions demanded of them, and to take proper care of their machines, that these conditions may be met.

In ordinary use many of the conditions herein described will not be encountered, but these instructions are given for the purpose that the Ludlow may give long, continuous and accurate service.

How to Order Parts

1. For convenience in manufacture, each part on the machine is listed in the group to which it belongs and given a symbol number. This is the practice followed in the part list.

2. Each part is illustrated and reference is made to the plate on which it can be found. The symbol number of part is given on the plate illustrating the part.

Example —

Parts Nos. 11, 12 and 13 are listed under Frame Parts. Part No. 12 is a screw and can be identified by reference to screw, bolt, nut and dowel chart, shown on Plate 20. The same is true of part No. 13.

3. When ordering parts always give part number shown herein. Every part is given a code word for convenience when ordering by telegraph.

The Ludlow Manual of Instructions

ASSEMBLING AND ERECTING

Erecting Equipment

Place the Ludlow in the position it is to occupy and have the necessary gas and electric connections made.

Before you try to do anything with the machine read these instructions first and familiarize yourself with the general principles of operation. Avoid attempting to make any adjustments until you are sure of what you are doing. All Ludlow machines are carefully assembled and tested at the factory so that all operating parts are known to be in perfect adjustment and condition.

The grease applied to protect the finished parts and cams of the machine in transit can be easily removed by using benzine.

Wipe all finished parts and cams of the machine.

Unpack the box crated with the machine and check its contents with the invoice attached therein.

Order of Assembly

Assemble the machine in the following order, and you will avoid confusion and omissions: (1), insert the metal crucible; (2), put on the delivery slide; (3), starting mechanism and table catch; (4), table lifting lever; (5), machine top; (6), locking release tripper; (7), locking levers; (8), mold; (9), slug pusher bracket; (10), galley bracket and galley; (11), turn the machine over by hand; (12), oil well; (13), connect the motor.

Assembling Metal Crucible to Machine

Insert the guide roller in the surface track of the metal crucible cam; this cam is the second one from the left as you face the machine. Drop the lugs at the rear of the metal crucible within those of the swivel plate at the back. Turn the swivel plate till it receives the lugs, line up and insert pins in place. Secure these by inserting the necessary cotter pins.

To Install Connections

When connecting the tubes (See Figure 3) screw tight body (A) in place. Then draw sleeve (B) back about one-half an inch from end of tube. Place tube in the body as far as possible, holding firmly and screwing sleeve tight into the body. It is advisable to remove screws holding down the thermostat when making the upper connections. The loops in the tubes allow adjustment for any variation between the connecting points.

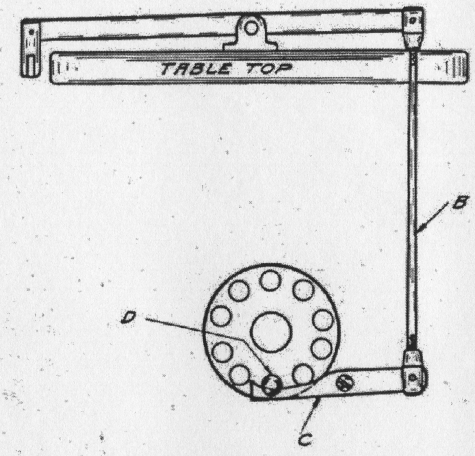


Fig. 1

End View of Starting Mechanism

After the metal crucible is in place, release the plunger from the connecting rod (Part No. 274) (refer to Plate "A") and insert the upper plunger connecting rod (Part No. 271) and screw down until the holes are in line with Part No. 253. The plunger is always

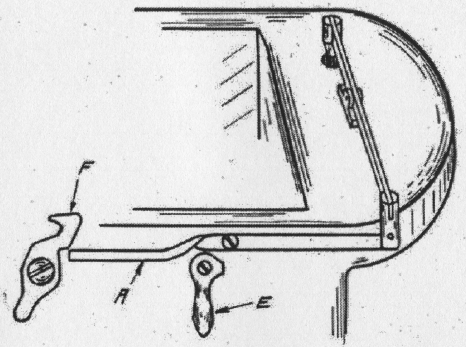


Fig. 2

Front View of Starting Mechanism

frozen in the right position before it is disassembled at the factory. The port of the well should be open at least 1-16 of an inch when the machine is at rest. When you have connected the plunger rods properly, tighten lock nut (Part No. 59). It is very important that this nut be tightened securely.

Assembling Delivery Slide to Machine

The delivery slide is assembled before leaving the factory. It is operated by the third cam.

To locate in machine, place pin held by lugs on bottom of slide into fork of operating arm. This slide is held in frame by two gibs. The one on the left is formed by the use of the mouthpiece bracket and the right by gib and operating rack (Part No. 680).

Starting Mechanism

Figures 1 and 2 show how to attach the starting mechanism and its operation.

Pressing up on the lever (A) (Figures 1 and 2) raises the rod (B) which draws the finger (C) away from the clutch pin (D). The pin is pushed into the first one of ten contact holes in the clutch disc by a spring and makes one revolution, riding out on the finger (C) when it is completed. Adjustment of the starting mechanism is made at the rod (B).

Also when the starting lever is raised, it locks the top of the machine to the body by slipping the catch (F) over a pin in the top. This catch should stay in place during the cast.

The greatest care should be exercised in placing the machine top. In order to insure such care have a man at each end and insert the lugs into the hinge brackets at the back evenly, as they fit very snugly. Thoroughly line up the hinges before attempting to drive the pins in place. When the pins are set in proper position secure them with the set screws in the table lug.

Locking Lever

This is shown in plate No. 12 as part No. 546, and its location is the highest point on the machine top. It is used to lock the line of matrices or blank slug block firmly in place before starting the casting mechanism.

This is accomplished by grasping handle of the lock down lever with the left hand and pressing it down to the right.

Important: This lever cannot be locked down properly without a line of matrices or a blank slug block being in place over the opening in the table top above the mold, due to impairing safety devices.

Locking Release Lever

This is the lever that unlocks the stick after the cast is made. It is operated by a pin on the main slide in back of the mold seat. Suspend the tripper on the locking release bar before fastening it to the table. To properly fasten the tripper to the bar, shove the tripper forward on the bar until the small pin running through the bar at the right fits snugly against the thumb screw holder. The thumb screw faces the rear of the machine. Adjustment of the locking lever release is made by turning the locking release rod to the right or to the left. To release the stick pull the thumb screw to the right.

The Mold

The mold is secured by the four screws and two dowel pins that will be found in the mold seat.

Bottom of mold and top of mold seat should be thoroughly cleaned before screwing mold in place.

