

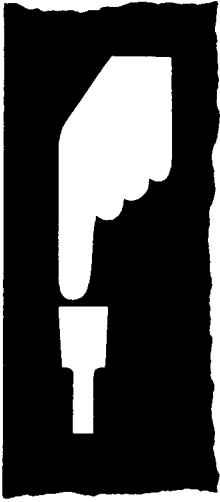
LINOTYPE  
INSTRUCTION  
BOOK



*Electrically-Controlled*  
**Hydraquadder**

MERGENTHALER LINOTYPE COMPANY

• LINOTYPE •



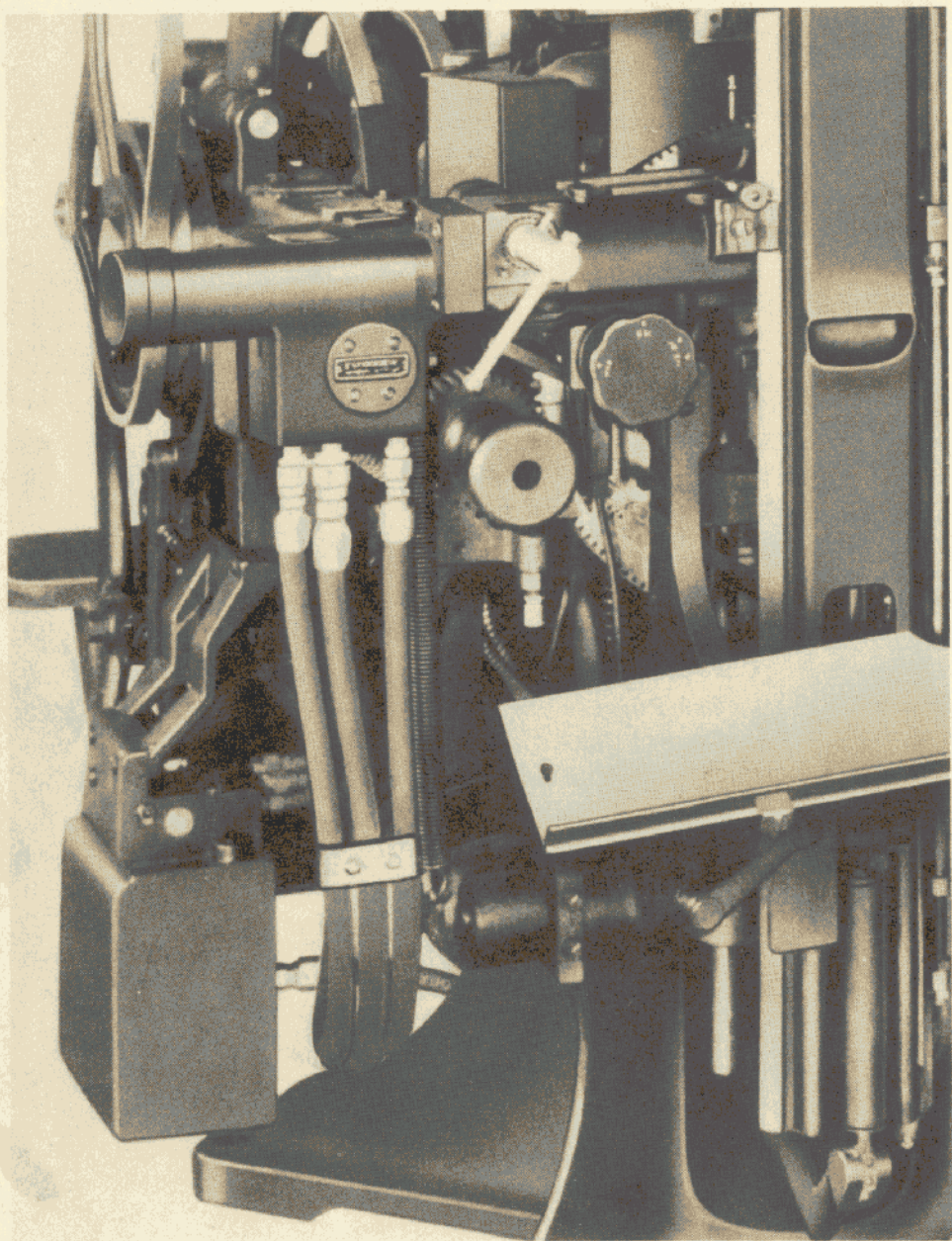
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*View of manually controlled Hydraquadder  
installed on a Linotype*



# I. Introduction

The Linotype Electrically Controlled Hydraquadder is the result of years of experience and study of the requirements of a quadding mechanism. The design incorporates the objectives of maximum efficiency, dependability and accuracy of operation with a minimum of maintenance.

