

## X. Care and Operation

### OILING AND CLEANING

**O**ILING and *cleaning* of the machine are among the most important of the duties of a Linotype machinist. A good quality of oil should be used, and that sparingly, though regularly, applied. Use two sizes of oil can, a long-spout oiler and a smaller one, and put the oil in the holes or cups, not all over *the frame* of the machine.

In oiling the Linotype judgment should be exercised as to the amount of oil to be used. It is not necessary to flood the machine in any part. The slow moving parts should be oiled on a new machine once a day, the fast moving parts *twice* a day. As the machine grows older and the parts become smoother they will not need oiling so often. *One important point* which should always be borne in mind is, that in oiling any part of the machine which comes in contact with the matrices, no oil must be allowed to accumulate *where it is liable to find its way on to the matrices*. If it is allowed to get on the matrices it will soon interfere with the proper working of the escapements and the matrices will not respond to the touch of the keybutton. *Always*, when oiling these parts of the machine, carry a piece of waste in your hand and after oiling the parts wipe off any surplus that may be on the outside. This is very important and *should never be neglected*. Do not use cheap vegetable or mineral oil. Use a high grade machine oil that will not gum. Be careful to remove all surplus oil, particularly around the assembling and distributing mechanism, so as to keep the matrices absolutely free from oil. The following is a list of places which require oiling. Faithful performance is most essential.

#### 1. *Base.*

Bearings for ejector lever shaft, one at each end.

#### 2. *Column.*

Bearings for elevator transfer lever shaft, one at each end.

Bearings for delivery lever shaft, one at each end.

Bearings for spaceband lever shaft, one at each end.

Bearing for mold slide, a grease cup.

#### 3. *Cam Shaft Brackets (Right-hand).*

Bearing for cam shaft, a grease cup.

Bearing for driving shaft, a grease cup.

Bearing for justification and vise closing lever shaft.

Bearing for second elevator lever shaft.

3. *Cam Shaft Brackets (Left-hand)—Continued.*

- Bearing for cam shaft, a grease cup.
- Bearing for justification and vise closing lever shaft.
- Bearing for second elevator lever shaft.
- Bearing for mold driving pinion, one at each end.
- Bearing for mold turning square block shaft, one at each end.
- Bearing for distributor shifter lever shaft, one at each end.

4. *Driving Shaft.*

- Bearing for left-hand end, a grease cup.
- Driving shaft loose pulley, a grease cup.
- Driving shaft motor gear, a grease cup.
- Driving shaft clutch rod.
- Driving shaft friction shoe rods and pins.

5. *Rollers.*

- First elevator cam roll, oil hole in the stud.
- Justification cam roll, oil at side of roll.
- Vise closing cam roll, oil at side of roll.
- Pot cam roll, oil at side of roll.
- Elevator transfer cam roll, oil at side of roll.
- Delivery cam roll, oil at side of roll.
- Mold cam roll, oil at side of roll.
- Mold cam lever roll, oil at side of roll.
- Second elevator cam roll, oil grooves in lever at side of roll.
- Pot pump cam roll, oil hole in lever.

6. *Levers.*

- Vise closing lever, oil hole on top of spring rod.
- Justification lever, oil hole on top of spring rod.
- Justification lever, two oil holes in hub.
- Mold cam lever, two oil holes in hub.
- Mold cam lever handle, two oil holes in hub.
- Pot lever, two oil holes in hub.
- Pot return cam shoe.
- Ejector lever, two oil holes in hub.
- Ejector lever adjusting pawl.
- Ejecting lever adjusting pawl plate.
- Ejector lever shoe.
- Second elevator safety pawl.
- Pot pump lever, stop lever, operating lever, oil hole in the stud.
- Starting and stopping lever hinge pin.