Slug Pusher Galley and Galley Bracket

The slug pusher galley and galley bracket are fitted

with dowel pins to insure proper position. It is only necessary to screw them in place.

Turn Machine Over

After assembling machine, it is advisable to raise the table top and turn the machine over by hand to see that it runs smoothly before using the power.

Test for Lockup

Bring the mouthpiece of the crucible up under mold by hand until in compression. Look into the mold to see that the mold centers over the holes in the mouthpiece. This adjustment was made before the machine left the factory and you should not have any trouble relative to this test.

To test the lockup endwise separate the mold and mouthpiece far enough to insert a cigarette paper under each end of the mold. Then bring the mold and mouthpiece back into compression. When both ends are held tightly it indicates proper adjustment.

OPERATION

Ludlow Composition

Hold the Ludlow matrix stick in your left hand, as you would any composing stick, with the sliding block from you and the pica scale to the left.

Ludlow sticks are graduated to pica ems. It is not necessary to set the stick preliminary to composition. Set your line and space it out to the measure desired—this will be to the line at top of the figure in the pica scale—then quad out and lock by means of the adjusting screw at the end attached to the movable quad block.

The output of Ludlow composition depends largely upon the general qualifications of the operator, whose speed is governed entirely by dexterity in handling the matrices. Two methods have been fully tried out—one is that of composing a word or more before inserting matrices in the stick; while the other adheres strictly to the same manner in which the printer sets ordinary type, placing each matrix in the stick as it is taken from the case.

Justifying Lines

When you have set the required length of line, allowing for justification, insert the necessary spaces. You will soon learn to judge accurately what spaces will be required to justify a line and will find it is done much more quickly than the same spacing can be done with type.

Having spaced a line to the required measure, fill out with large quads and tighten just enough to hold the matrices from falling out when the stick is turned bottom up. Locking too tightly is liable to throw characters off their feet. Proof-read your line.

Centering Lines

To center a line, place one-half the remainder of the measure in front of the line, and quad out the remaining space. Short lines to be centered on 23 to 30 ems are easily handled in a single stick. For instance, if you have 11 ems of matrices to center on a 27-em

measure, place 8 ems, half the difference between 11 ems and 27 ems, in front of the line, quad out the remainder and cast. In assembling this line in the form you simply drop a 6-em slug after the 21-em slug. This procedure removes the necessity of handling the extra 21 ems of quads necessary when using the double measure stick.

Work that does not have to be trimmed to measure may simply be centered in any Ludlow stick that will accommodate it, allowing the excess blank slug to serve as furniture in the lock-up.

Matrix Stick

Ludlow sticks are also made in two and three slug lengths in which lines longer than the mold length are set. When holding the stick in your left hand in position to compose a line the niches in the upper edge act as stops when pushing the stick up for the second and third casts; and in the opposite side the indications are shown for inserting the division quads which form the floating pieces limiting the length of the respective slugs.

Try to work your measures to multiples of your mold. With the 21-em mold endeavor to hold your measures to 21 ems rather than 22 or 23 ems, or to 42 ems rather than 43, 44 or even 45 ems. This saves time, and the shorter measures will usually be more satisfactory.

Repeat Lines

It is advisable to go through your copy and select all repeat lines, also those that are very similar and of the same measure. Sorting the work in this manner greatly helps in production.

Two-column step headings may be set in a Ludlow stick with the first line to the left and the second line to the right. In setting them up in this manner one justification and one trip to the machine are eliminated. Short pieces of blank slugs may be used if it is desirable to have the lines run full measure.

Casting the Line

Place the stick over the opening in the table of machine for casting with the lock-screw toward you. Push it against the stick-stop, holding it there until the locking lever is securely locked down. When using multiple sticks always shove the stick in place for the second and third casts, holding until locked down or your slugs will not properly join. If you let go of the stick before it is locked, the spring in the stick-stop will push the stick back a trifle, which will make a space between slugs. Never lift the table top after starting the machine until the stick has been released.

When casting a number of six-point slugs, loosen the large spring that operates the plunger. This spring works on the principle of a turn-buckle. There is a lock-nut at the bottom. Loosen the lock-nut before turning the spring and tighten the lock-nut after the adjustment has been made.

Speed

Grasp this fact at the outset: Speed on the Ludlow Typograph has only one limitation; that of its operator. Study your machine, but above all study your

Metal Crucible Adjustments

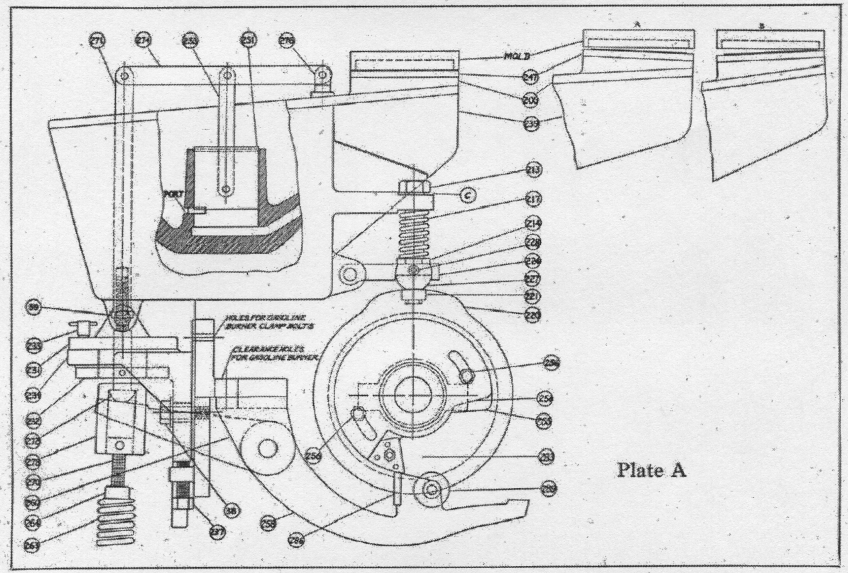


Plate A

methods, for it is upon them that ultimate results depend.

Six Point Lining Gothic Stick

The six-point Lining Gothic stick allows the casting on a six-point slug, of a line of six-point Lining Plate Gothic typefaces, flush with the bottom of the slug. This stick is essential when the six-point Lining Plate Gothic typefaces are to be set solid. All sizes of the Ludlow Lining Plate Gothic typefaces align at the bottom, and the casting of the six-point sizes on the six-point slug would give an overhang at the bottom if locked in a standard matrix stick for casting. To eliminate this overhang, the six-point Lining Gothic stick is made with a side lockup variation of three points. One side of the stick is three points wider than the other side causing the line of typeface matrices to be lined along one side of a six-point mold when locked in position for casting.