The Electric Hydraquadder utilizes true hydraulic principles to actuate the vise jaws to quad or center the assembled line of matrices. The vise jaws are moved quietly, positively and with the force necessary to efficiently perform the quadding functions desired.

The Hydraquadder is independent of machine functions, except for timing of operations, and does not obtain its driving power from any machine motion. It operates quietly and with exceptional smoothness at any machine speed. The maintenance requirements are practically nil except for periodic lubrication at a few points.

Whenever composition requirements call for white space with lines set flush left, centered or flush right, the Electric Hydraquadder effects savings by enabling the operator to set quadded and centered matter at speeds faster than the simplest straight matter.

The electrical control feature of the Hydraquadder incorporates the latest advances in electronics and automation to make it the simplest and most dependable quadder for either tape or push button operation. It uses the modern printed circuit that assures permanence of electrical connections and eliminates maintenance.

The simplified electrical system is designed for trouble free operation and no special electrical knowledge is needed for inspection or replacement of parts. All relays and connections are the "plug in" type and are keyed to eliminate possibility of error.

An added feature of the Hydraquadder is the use of the Mohr Measure Control which permits simultaneous left-hand vise jaw and assembler slide setting when changing measures. This feature, in conjunction with the self-locking delivery slide and automatic line stop return, makes measure changing a one-step operation. Also, an electrical left-hand vise jaw safety prevents the cast being made if for any reason the line of matrices is not aligned properly in the first elevator jaws and held firmly between the vise jaws.

Some other features and advantages of the Electric Hydraquadder are:

1. It employs true hydraulic principles, where the hydraulic fluid is continuously available for precise control of both motion and force of the vise jaws.

2. The vise jaw force is entirely independent of line length.

3. The vise jaw force in centering is the same as in quadding.

4. It incorporates a controlled wiping action of the vise jaws, as the line of matrices rises after the cast, to keep the vise jaws free of metal.

5. It eliminates trapped air and any need to bleed the lines.

6. It is silent in operation, and exceptionally smooth at any machine speed.

7. The complete electrical system is operated at low voltage and is non-hazardous.

8. The rate of vise jaw travel is automatically controlled by the hydraulic pump.

9. The Hydraquadder will produce accurate centering. This is assured by the precision centering pinion which meshes with the teeth of the racks connected to each piston in the cylinder and selector valve housing.

10. Left-Hand Margin Control when quadding assures that the margin when casting regular and when quadding left will be identical.

11. Plug-in type relays—quickly removable.

12. Four relays used for tape operation—two for push button operation.

13. Self-clearing push button box. No need for switches to change from manual to tape operation. Action is automatic. Any depressed button will be raised to normal or up position by means of self-clearing solenoid in push button box.

14. Simplified method of recasting quadded or centered lines.

15. Positive regular position, no lost lines.

16. Capable of twelve lines per minute operation.

17. For tape operation quadder can be set for continuous quadding or centering by depressing quad or center button and regular button simultaneously. The quad or center signal does not have to be punched in tape for each line.

18. Selector valve turned to pre-determined position for quadding or centering by hydraulic action.

19. Designed for minimum maintenance.

## II. General Description

The Electrically Controlled Hydraquadder consists of the following components:

1. *The Hydraulic Fluid Circulating Pump* which is attached to the rear of the Linotype column on machines equipped with the driving gear and pinion type of motor drive. On machines equipped with the Linotype V-Belt drive, the pump is fastened to the underside of the motor bracket.

As shown in Fig. 2, the pump 36 is driven by a fibre pinion 42, which meshes with the regular Linotype driving gear on machines equipped with the gear and pinion motor drive. On machines equipped with the V-Belt drive, the pump 36 is driven by a V-Belt 167, and pulley 169, as shown in Fig. 3.

The function of the pump is to circulate the hydraulic fluid, from the sump, through the various parts of the hydraulic system.

2. *The Main Control Valve and Sump Assembly*, Fig. 1, is fastened to the left-hand cam shaft bracket by means of two longer bracket screws 198. In the main control valve body 13, there are several port openings and a horizontal sliding valve spindle 16, which is actuated by a cam 35, attached to the first elevator cam, by means of a roller 10 and lever 18. Below the main control valve is the sump or reservoir 2, for the hydraulic fluid. Attached to the top of the main control valve is the secondary control valve 193, which will be discussed in more detail later.

The purpose of the main control valve is to time and direct the flow of hydraulic fluid to the remainder of the hydraulic circuit so as to close and open the vise jaws when quadding or centering, and to apply the necessary operating pressures.