7. *Cams.*

- Ejector cam.
- Pot return cam.
- Vise closing and mold turning cam, on side where square block slides.
- Mold turning bevel pinion, on sides of square block.
- Mold turning cam shoes.
- Delivery and elevator transfer cam, on spot for second elevator safety pawl.
- Distributor shifter cam.
- Distributor shifter cam rider, end and hinge pin.
- Automatic safety pawl, end and hinge pin.
- Automatic stopping pawl, end and hinge pin.
- Delivery cam shoe.

## GENERAL DIRECTIONS FOR OPERATING MACHINES

*Fingering of the Keyboard.*—The touch of the key necessary to operate the escapement is exceedingly light on the Linotype machine, very much lighter than on a typewriter. The depression by the finger on the keybutton is only about three sixteenths of an inch, while on a typewriter it is nearly an inch. The arrangement of the Linotype keyboard is based on the relative use of the letters of the alphabet in the English language. The letter “e” (lower case), being used far more than any other letter, is placed in the channel at the extreme left of the magazine, so that when released by the escapement this matrix drops almost directly upon the star wheel. The lower-case “t,” which has the next largest use in words, is placed next to the “e” channel in the magazine, and so on across the magazine, the least-used characters being at the extreme right in the magazine and keyboard. In other languages than English, the keyboard is based on the relative use of the letters in the language in a similar manner. The spaceband key is not in the keyboard proper but is placed a little to the left, and is extended in such a way that it can be touched with the little finger of the left hand when the hand is in different positions over the keyboard.

Various rules for fingering have been devised. There are three systems which have been published, each of which is declared by its author to be the best and giving the highest possible speed in composition with the least amount of muscular effort. It is probable that any of these methods is good.

The great object of everyone who is learning to operate the keyboard should be to cultivate a regular movement of the fingers so that there is exactly the same interval of time between the touch of a key and the succeeding one. There are certain combinations which come so often that the fingers can operate them much more rapidly than other combinations of letters; for example, the word “the,” the syllables “tion,” “sion,” “ough,” and the like, occur very frequently. There is a temptation on the part of operators to finger these combinations much more rapidly than the letters or syllables used less often. Operators should be on their guard against acquiring this habit. It is productive of transpositions and clogs of matrices in the assembling.

Any one who watches a rapid operator is struck by the fact that the movements of his fingers *seem* to be slow. As a matter of fact, the “swift” learns to make a perfectly even interval of time between the successive touches of the keys, so that the matrices come into the assembler elevator with perfect regularity.

A correct style of fingering, and this evenly timed touch of the successive keys are two great secrets of rapid operation of the Linotype.

*Timing of the Spacebands.*—The matrices of the Linotype machine are all of the same general shape and vary only in thickness. The space-

band, however, is a very different thing, being heavier than the ordinary matrix, and about four inches long, instead of an inch and a quarter. Its fall is also vertical, directly upon the star wheel, instead of at an angle upon the assembler belt, as is the case with the matrix.

A matrix is released from the magazine by the first upward movement of the keyboard cam, while the spaceband is released on the return movement of the keyboard cam. There is also a certain amount of lost motion left in the connections to the keyboard rod which operates the spaceband lever. The object of this arrangement is to give the matrix a little advantage in the time of release over the spaceband if a finger key and the spaceband key are both touched at the same time because there is a general tendency for the spaceband to drop in front of the final letter of a word, as before the letter "e" in the word "the," instead of in its proper place. The operator should see to it that the escapement of the spaceband is working properly, that the points which lift the spaceband over the retaining shoulders are sharp and of equal length, that the shoulders are square and not worn, and, finally, that the lost motion in the key rod that operates the spacebands is just enough to give a matrix, such as the lower-case "e," the proper advantage in the time of its travel to the assembler elevator.

The forègoing adjustment is of very great importance in the rapid operation of a Linotype machine. This will be seen when it is noted that the matrices and spacebands may be falling into the assembler stick at the rate of from five to ten a second. It would seem as though it were impossible to time two pieces of metal of such different size, weight, and path to be traversed as a matrix and a spaceband so that they will come into their places successively in the exceedingly small interval of time that can be allowed. As a matter of fact, however, this difficulty is more theoretical than real. A little experience and care will make it possible to pour the matrices and spacebands into the assembler stick in a shower, and yet they will find their proper places to form the characters of the composed line.