Off-Set Stick

The Ludlow off-set matrix stick is used to obtain variations in top and bottom alignment of Ludlow typefaces. This special stick allows six points space between the side of the stick and the bottom of the line of typeface matrices when assembled in the stick for casting. The matrices can be moved against or away from the sides of the matrix stick for any alignment. When the combination of typefaces is arranged, such as caps and small caps, aligned at the bottom, the quad block at the end of the stick is tightened locking the matrices in the desired position for casting. This matrix stick is used to great advantage in aligning caps and small caps.

CARE AND ADJUSTMENTS

Keep Machine Well Oiled

It is imperative that the machine be properly oiled if the machine is to be kept in good operative condition, and is to give service over a term of years.

The operator who does not keep the Ludlow well oiled and clean has not the first qualifications of a good operator.

The Ludlow is a machine of slow motion and it does not require great quantities of oil.

Caution: Do not use poor oil. Always wipe away all surplus, and avoid getting oil in the mold.

Instructions for Care of the Ludlow

1. Clean all metal off the working parts.
2. Oil all the parts regularly.
3. When replacing a mouthpiece wiper, always soak the new felt in oil before applying, then see that it wipes surface clean.
4. Remove the mold and scrape away adhering particles of metal from the bottom with a slug. Wipe the mold, mold seat, and trim knife thoroughly before reseating the mold.
5. Lower the top and cast a blank slug. Note this slug carefully. If it is light and hollow the metal may be too hot. If its surface has a wrinkled appearance it is cold. Regulate the heat accordingly. The bottom of a perfect slug will show the holes and vents of the mouthpiece on its bot-

tom, and its entire surface will be smooth. A thermometer test of the metal should show around 540°.

6. The Ludlow Typograph is a machine of few and simple parts. It is easy to understand, to adjust and to operate, but it must be kept clean, oiled, and receive at least ordinary care. If the machine is used by both day and night forces, one man from each force should attend to this work. He should see that screws, nuts and bolts are tight, and this responsibility should be given to one man to insure proper care.

Description of Ludlow Equipment, Layout

One of the most economical features of Ludlow equipment is compactness. This feature saves travel, time and the energy of the printers, and floor space in the composing room. The cabinets are grouped as closely as possible about the machine, keeping the spacing material centrally located. Group matrices by type faces that will be used most, close to the machine. This will save many steps. The cabinets are not hard to move, so you can move them about until you have the best layout suited to your office.

Place the cabinets so there will be little danger of persons running into open cases.

Keep Accessories in Place

Do not cast a line and lay the stick down full of matrices. Return the matrices and the spaces to their proper places and keep them in order.

Ludlow Stick

The Ludlow stick is not only a receptacle for matrices, but also part of the casting mechanism. The stick is accurately made and must be used carefully. Do not use it as a hammer. Be careful not to drop it. Keep your Ludlow sticks clean and free from rust.

Steel Matrix Cabinets

There are two styles of matrix cabinets, the 16-case steel matrix cabinet with eight cases pulling from each side, and the 20-case steel matrix cabinet with all cases pulling from one side.

Lay the matrices in the cases with the cap side to the cabinet, figures and points above the lower case. Keep the cases closed when not in use to avoid upsetting the matrices and to exclude dust. Each case is provided with a stop which can be released by pressing the spring lever attached on the bottom of each case on the inside right hand corner, permitting the case to be removed.

Matrices

When properly used, Ludlow matrices are practically indestructible. They show but little wear in shops where they have been used for several years.

Matrices receive more hard wear on the table top of the machine than from any other source. This is caused by dragging the stick full of matrices across the table top and laying the stick down on the table top. It is advisable to obtain a large piece of felt blanket or a heavy piece of bookboard of suitable size to cover the

space to be protected on the table top, then fasten under the guard-rails that surround the machine top. This will assist greatly in keeping the matrices in good condition.

You will find that this protection for the matrices will also tend to keep the working surface of the machine top cooler.

Clean Plunger and Well Once a Week

A dirty plunger is the cause of light slugs more often than any other trouble with the exception of an overheated mouthpiece or metal being low in crucible. When dirt accumulates in the well and on the plunger, the plunger cannot give a full stroke, is retarded in motion and does not deliver a charge of metal with sufficient force to fill the matrices and mold. This is especially so with reference to the larger faces. Attend to this work at the beginning of the day and you will not have trouble when you are handling rush work.

To remove the plunger raise the table top. Remove the pin that holds the plunger connection lever to the crucible, throwing the pin holder back against the table. Then raise the connection rod until the plunger is free from the well. Remove the pin holding the plunger and swing the connector rod free. Remove the plunger with a pair of pliers, and with a clean piece of cloth wipe it thoroughly. If dirt is adhering to the surface take a piece of fine, worn emery cloth and polish the surface lightly. Next clean the well. Be sure to remove all metal from the well.

A good tool for this is a thin piece of sheet brass made into a semi-circle that will fit the well and which is fastened to a long handle. With such an instrument you can scrape the well very thoroughly. Before putting the plunger back grease it with tallow. This retards the accumulation of litharge on the plunger and in the well, which is the principal substance that gathers on these parts. Ordinary machine oil will do in the absence of tallow, but animal or vegetable fat is better than mineral oil.

Should the plunger become cold, so that the metal chills when you insert it, let it rest on the well top a few minutes. In replacing the plunger, try plunger in well to insure free movement to bottom of well.

Care of Molds

Give the molds careful attention. Keep those not in use well oiled and stored away in an oiled envelope. Never lay one down on an iron surface, nor with an accumulation of tools. Ludlow molds are not adjustable and should not be taken apart.

To remove a mold from machine, it is only necessary to remove the four large screws, insert the mold handle and lift it off. Before replacing, thoroughly wipe the mold seat.

Changing Ejector Blades

To change an ejector blade, loosen the large screw in the ejector clamp.

In replacing ejector, thoroughly clean and be sure to seat properly on base.

Shut Off Power if Machine Stops

It is advisable not to attempt to force the machine should it stop while making a cast. Forcing the machine may shear the safety key in the large enclosed gear wheel on the right of the machine. This key is purposely made of soft material so that it will shear off rather than break some of the interior cam rollers, or pins.

Mouthpiece Wiper

Keep a clean, well-oiled piece of felt in the wiper holder. Oil the felt once a day. It is not necessary to remove felt unless worn.

Replacing Mouthpiece

Do this *while the machine is hot*, otherwise the screws will break. Before refitting, thoroughly clean all surfaces and put a little graphite and oil on each screw before inserting. Set all screws firmly. *After about 15 minutes give the screws an extra turn all around.* Do not stone or file the mouthpiece down to get adjustments. Leave the vents as they are; adjust the pot itself to get proper contact.