There are four hose connectors in the right-hand side of the main control valve body, Fig. 4, and one connector in the lower part of the sump. The connector in the sump is attached to the inlet side of the circulating pump by a hose A, Fig. 1 and 4. The outlet of the pump is connected by hose B, to one of the four connectors in the main control valve body 13. Two of the connectors in the main control valve body are connected by hoses F and G to the selector cylinder 172 (Fig. 1), which is attached to the cylinder and selector valve



housing 1. The remaining connector on the main control valve body is connected by hose D, to the cylinder and selector valve housing.

Within the sump (which holds approximately one gallon of fluid), and attached to the bottom of the main control valve, is an exhaust pipe to the sump and two pressure relief valves which bleed into the sump, Fig. 9. The pressure relief valves are used to control the pressure in the hydraulic system during quadding and centering functions and the exhaust pipe allows the hydraulic fluid to be re-circulated to the sump.

3. *The Secondary Control Valve Assembly*, 193, Fig. 1, is mounted on top of the main control valve 13. It is similar to the main control valve in design, having a horizontal sliding spindle 194, which controls the flow of hydraulic fluid through port openings in the secondary control valve body. The spindle is actuated by two shoes 195 and 196, located on the flange of the first elevator cam through a roller and lever arrangement. The secondary control valve is connected by two hoses C and E, to the cylinder and selector valve housing, Fig. 1 and 4.

The purpose of the secondary control valve is to prevent the flow of hydraulic fluid to the vise jaw pistons while selection of the quadding or centering function is occurring.

Openings in the main control valve housing and the secondary control valve housing permit the flow of hydraulic fluid between the two housings without the necessity of hose connections.

4. *The Cylinder and Selector Valve Housing* 1, Fig. 5, is a casting fastened to the left side of the vise frame and vise cap. It has two horizontal cylinders side by side, approximately in line with the vise jaw blocks. Inside each cylinder is a piston 132, and piston rod 130, 131, Fig. 21. The hydraulic fluid acts against the piston in either or both cylinders to move the vise jaws against the line of matrices. The rear piston is connected through its piston rod, to a rack 98, Fig. 7, which is in turn connected to the left-hand vise jaw block 97, through its adjusting rod 96. The front piston rod is connected to a second rack 95, which is fastened to the right-hand vise jaw block 94.

The selector valve 145, Fig. 22 determines whether the machine is to operate at regular, quad left, center or quad right. The position of the selector valve 145 is controlled by the movement of the selector piston rod 176 and slide 177, Fig. 30 in conjunction with the action of the selector solenoid latches 199 and 200, and associated parts of the memory relay circuit.

A small gear 87, Fig. 6A, located at the rear of the housing is mounted on the selector valve shaft. The gear is turned by the movement of a rack 88, to which is attached a slide 177 (in the Selector Cylinder and Latch Housing Assembly), which in turn is connected to the Selector Cylinder piston rod 176. Stop latches 199 and 200, Fig. 30, which engage with the slide 177 locate it at various positions,

which results in the gear 87, Fig. 6A, turning the selector valve to the position required for the quadding or centering function selected.

Also incorporated in the cylinder and selector valve housing is the left-hand vise jaw banking screw arm and adjusting nut which takes the place of the normal vise closing wedge.

5. *The Selector Cylinder and Latch Housing Assembly 172*, Fig. 30, is mounted on the rear of the Cylinder and Selector Valve Housing. A piston rod 176, in this assembly is connected to a slide 177, which in turn is fastened to the selector rack 88.

At the appropriate time in the machine cycle, hydraulic fluid exerts pressure against the piston 202 to move the slide and rack, in order to rotate the selector valve for the desired quadding or centering function. The stop latches 199 and 200 are actuated by the selector