The best operators learn what is called the "touch system;" that is, they learn the positions of the keys so that they can finger the keyboard while reading the copy, and the eyes do not have to follow the fingers in their movements. The best operators also train their ears so that they hear the fall of each matrix into the assembler stick, although they are not conscious of the fact. Many operators will, without conscious attention, instantly detect the failure of a matrix or of a spaceband to drop into position properly.

This training of the hand and ear will contribute very greatly to the speed of the operator. It will prevent frequent corrections by hand in the assembler stick. These corrections in the assembler stick cause a great loss of time, and they break up what an operator calls his "movement."

This training of the eye, ear, and hand to work automatically and in cooperation cannot be gained in a short time, and some are so constituted that they can never attain it. It is far better, however, for one learning to operate, to understand these things at the beginning, and to make slow, *but steady*, progress rather than to acquire bad habits that are very difficult to overcome.

*Keeping the Metal at the Right Temperature.*—The operator should get into the habit of regularly dropping in a pig of metal at a certain interval. This interval varies with the speed of different operators, but on the average a pig should be dropped in about once in twenty minutes. If the *metal* is replenished at about this rate, there will be little trouble with the governor. On the other hand, if the *operator* allows the metal to run down so that he has to put in two or three pigs at a time, it is almost certain to cause trouble. This regulation of the metal does not require any *great* amount of attention or care, but the necessary things above mentioned *must not be neglected*, and this care will add greatly to the “string” which an operator will hang up at the end of a day.

*Distributor Stops.*—If there should be a number of distributor stops the system of distribution should be gone over carefully, as explained on pages 123 and Fig. 116. The distributor lift should be examined. If the flexible partitions are used, it should be noted whether these are bent, and in that case they should be straightened back with a pair of pliers, and, if necessary, the *adjustments* shown on page 120, Fig. 116, should be reset. The latter, however, seldom happens.

#### TO TAKE A KEYBOARD APART

Whenever it is necessary to take the keyboard apart to clean, it should be removed from the machine in the following manner: Remove the *keyboard cam frames*. Disconnect the assembling elevator lever. Procure a strip of wood furniture fifteen inches long, which is the proper length to just pass inside of the frame posts, fasten a strong cord to each end of the wood strip, take off the keyboard locking bar, place the strip of wood along the back of the keybars, bring the string inside of the side posts to the front of the keyboard. Draw the two ends of the string tight, so that the strip *can not* move, and fasten it to the keylevers. Take out the two keyboard side plate bracket screws (on each *side* at the rear of the keyboard frame). Take out the four keyboard front plate screws. Remove the two screws which hold the keybar banking bar to the posts and pull the bar off the dowel pins. Pull the frame toward the front of the machine and lift it out. Place the frame on a bench on table in a slightly inclined position with the *rear* end the higher. Take out the lower row of keylevers by removing the fulcrum rod. Take off the *keybars*, keeping them in their regular order. Take out the remaining keylevers by removing the fulcrum rods. Wash the keylevers in denatured alcohol or gasoline; brushing vigorously with a jeweler's brush the parts that come in contact with the frame.

If there is any corrosion left, polish the levers with metal polish; wipe them dry with a clean rag. The keybars should be cleaned in a like manner, but rub each side of each keybar on a graphite board instead of using metal polish. Wash the frame of the keyboard thoroughly, and wipe dry. If an air hose is available, blow all the parts dry with the air.

When reassembling the keyboard, work upward. Place the lower row of keylevers in first, run the fulcrum rod through the holes; then assemble the next rows, using the same procedure for each row. This method makes it easy to assemble the keylevers.

After the board has been assembled, test out each key to see that it is working freely, before replacing the strip of wood.

When replacing the banking bar the slot in the keybars must fit over the bar; raise up on all the keybars with the plate extending underneath them until the banking bar dowel pins fit into the dowel pin holes.