Stick Stop

This device regulates the position of the type on the slug, endwise. If the face does not come flush with the end of the slug you can make proper adjustments with the adjustment screws found in the back piece of stick stops. When casting with long sticks, use knob to operate stick stop slide. (See page 15, paragraph "Safety Finger").

Ludlow Motor

The motor used on the Ludlow is approximately one-sixth of one horse-power. If kept well oiled it will need little other attention. The oil cups are of the gravity type, and should hang from the bearings. Notice whether those on your machine do so. If not, remove the cap screw underneath and transpose it with the oil cup. To fill the cup, remove the cap screw, letting the oil run through the bearing into the cup below. If the brushes squeak first pull the connection plug to avoid blowing a fuse, and put a little vaseline on the commutator and wipe off. In the absence of vaseline, oil will do.

Trouble

An endeavor is here made to cover the most frequent causes of trouble to be found in the operation of the Ludlow, but with ordinary care on the part of the operators there should be very little trouble as to the operation.

The Ludlow, when turned over to the user by the Ludlow erector, will be in perfect adjustment. But no matter how perfectly adjusted, ordinary care is required to keep it so. Hot metal is hard to control on account of its extreme fluidity. All hot metal machines require certain adjustments. The Ludlow Typograph has provisions for making all the necessary adjustments. It is the duty of the operator or machinist to learn these adjustments and to see that the machine is in perfect condition at all times. However, should trouble appear, be sure you understand it before using a hammer or a file or forcing the machine in any way. Too hasty use

of such tools often puts a machine out of operative condition until new parts can be obtained.

Temperature of Metal

Successful, continuous operation of the Ludlow depends upon three things; care exercised in handling, a clean plunger, and the correct temperature of the metal. The last two, of course, depend on the first and are equal in importance. The necessary care of the plunger has already been explained, and the temperature of the metal should be given careful consideration.

The metal should be kept at a temperature of 530 to 550 degrees F. In the absence of a thermometer, fold a piece of white paper and insert it in the metal. If the paper burns or turns dark brown, the metal is too hot; if it merely turns a very light brown the heat is about right.

Casting with Cold Metal

A cold throat and mouthpiece will cause the mouthpiece to freeze in making a cast. A slug may be delivered on the first cast, but the metal, if too cold, will "freeze" in the mouthpiece and prevent a second cast. This trouble is readily detected and the remedy is to apply more heat by turning the gas flame up at the needle point of the mouthpiece burner or by advancing the indicator on the rheostat when electricity is used. As soon as perfect slugs are cast turn the gas or electricity back to normal.

Slugs Stuck in Mold

A slug stuck in the mold will stop the machine. If this should happen, immediately stop the motor and allow the mold to cool. Then back the machine up slightly by pulling on the belt attached to the driving gear, and switch on the motor. If the slug is not ejected, stop the motor and remove the mold, allowing it to cool. Lay the mold, bottom up, across two pieces of wooden furniture, and drive the slug out with a piece of wood. *Never use a screw driver, a nail or any iron tool* when removing a slug from the mold.

Slugs Stuck in Matrices

If the metal gets too hot while casting slugs, the slugs may run light and stick in the matrices. To remove the slug from the matrices lock the stick in the machine, raise the table top and use a pair of pliers. Don't twist or jerk the slug out, pull easily and gradually. When new molds are first put into use, slugs sometimes stick in the matrices, but with a little use this trouble soon disappears. The slugs will also stick in the matrices if they are battered, this condition being due to misuse, but rarely occurring, as Ludlow matrices have a wearing power of many years. However, in the space occupied by the Ludlow equipment it is advisable to have the floor, if concrete or iron, covered with linoleum. This guards against unusual damage to matrices when they are dropped.

Light Slugs

There are several causes for light slugs. The principal cause is a dirty plunger and well. A dirty plunger will prevent a full stroke. The result is a light slug, because not enough metal is forced into the mold. If

the plunger is dirty, it will become tight in the well, which will retard the full stroke. This may be detected while the machine is in operation and when the metal pot swings for the casting of slugs.

The large spring that operates the plunger may not have tension enough to force home sufficient metal. In such case loosen the lock-nut at the bottom and give it a few turns to the right.

The plunger may be set too low to allow a proper intake of metal. In this case raise the plunger by turning up the plunger connecting rod (Part No. 271). To do this first loosen plunger connecting rod nut (same as Part No. 59). Care must be taken not to turn the plunger connecting rod up too far.

When you have the plunger set to proper height, lock the plunger connecting rod nut firmly.

Safety Finger

The safety finger (Part No. 753) is located in the lower left hand corner in the machine body. It may fail to release the plunger cam lever, and the result will be no slug. Several things may cause this:

The screw bearings of the locking lever (Part No. 546), the lever that locks the stick in place, may have worked loose. As the safety finger should just clear the plunger cam lever when a stick is locked in place, these loose screws allow enough play to prevent the release, and the machine turns over without a cast. Tightening the screw bearings of the locking lever mentioned will relieve this trouble.

Safety Clutches

The safety clutches (Parts Nos. 735 and 737) must make proper contact. The tongue of the lower clutch must fit into the groove of the upper clutch. Should you raise the table with a stick locked in position, upon lowering again it will be necessary to turn the lower clutch to meet the upper clutch, which is done with the lever located just below the lower left corner of the machine body.

Be careful to always observe the condition of the safety finger (Part No. 753). See that it is strong, free from metal and properly in place; also that this whole part works freely, the safety finger at the lower end of the shaft passing over the plunger cam lever without any friction. Make sure that this safety device is in proper position before turning the machine over, without having a stick locked in position.

Non-Delivery of Slugs

Sometimes a large slug may fall off the ejector blade while being pushed into the delivery slide and it fails to reach its proper place on the slug holders, with the result that it remains in the slug carrier instead of being delivered to the galley. When this happens the slug pusher rack (Part No. A-693) will catch behind the slug and the latter will be jammed between the front of the slug carrier and the slug pusher rack. Back the machine up a trifle and remove the slug. You can pull the pusher rack forward into position, but it will automatically come to normal in the next revolution of the machine. The gears that control its motion are of spring-friction construction which allows the slug

pusher rack to be caught and held by a slug without breakage. It is always advisable to immediately stop the motor in such cases and to avoid forcing the machine. Never try to make any adjustments on the Ludlow without first locating the source of the trouble. Oftentimes the slug holder spring gets weak or slug holder bearing screws work loose, causing the above mentioned trouble.

Slug Holders

Should the small spring controlling the slug holders become detached, remove the delivery slide and attach same. To do this, remove the mouthpiece wiper bracket (Part No. 806-B) on the left, and slug carrier operating rack (Part No. 695) on the right.