It is usually necessary to clean the entire keyboard only once or twice a year unless the shop conditions around the machine are very dirty.

#### TO REMOVE THE KEYBOARD CAM FRAMES—ALL MODELS

Removal of keyboard cam frames can be accomplished in the same general manner. The cam covers and belts are taken off, the screws in the rubber-roll shaft brackets are removed, and the frame drawn out. In the various models a slight difference may be observed in the shape of the brackets, and in some cases the interferences differ; but a close examination of the parts should show what to do first. Where possible use the same screws where they were taken out.

#### TO REMOVE AN INDIVIDUAL KEYBOARD CAM

To remove an individual keyboard cam from keyboard of Model 1: 1. Throw off belt. 2. Remove cam frame covers. 3. Locate cam by touch of key. 4. Withdraw cam yoke pivot wire as far as the cam yoke wanted; lift out cam yoke. Reverse operation for replacement.

Models 2, 3, 4, 5, 6, and 7, use the same operation, except that the belt need not be thrown off the pulley. For Models 8, 9, and 10, proceed as follows: 1. Remove keyboard cam frame covers. 2. Push up cam yoke spring bar latch and swing out the spring bar. 3. Lift out the cam yoke. When putting in a cam reverse the operation, being sure the spring bar latch is locked.

#### TO REMOVE A MAGAZINE FROM THE MODEL 9

Open the assembling entrance cover and the assembler cover; remove the matrix delivery belt from the upper pulley, and belt from the pi stacker pulley; unlock and swing open the entrance; place the right and left magazine supporting arms on the proper lugs on the sides of the magazine supports; place the left hand in front of the magazine to support it, and draw out the magazine locating bar with the right hand. The magazine can then be slid forward upon the supporting arms and be re-

moved. When replacing push the magazine up full distance, push in the locating bar and lower the magazine slightly to position. Reverse the other operations to complete the change. This change is quickly and easily accomplished.

#### TO REMOVE A CHANNEL ENTRANCE—MODELS I, 2, 3, 4, 5, K, L

1. Place a mark on the lower edge of the partition plate and frame. This is a guide for the return of the plate to proper position.
2. Remove channel-entrance frame spring.
3. Remove the two frame hinge screws and take the frame to a work bench.
4. Remove the guide bar brackets. This will allow the guide bar and the automatic stopping bar to be taken off.
5. Drive or pull out the locking-strip rod; remove the strip.
6. Remove the screw in the slotted hole in each end of the partition plate.
7. Fasten the frame in the jaws of large vise and take a hammer and a block of wood and drive the partition plate in the direction of the partition that is to be removed.
8. When the plate has moved far enough withdraw the partition and put in new one. In driving the plate back to place, be careful that the lugs of the partitions do not catch on the frame. When the marks coincide that were previously made on the edge of the partition plate and frame, put in the screws in the slotted holes. Finish by replacing the other parts.

#### TO REMOVE ASSEMBLER STAR WHEEL

1. Take the two screws out of the small holder bracket.
2. Take screw out of the assembler rails.
3. Draw off the star. This operation is practically the same on all models.

#### TO REMOVE MATRIX DELIVERY CHUTE—MODELS 2 AND 4

If matrices catch in the matrix delivery chute and cannot be dislodged with the fingers or a bodkin, the chute must be removed. To do so, shut off the starting and stopping lever; release delivery slide and permit it to go to the left. A screwdriver can then be put through the face plate, where the delivery slide was, and the screw holding the chute released. The chute can then be drawn downward and out. When replacing it, the tongue of the matrix guide must be placed inside the chute and properly adjusted to its position inside the chute before tightening the screw to insure its proper operation.

#### TO REMOVE THE SPACEBAND BOX

Shut off the starting and stopping lever, and turn the cam shaft backward until the spaceband lever pawl has moved into the intermediate channel. Remove the electric light or bracket screw from the spaceband box, and swing the bracket clear of the spaceband box. Remove the screw in center of spaceband box, which holds it to the face plate, and the spaceband box can then be taken off. When replacing the spaceband box hold the pawl levers up so that the screws on the back lever will rest on top

of the spaceband keylever, see that the dowels are in the holes properly, and that the spaceband chute is properly located alongside of the assembling elevator gib.

#### TO REMOVE LINE-DELIVERY SLIDE—MODEL 1

1. Push in controlling lever and open vise. 2. Release the slide and allow it to move to the left its full distance. 3. Take out the delivery link screw and the flat spring that holds the link knob in the delivery lever, then draw out the slide. On rebuilt Models 1 and 3 machines, the first two steps should be taken as before, but the third operation consists in removing the slide stop, and by raising the catch from above the knob, the slide is free to be drawn out. The plan applies to Model 10 also.

On Models 2, 4, 5, 8, 9, the first two steps are followed as mentioned above. The third step is to remove the slide stop, and the fourth is to raise the delivery-lever link spring, after which the slide may be drawn out.

#### TO REMOVE DRIVING SHAFT FRICTION CLUTCH

To remove the driving shaft friction clutch shut off the power; if a motor, turn off the current; if a belt on the loose pulley, remove the belt. Do not attempt to take the clutch off with the power on the machine. Take off the nut on the clutch rod. If the machine is of a later model, remove the screw from the driving shaft friction link collar. Remove the clutch arm key screw. The clutch can then be removed. If the driving shaft is to be removed take off the pulleys or the gear, if motor driven; remove the driving shaft clutch flange screw; drive out the taper pins which hold the driving shaft pinion into the shaft, and the pinion collar on to the pinion. The shaft and pinion can then be removed. In putting the pinion and shaft together again care must be taken that the taper hole for the pin exactly aligns before driving in the taper pin.

#### TO REMOVE SECOND-ELEVATOR STARTING SPRING

1. Pull out controlling lever, and when second elevator descends, push in lever. 2. Take out the screw in end of spring rod, withdraw rod, and remove spring. In putting on a new spring have the adjusting nut turned up to the shoulder of the bolt cap. When the screw is put in, turn the adjusting nut to give a slight compression to the spring. Keep the rod oiled.

#### TO REMOVE THE MOLD SLIDE

On machines having the universal ejector blade, start the machine, and when the first elevator has reached the lowest position, stop the machine by pushing back the starting and stopping lever. Open the vise to first position; raise the first-elevator slide by hand, and lower the vise to a horizontal position and rest it on a block or other support; remove the ejector lever link; lower the mold cam lever handle; set the ejector blade scale bar at 12; remove the ejector blade controller link rod, and the con-



troller can be removed; detach the hose from the mold disk stud, first turn off the water, and the mold slide can now be removed. On machines equipped with the old style ejector slide it is necessary to remove the first-elevator back jaw guard, and hold the mold slide when taking it out, so the ejector slide will not fall out. Otherwise all the operations are entirely the same except that there is no ejector blade controller and controller link rod to be removed.

#### TO REMOVE AN EJECTOR-LEVER PAWL

1. Push in controlling lever. 2. Remove lock nut from screw. 3. Turn the screw out until it touches the gear wheel, then turn the cam shaft back, and move the ejector lever forward. The pawl can then be removed. In replacing, reverse the operations.

#### TO REMOVE THE MOLD DISK

On machines having the water-cooled mold disk, shut off the starting and stopping lever; disconnect the ejector lever link; lower the mold slide handle and draw out the mold slide, until the mold disk is clear of the mold disk pinion; remove the mold disk guides; take out the three screws in the mold disk plate, and lift the mold disk off the stud. In removing the mold disk from the old style stud, proceed as above, except that instead of taking out the three screws from the mold disk plate, remove the nut from the mold disk stud. In loosening the nut use a piece of brass and a hammer. Do not use a steel drift. Push the stud back and lift off the disk. Before replacing, be sure that the front and back ends of the mold stud bearing, as well as the shoulders of the mold stud, are perfectly clean. Screw the nut up tight, and the stud and disk should revolve freely, and be very sure that the mold disk does not bind when the guides are replaced in position.