Fins or Flashes on Slugs

Fins, or flashes on a slug, indicate that something is out of adjustment.

A line of matrices locked too tightly in the matrix stick will not properly plane down. Flashes may occur as a result. Such lines may also have uneven printing surfaces. Foreign matter on top of the mold, or adhering to the matrices, may also cause flashes. The main slide being out of adjustment and the lock nut being loose are other causes.

If the table catch (F), (Illustrations No. 1 and No. 2) the duty of which is to hold the table and frame rigidly together during the cast, works loose so that the starting lever (B) removes it from the pin (C) when the lever returns to position, which occurs before the plunger is released, flashes may appear on the slug because the rigidity of the lock-up is destroyed. The table catch (F) should remain in position on table pin until the cast is made.

Should (F) lock up too tight, do not file catch, as it is fitted to lock properly. (Clean off any adherents that might settle on finished surfaces between table and frame.)

Hair Lines Between Letters

Hair lines come when matrices do not fit closely together. When matrices are dropped on a concrete or iron floor or carelessly handled the corners tend to become bruised or battered. When a battered matrix is assembled in the line, it creates a space for hot metal to enter, resulting in hair lines. These matrices should be very carefully dressed on the sides only, with a fine file, and this trouble will disappear. Also if matrices are permitted to get dirty hair lines may appear.

Regulate Metal Supply

The object is to keep the metal pure and to regulate a uniform supply in the metal crucible. The regulation of the supply of metal assists in maintaining a constant heat. The best way to obtain the best results is to have one man responsible for the purity and the supply of metal.

The printing face of a slug is very materially affected by the heat of the metal in the metal crucible, while the weight of the slug depends more on the correct heat at the mouthpiece. If the mouthpiece runs too hot, it in

turn heats the mold, causing the slugs to bleed, resulting in light slugs. On the other hand, if the metal in the crucible runs cold, the printing face of the slug will likely be porous, especially in the larger sizes. Therefore, it is very important that close attention be given the correct control of the metal.

The best results will be had when pure metal is used, and when the temperature of the metal is around 540°.

Metal Control

The height of the metal in the metal crucible has much to do with the production of good slugs. It should be kept about an inch from the top of the metal crucible. The purity of the metal also must be considered in producing good slugs. The Ludlow will produce good slugs from good metal, but you cannot expect any machine to produce good slugs from poor metal.

The publishing houses or commercial plants operating a metal refining pot have the best opportunity of keeping their metal in good condition. Those who do not possess such a convenience are obliged to feed old slugs in the metal pot which are more or less covered with ink. The purity of the metal used should be given very close attention.

Where slugs are fed into the metal crucible, a little sal ammoniac added and stirred before skimming will help bring the dross to the surface.

Gas Regulation

Note—Read in connection with accompanying drawing, Illustration No. 3.

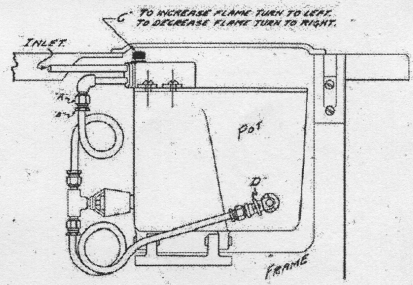


Fig. 3

Regulation of Gas Heated Metal Crucible

Success in operating a Ludlow machine equipped with a gas heated metal crucible depends in no small measure upon the gas regulation. The machine should be installed on the main line with the other metal machines of the office, which line is, of course, regulated by a main governor. But the expansion governor on the Ludlow is very important to the regulation of the heat of the machine.

Some of the first Ludlow installations were made with the gas governor connected to the crucible burner only, but it has been found very beneficial to connect

Instructions for Adjusting Ludlow Mold and Adjusting Table Locking Down Mechanism on all Machines Above No. 2092 that are Equipped with the Equalizing Bar Lock

1st. Shut off motor. Remove two Part No. 746 (Safety Connecting Rod Studs) and Part No. 747-A (Safety Connecting Rod) on top of table and release two adjusting screws and lock nuts that are in the two equalizing bar locking clamps Part No. 588. Release the screw and lock nut on the left end of the locking equalizing bar lever (Part No. 585).

2nd. Turn machine over by hand until mold has reached the highest point of travel, then place gauge No. A-957 over mold and adjust height of main slide so that a two point lead will just fit between table top and bottom of gauge while holding gauge down firmly by hand on top of mold—then tighten screw and nut (Part No. 613-A and Part No. 615). While gauge is still in position, tighten screw in end of equalizing lever until the play is entirely taken out of the locking equalizing lever bar (Part No. 590-A)—then turn machine a little farther by hand, bringing crucible up to its highest point underneath mold. Place a cigarette paper under each roller and adjust the two screws in equalizing bar locking clamp so that paper will hold and yet can be drawn out from between the roller and equalizing bar shoe without tearing. Tighten all lock nuts after adjustments have been completed.

Note: If Operator does not understand the main slide adjustments on the Ludlow, follow instructions given below:

Loosen Part No. 613-A (Main Slide Adjusting Plate Screw) sufficiently to permit the moving of Part No. 612 (Main Slide Adjusting Plate)—then loosen Part No. 615 (Main Slide Adjusting Screw Nut) and raise or lower main slide with Part No. 614 (Main Slide Adjusting Screw) until you have the proper height of slide as given above.

Adjustable Table Locking Down Mechanism

1. See that the adjustable table lock in back of the mold is set to proper height when table is locked down in position and when knob on the table lock reads "ON."

2. To make this test, first release the spring on the table lock underneath the table, then lower the table and lock it down with the front table locks, then take a hold of that part of the adjustable lock which projects through the top of the table and move back and forth. If it moves very freely raise pawl underneath hand and move notched eccentric bushing to the left, mov-

ing one notch at a time until lock binds slightly when you move same back and forth, then drop pawl in position and replace spring on lock underneath table. If unable to get the proper adjustment through the eccentric bushing that part of lock on main frame should be lowered. To make this latter adjustment, raise table top, release check nut and adjust screw to proper height. Lock check nut and make final adjustment with eccentric bushing as stated above, then replace spring on lock.

During a part of the cycle of the machine and at the period that the mold is in casting position, the automatic lock is in operation, locking table to the main frame of the machine. This lock is operated by a screw stud on the back side of the main slide. When slide raises, the screw stud forces lock into place and lock is released by a spring as the slide returns to normal position. This screw stud also acts as a safety. In case table lock should be adjusted too high, this stud will break off when main slide raises, thereby preventing damage to the machine. In the event stud breaks off, readjust table lock and replace screw stud. (Note: See instructions in paragraph "2" of "Adjusting Table Locking Down Mechanism.") In case lock spring breaks or type metal, dirt, etc., gets into the lock and prevents same from releasing, remove screw stud by inserting screw driver from rear of machine. This will allow lock to be released and table raised. Clean lock thoroughly, assemble in place and replace screw stud.