#### SETTING THE MOLD DISK TO CAST IN PROPER MOLD

See that the mark on the mold disk exactly matches the one on the mold disk pinion. If it does not, draw the mold slide forward until the disk is clear of the pinion, and turn the disk until the marks coincide. Then push the slide back so that the teeth in the disk and pinion are in mesh. With the machine standing in normal stopping position, pull the mold disk pinion forward off its locking pin, and turn the disk until the mold required is in the ejecting position, when the pinion can be pushed back on to its locking pin, and the mold required will be in the proper position.

#### TO REMEDY A MOUTHPIECE LEAK

When the mouthpiece leaks: if the mouthpiece is of the old style fastened with a gib or wedge, drive out the wedge, remove the mouthpiece and fit it to the mouthpiece bearing, using a little Prussian blue. The fitting must be done with a fine file or scraper until there is a perfect joint. Then

replace the mouthpiece and wedge. If the mouthpiece is of the new style, where the mouthpiece is fastened to the crucible by screws, remove the mouthpiece and fit the face of the crucible to the cast iron of the metal pot in the same manner. This operation requires some skill and should not be attempted by one who does not understand the use of file and scraper.

#### TO REPLACE MOLD TURNING BEVEL PINION IN PROPER POSITION

If the mold turning bevel pinion has been removed for any reason, in order to replace it in proper position, bring the machine to normal stopping position and mold required in ejecting position. The square block on the mold turning bevel pinion should then stand with the set screw up.

#### TO REMOVE SLUG STUCK IN THE MOLD

1. Push in controlling lever. 2. Take hold of cam and turn back cam shaft sufficiently to allow the ejector pawl to be raised. 3. Draw back the ejector lever until the pawl clears the cam. Then pound the slug out by a series of gentle strokes.

#### TO REMOVE THE PUMP LEVER OLD STYLE SPRING

Place a short rod in the hole in the spring rod just above the spring washer; remove the pump locking pin; start the machine, holding the pump lever stop lever operating lever over so the pump lever will descend. When it has reached its lowest point, stop the machine and the spring and rod can be removed.

#### TO REMOVE A PLUNGER THAT IS STUCK IN WELL

On new machines the plunger is sometimes liable to stick in the well and stop the machine. In such a case proceed as follows: 1. Shut off the starting and stopping lever. 2. Withdraw pin from plunger and let the cams come to normal position. 3. Take out metal from pot until well is exposed. 4. Place a piece of tallow in well or put in a little oil on top of the stuck plunger. 5. Fasten a monkey-wrench on plunger rod and try to work the plunger back and forth. A few light taps on the top of the rod with a light hammer may help to start the plunger and allow the melted tallow or oil to loosen it up. 6. Place a pin in plunger rod and fasten wrench underneath. Work the plunger upward slowly with a rotary movement, tapping wrench lightly with hammer if necessary until the plunger is released. Plunger should then be removed and thoroughly cleaned. The plunger should be cleaned once a week.

#### TO REMOVE JUSTIFICATION SPRINGS

1. Place a short rod of suitable size in the hole near the lower end of each rod. 2. Open the vise jaw and draw out the starting lever. When the cam rollers reach the deepest depressions in the cams, stop the cam shaft. 3. Raise the levers to full height and lift out the springs. Allow the cams to come to normal position. If the rods cannot be taken out because the

levers cannot be raised high enough, the rollers must be removed. This will allow the levers a higher movement. In replacing the springs be careful to put them back in their right places.