For metal crucible adjustments, see Ludlow Manual of Instructions.

LUDLOW TYPOGRAPH COMPANY

2032 CLYBOURN AVENUE

CHICAGO

2-13-28

the mouthpiece burner also, to the governor. Both burners are then under one control and as the heat at the mouthpiece responds very quickly to an increase or decrease in flame, a steady control for this flame has proved its worth.

Owing to the fact that the expansion and contraction of type metal is greater than cast iron, it is necessary to light all burners at the same time, for if the crucible burner is lit and the mouth and throat burners are not, the metal in the bottom of the crucible will melt out first, and therefore set up an enormous strain which is liable to result in a broken crucible; wherein if the throat and mouth burners had been lit, the strain in the bottom of the crucible would have been eased off through the throat and mouth.

It is our experience that each machine has its own gas problem, but when it has been worked out very little trouble occurs from overheating. Keep the temperature of metal from 530° to 550° F, by turning the adjusting screw (C) to the left to increase, and to the right to decrease the flame. The flame for the mouthpiece may occasionally need some adjustment. Make this adjustment at the mouthpiece mixture needle point, (D) only when temperature in metal crucible reaches 530° to 545° F.

Height of Table to Mold

The variance of the height between the top of the table and the top of the mold when in casting position should be 3/32 of an inch below surface. When the mold is in proper adjustment, it will lift the stick slightly off the table, nearly 1/16 of an inch when the stick lies loose on the mold, but only about one point when locked in position. This makes the table rise in the center when the cast is made. This is proper. Raising the stick from the table during the cast allows matrices to be properly planed when the mold presses them against the equalizing bar.

Correct Locking Pressure

Lock the stick in position. Now grasp the adjusting screw on the end of the stick and pull. It should require a strong pull to remove it when properly locked. That is the test for correct locking pressure. This pressure is adjusted by the screw with the lock nut at the left end of the locking equalizing bar, to which the equalizing bar is attached.

Metal Crucible Adjustments

Whenever it is necessary to make metal crucible adjustments, great care should be taken. In the first place, some mark should be put upon the parts to be adjusted in such a way that if your efforts do not succeed, you will be in a position to replace the adjustments as they were originally, and start over again.

In the upper right-hand corner of Plate A on page 18, illustrations "A" and "B" show two kinds of incorrect seating relation between the metal crucible and mold. Provided Part No. 213 is in proper adjustment (as explained below under "Mouthpiece Adjustment"), either condition can readily be remedied by lowering or raising the bracket (Part No. 234), as follows: Loosen both bolts No. 38; turn *down* both bolts No. 237 to

remedy "A" condition, or turn *up* both bolts No. 237 to remedy "B" condition; then re-tighten both bolts No. 38. Caution: Be sure that *both* bolts No. 237 are turned up or down the same amount. Apply "Test for Lock-up" instructions (second paragraph, page 8) carefully before and after making such adjustments as the above.

Mouthpiece Adjustment

To make adjustment of the mouthpiece of the metal crucible with the mold proceed as follows:

Bring the mouthpiece in position under the mold, bringing parts No. 220 and No. 227 in position as illustrated on Plate A. This shows the metal crucible and the mouthpiece in compression against the mold. This compression is taken up on part No. 217. Note detail "C" which shows head of bolt No. 213, which when in proper adjustment is raised about 1/16-inch from its platform. The raising of this bolt head indicates that the spring is in compression and that there is pressure between the mouthpiece and mold.

This description covers all parts that are necessary to put mouthpiece in perfect contact with mold. You must, however, remember that the balance between these two adjustments, that of the mouthpiece of the metal crucible with the mold as described in the preceding paragraph, must be maintained so that no undue pressure is exerted from either front or rear. You can readily understand that if the rear is adjusted extremely high, to force the front of the mouthpiece in balance with the rear might throw undue strain on the front adjustment, or the reverse if the front is high, and perfect contact will not be had.

Low Plunger

The port or intake at the back and bottom of the well is a long slot about one-fourth of an inch wide. To insure a good intake of metal the opening between the plunger and the lower edge of this well port should be at least 1/16-inch. The size of the opening can be determined by inserting a wire of about that thickness bent into an "L" shape. If an adjustment must be made remove the back pin from the plunger connection lever, raise the lever clear of the upper plunger connecting rod and turn the rod up or down, according to whether opening is too small or too great.

Pot Swivel Adjustment Nut

The pot swivel nut (Part No. 232) should be tight enough to steady the metal pot when turning, yet allowing an easy motion. To loosen or tighten this nut remove pin (Part No. 233) and turn to the right or to the left, allowing the pin to drop into the hole that gives the closest adjustment.

ELECTRICAL EQUIPMENT

Installing an Electric Crucible

Remove the old crucible and refer to instructions for "Assembling Metal Crucible to Machine" on page 5, After the electric crucible is on its bearings and before you make the connections to the control box, adjust the metal crucible to the mold. Refer to instructions on "Metal Crucible Adjustments" on page 19.

Directions for Operating Electrically Heated Ludlow

Any piece of electrical apparatus is more or less of a puzzle to the layman. But the electric-heated Ludlow Typograph is so constructed and wired that with a few instructions anyone with a little mechanical inclination can easily master its operation; and if any troubles arise, quickly overcome them.

There are seven wires leading from the control to the metal crucible. They are numbered and lettered for convenience in making connection. Four of these wires are numbered as follows: 1, 2, 3, 4, and three are lettered C, L and H. Nos. 1 and 2 feed the throat and mouth units; 3 and 4 feed the crucible units. ("Unit" is the term applied to an electric heater.) The wires lettered C, L and H are connected to corresponding terminals of the thermostat which operates the magnetic switch of the control panel.

In the terminal box at the back of the crucible are five brass terminal bars numbered: 1, 2A, 2B, 3 and 4. Bars 2A and 2B are connected with a short piece of wire and are therefore virtually one. This is simply a matter of convenience in making tests, which will be referred to later.

Arrangement of Units

There is one heating unit for the throat and one for the mouth. Throat unit No. 306-E is flat in construction and about 2 by 6 inches in size. It is located against the under side of the throat by a floating cast iron cover which is screwed down by a screw located in the crucible casing at each end of the throat cover. This throat cover is insulated from the heat of the throat unit by asbestos pads. Enough asbestos padding is used so that when the cover is screwed down, it rests squarely on the pads with the flange of the upper end of the cover clearing the crucible casing.

The mouth heating unit (Part No. A-303-E) fits into a round hole parallel with the mouthpiece. This unit is known as the cartridge type of unit. It is fifteen sixteenths of an inch in diameter and about two and one-half inches long. It is inserted and removed through an opening in the nose of the metal crucible.

There are two metal tight units (No. 211-E and 212-E, Fig. 4), which are shaped to fit close to the wall of the crucible and are submerged in the metal. The drawing illustrates the method of connecting these units.

Fig. 4

They are held in place by the crucible cover which rests on the stems of the units as they pass under the cover, and projects into a small housing attached to the Terminal Box. Inside of this housing the terminals of the units are connected in parallel by two short wires

Electric Crucible Connections

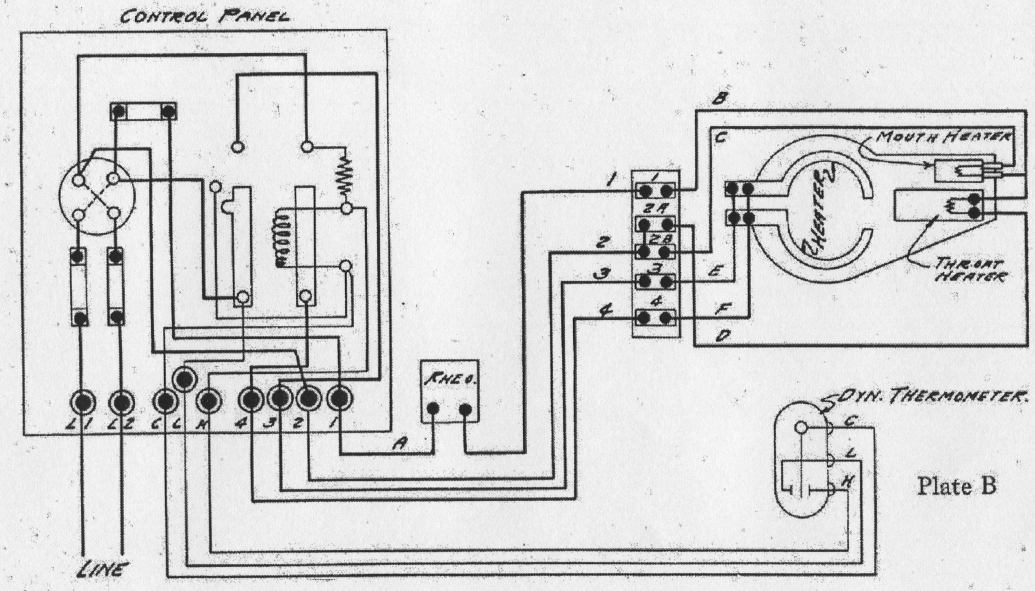


Plate B

which lead into the terminal box and are connected to bars No. 3 and 4. (Plate B.) Two wires leading through the flexible conduit connect bars 3 and 4 to corresponding terminals in the control panel.

As stated before, wires numbered 1 and 2 feed the mouth and throat units. Starting from terminal No. 1 in the control panel, there is a short wire (A) which leads upwards through a short length of conduit at the top of the panel and is connected to a rheostat that is fastened to a bracket which is held on the machine frame by three screws. Its function is to control the heat at the throat and mouth. This rheostat is of the double type and is convertible for either 110V or 220V. In the 110V equipment, the upper and lower section are connected in parallel; two short wires join both sections, and the lead wires are connected to the terminals of the lower section. In the 220V equipment, the sections are connected in series; a short wire connects one terminal of the lower section to one terminal of the upper section. The lead wires are connected to the remaining terminals.

When the knob of the rheostat is turned until the small indicator points to number 14 on the graduated plate, the full resistance of the rheostat will be intercepting the current feeding the throat and mouth units, which will then be delivering the minimum of heat. As the knob is turned in the opposite direction, the resistance will be gradually eliminated until the indicator points to number one, where the full current is allowed to pass to the units, which will then deliver the maximum of heat.

From the rheostat (see Plate B), wire number 1 leads through the panel and flexible conduit into the terminal box, where it is connected to bar No. 1. From bar No. 1, wire B extends through the wall of the crucible casing and proceeds between the crucible and the casing to the bottom of the crucible, where it is connected to one of the terminals of the throat unit. It continues and is connected at the throat of the crucible to one of the terminals of the mouth unit; thus the mouth and throat units are connected in parallel and are controlled jointly by the rheostat.

You will notice that from the mouth and throat units, independent wires return to the terminal box. The wire returning from the throat unit is connected to bar No. 2A in the terminal box, and the wire returning from the mouth unit is connected to bar No. 2B. (See Plate B.) This is a matter of convenience in locating a defect in case trouble should arise in the heating of the mouth and throat.

Trouble Indications

Electric machinery, like all other human inventions, occasionally has troubles of its own. Electric heating apparatus is no exception to the rule.

There is a limited number of amperes required to operate the electric crucible, and if the fuses as specified burn out, it indicates a defect such as a "ground" or "short" circuit, which must be repaired.

The two main fuses should be 20 ampere (not over 25 ampere) capacity for 110 volts; or 12 ampere (not over 15) for 220 volts. The upper fuse, which is on the throat and mouth circuit, should be 6 ampere (not over 10) for 110 volts; 3 ampere (not over 5) for 220 volts.

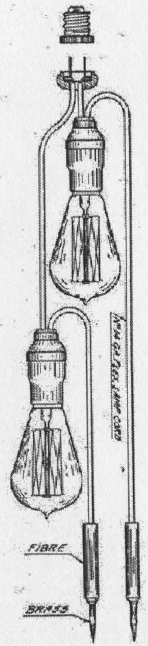


Fig. 5
Test Cord

Extended trouble may result if stronger fuses are used than those specified in the above paragraph. It may cause the lead wires to become heated; or if there are other machines with electric appliances on the same circuit which feeds the Typograph, they will be thrown out of action when the main cut-out fuses are forced to burn out.

A test lamp is the most convenient and time-saving tool which can be used for locating any trouble which may develop in the electric crucible. This test lamp (See Fig. 5), requires two ordinary electric lamp sockets, one separable attachment plug and a few feet of flexible lamp cord. One socket should be connected to each wire leading from the attachment plug as shown in Fig. 5, the ends of the wires leading from the lamps to be used for making tests.

When the test lamp is connected to a lighting circuit and the ends of the wires or test points are brought together, both lights will show half bright. This because the lamps are connected in series, each lamp receiving half of the full current. The purpose of having a lamp on each test cord, is to avoid burning out a fuse when the test points come in contact with the machine or anything that is grounded.