#### TO REMOVE THE POT LEVER

Start the machine and bring the pot forward to the lock-up position; stop the machine and remove the pot balancing spring; start the machine and let it run to the normal stopping position; place a block of wood or several slugs between the pump lever roll and the pot lever shaft bearing, to take the pressure off the pot lever roll. This can be done by taking out the pump locking pin and pulling the pot forward with the plunger rod. Loosen the set screw and remove the pot lever shaft; remove the pot lever eyebolt pin and take the pot lever out downward. If it is necessary to remove the pot lever roll, loosen the set screw and remove the pin. Due to the heat from the pot and the difficulty of properly lubricating this roll, the bearing is composed of two washers and nine anti-friction rolls. If any of the rolls become worn they should not be repaired, but new ones put in. Before applying new rolls they should be thoroughly cleaned; and after they are cleaned, should be smeared with a thick paste of tallow and graphite. In assembling the roll, place it on a flat surface and put in one of the washers, then the anti-friction rolls. Roll up a piece of paper and put in the center to keep them in place, and then the other washer on top. Put the roll in the pot lever and push the paper out with the pin. Tighten the set screw and the lever is ready to place in the machine.

#### TO REMOVE THE DISTRIBUTOR CLUTCH

Loosen the set screw and take out the clutch lever hinge pin. Then remove the clutch lever and spring; remove the screw from the clutch bracket and loosen the screw in the front screw bracket right-hand, so that the clutch bracket can be taken off its dowel pins without springing the clutch shaft; remove the clutch shaft screw, and the clutch and bracket can be removed. If it is desired to take the clutch apart, by removing the screw and washer in the end of the clutch shaft, the shaft may be withdrawn from the pulley and flange. In putting the distributor clutch back on the beam it is very important that the timing pin in the distributor screws mesh into the clutch shaft gear, where the tooth is cut away, so that the screws will be in accurate time with each other. On some of the older machines there were no timing pins in the gears, but the gears had a mark on them, and these marks must exactly coincide, in order that the screws may be accurately timed.

#### TO REMOVE ANY CAM FROM THE CAM SHAFT

The removal of any of the cams from the cam shaft happens so seldom that it seems almost unnecessary to mention it, but, in case it should be necessary, the following instructions may prove useful:

Start the machine and when the second elevator has descended on to the intermediate channel, stop it, and remove the second elevator lever and the second elevator cam lever; remove the first elevator cam; start the machine and bring it to its normal stopping position. Then remove the driving belt, or, if motor driven, remove the motor. Remove the step; remove the distributor shifter lever and spring; remove the ejector lever link; pull out the shaft and let the ejector lever down on to the floor; put a short rod in the hole in the justification lever spring rod, and the vise closing lever spring rod, to prevent the springs working; put a short rod in the hole in the pump spring rod in the old style, or, remove the pump lever spring (inside of the column) on the later machines; remove the pump lever; remove the pump bracket; let down the vise and put a support between the vise cap and the first elevator slide, to hold back the first elevator auxiliary lever; pull the pot forward and block it between the base and bottom of the pot to hold it away from the cams; remove the mold gear arm; remove the cam shaft bracket right-hand tie rod and cap; remove the delivery and elevator transfer cam locating piece which is fastened to the cam shaft; loosen the set screw in the delivery and elevator transfer cam, and move the cam to the left about two inches; turn the cam shaft by hand until the cams clear the pot lever; then move the cam shaft to the right in order that the vise closing and mold turning cam may pass the distributor shifter lever spring hook. The cam shaft can now be lifted from the machine to the floor and the cam required taken from the shaft, after the four bolts which hold the cams together are removed. If it is necessary to remove all the cams from the shaft, in reassembling them, place the pot and pump cam on the shaft, with the short hub to the right and position it endwise with the set screw; the shaft is spotted for the point of the screw. Place the justification and second elevator cam on the long hub, with the largest cam going on first, and turn it on the hub until the four bolt holes match, then the vise closing and mold turning cam, with the mold turning segments to the left or outside, and turn it until the bolt holes match. Put in the bolts and tighten them. Place the delivery and elevator transfer cam on the right-hand end of the shaft with the cam side toward the right, positioning it endwise with the delivery and elevator transfer cam locating piece, and the cam shaft collar on the left-hand end of the shaft. The shaft and cams are now ready to put back into the machine.