If a test point is applied to each terminal of a heating unit, and the light appears more dimly, the element of the units is in good condition. Bring the test points directly together and note the difference in the light. No dimming of the lights indicates a short circuit. No light will indicate open circuit or dead unit.

Apply one test point to a unit terminal and the other test point to the unit casing. If the test lamp shows no light, it will indicate that the heating element is clear or not grounded.

Electrical Terms

A heating unit is known by any one of the following terms: "Heating Unit," "Heater," "Heating Element," or just "Element."

Electrical power is expressed in watts. In terms of power, a watt is equal to one ampere times one volt. Seven hundred and forty-six watts equal one horsepower.

A volt is pressure, like pounds of steam.

An "ampere" is the term for current flow or volume of flow. Amperes develop heat. Therefore, if your machine is using more amperes than your fuses are marked, the fuses may burn out.

How to Locate Trouble

The Typograph Machine should be permanently grounded. If it is not grounded by conduit, which carries the line wires that feed the machine, it should

be grounded by a special wire (about number 8 gauge) to a water pipe or any safe transmission to ground.

Mouth and Throat Circuit

When the upper fuse in the panel burns out, it indicates trouble in the mouth and throat circuit. Turn off hand switch in the control panel.

In the terminal box at the back of the crucible, remove wires B, D and C from bars 1, 2A and 2B. Now connect the test lamp to the lighting circuit and connect one test point to wire B, the other test point to wire D. If the lights are slightly dimmed, the throat heater element is in good condition. If there is a short circuit, the light will appear with same brightness as when the two points are brought directly together. No light will indicate an open circuit, probably a poor connection, or the unit is defective or "dead" as it is commonly called.

Test the mouth unit in the same manner by placing one test point on wire B, the other test point on wire C.

Now test all three wires, B, D and C for grounds. If the machine is grounded as stated above, simply touch wire B, D and C with the positive test point of the test lamp. First touch the bare iron of the machine with one test point and then with the other. The one that lights a lamp is the positive test point. If the machine is not grounded, connect either one of the test points to the bare iron of the machine,—the remaining one to be used for testing the wires. The wire leading most direct to the ground will show the brightest light. If a light appears while making a test for grounds, leave the test lamp connected to the wire producing the brightest light, then proceed with the work of removing the ground. Sometimes the light will disappear when a certain cover or insulation, etc., is being handled. However, when the light goes out, it indicates the exact location of the ground.

To remove a defective mouth unit, take off the small cover at the mouth, also remove the throat cover. You will find the mouth unit terminals connected to the lead wires in the recess at the side of the throat. These connections are covered with asbestos insulating tubing.

To replace a defective throat unit, it is necessary to remove the throat cover and take out the asbestos heat insulating pad which covers the throat unit; also remove the large cover at the bottom of the crucible. The terminals of the throat unit are connected to the lead wires under the large cover. The connections are insulated with asbestos tape.

When placing a new unit in the throat of the crucible, the end of the unit from which the terminals project should be even with the bottom end of the throat channel in which it rests. If the unit is placed too high towards the nose of the crucible so that its end rests on the curve of the throat surface, there will be an air pocket between the unit and the throat surface, which will prevent the throat from becoming properly heated.

When re-connecting wires to terminals, be sure that all connections are as tight as you can get them; also see that the connections are safely taped to prevent a ground. You can use the asbestos tape which was removed from the old unit. A thread from the tape can be used for binding.

If no defect is detected after making the above test, the trouble will most likely be found in the rheostat.

Remove the small cover which covers the terminals of the rheostat. Disconnect the wires from the terminals, so that each section can be tested independently. With the test lamp connected to the lighting circuit, place a test point on each terminal of the upper section. Turn the knob so that the indicator points to number 1; then as you gradually turn the indicator toward number 14, the light should become more and more dimmed until point 14 is reached, which is the full resistance of rheostat. Test the lower section in the same manner.

If the light goes out at any point, it will indicate a defect or open circuit, which will require a new rheostat.

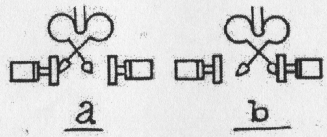
To Test Crucible Units

To test the crucible units, remove the small housing attached to the terminal box; disconnect the wires so that each unit can be tested independently.

Heat of Metal Controlled

The temperature of the metal in the crucible is automatically controlled by the thermostat attached to the back of the metal crucible wire housing box. This thermostat is operated by mercury contained in a bulb which is immersed in the metal. A tube leads from this bulb to the thermostat and in the thermostat terminates in a hollow spiral spring. The bulb, tube and spring are completely filled with mercury and the thermostat is operated by the expansion and contraction of the mercury as the metal heats and cools.

Through the glass at the bottom of the thermostat



case you can see an arrangement similar to the sketch here shown. When this little spring contact is in the position shown at (a) the current is on, and when in the (b) position the current is off. This operation is performed as follows: When the heat is turned on the mercury starts to expand and as it expands the hollow spiral spring before mentioned is forced to slightly uncoil, or straighten out. At the center of this spring is fastened a thin piece of steel which extends downward, and at its bottom end are secured the contact springs above shown. When the metal reaches a certain degree of heat the contact shown at (a) is broken and the bar travels across to the other side and makes the contact shown at (b). When this contact takes place the circuit is broken in the control panel. This allows the metal to cool, and as it cools the spring in the thermostat recoils and brings the contact spring back to the (a) position, again throwing on the current. After the crucible has been brought to the proper temperature it usually only takes three or four minutes for the spring to travel from the (a) to the (b) position, but it

requires seven to nine minutes for cooling or to travel from the (b) to the (a) position. This results in quite an economy in current consumption and keeps the metal at a very uniform heat.

To Change the Temperature

Directly behind the contact springs of the thermostat there is a scale with a sliding point in front of it. On one side of the center of this scale is the word "Raise," on the other side "Lower." A screw head projects from the case at the lower right hand side. If it is desired to have the metal hotter, turn this screw so that the point in front of the scale moves toward the word "Raise." Turn the screw the opposite way if it is desired to have the metal cooler.

In the absence of a thermometer, the temperature of the metal can be very accurately judged with a piece of white paper. Fold the paper several times and insert it in the metal, holding it there ten seconds or longer. If the temperature is correct the paper will be turned a very light straw color. If too hot, it will turn black. Try always to keep the metal at that degree of heat which gives the best working results. If a thermometer is at hand the correct degree will be found somewhere between 525 and 542 degrees.

The control panel at the back of the machine contains the starting switch, the circuit breaker, and three fuses. The switch and fuses are all that need concern the operator.

Again, remember to never do any work on the electric equipment of the Ludlow without first turning off the switch and removing the two main fuses.