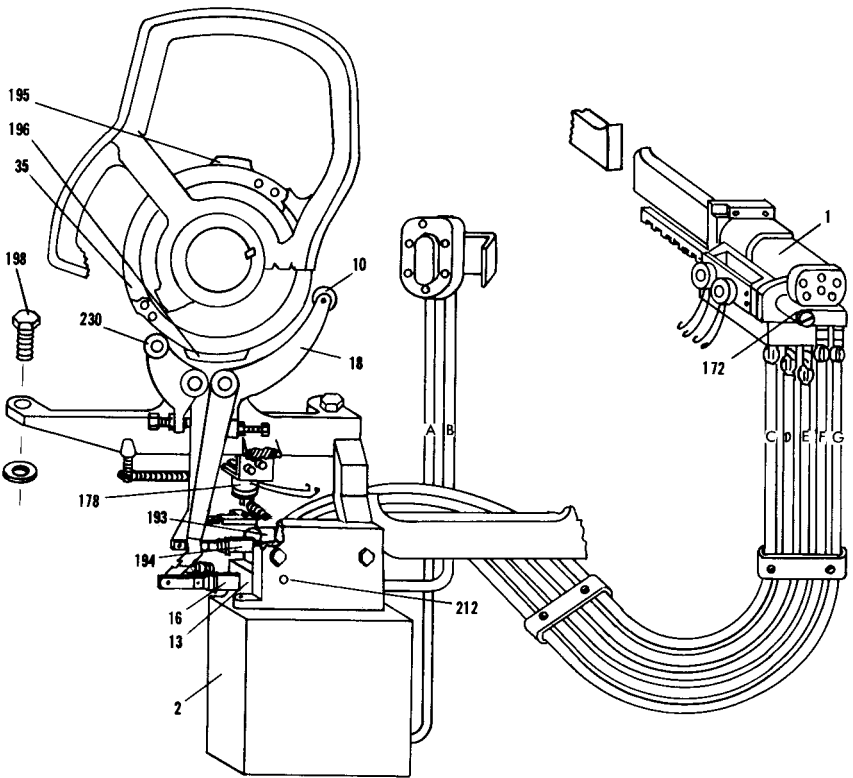


FIG. 1 Side View of Complete Hydraquadder.

solenoids 203 and 204, to stop the movement of the slide 177 and rack 88 at a particular location for the quadding and centering function selected, so that the gear which meshes with the rack, will rotate the selector valve to the correct position for either QL, QR or Centering.

The selector solenoids in this assembly are energized either individually or simultaneously (depending on the quadding or centering function desired) through the memory relay circuit in accordance with the selection made.

6. *The Selector Rack Support Assembly* 53, Fig. 5 includes the selector handle 17 which is located in either of four positions by means of a gear 82 on the selector handle shaft meshing with the rack 88, Fig. 6A, to which is fastened the slide 177, which in turn is connected to the piston rod 176 in the Selector Cylinder and Latch Housing Assembly.

When the selector handle shaft is rotated to any position from regular, a lever 61, Fig. 5, which pivots on the shaft, is moved by means of a shoe 89, Fig. 6A on the rack and through a link 63, Fig. 5, the justification stop lever 69 is moved into position to block out justification, in order to provide uniform word spacing.

When the centering function is called for, the movement of the selector handle shaft cams a small pinion 74, Fig. 5, downward, meshing it with the teeth on both vise jaw racks, which are connected to the vise jaws. The pinion meshed with both racks maintains the vise jaws in exact synchronization for accurate centering.

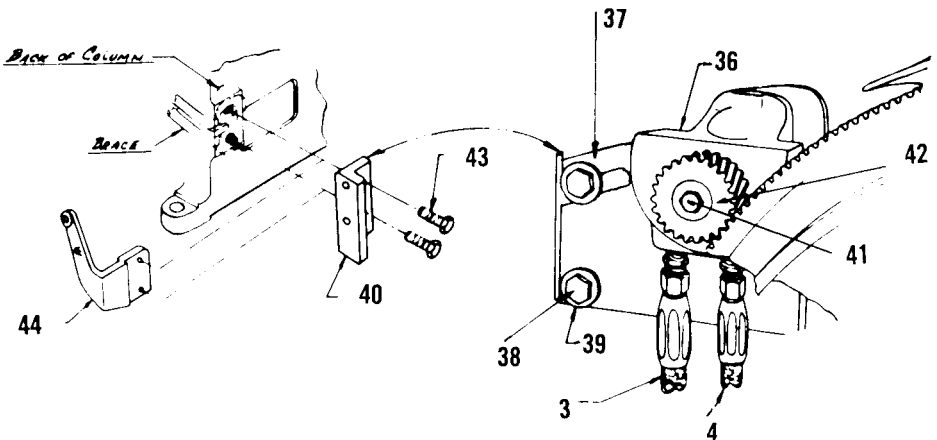


FIG. 2 View showing Pump and Pinion with Overhead Geared Motor Drive.

When the selector handle shaft rotates to the L.H. Quad position from regular, the movement of the rack 88, Fig. 6A also moves a stop 58 into position to limit movement of the left-hand banking screw arm 205 (takes the place of the wedge) so that the left-hand margin is exactly the same as that of a justified line.

7. *The Mohr Measure Control Assembly* is fastened to the right-hand end of the vise cap and is designed to move the left-hand vise jaw to the measure it is desired to cast. The operator simply turns the Measure Control Dial to any setting from 4 to 30 ems and the L.H. Vise Jaw is moved to the correct measure for casting.

The Measure Control supplied either has the L.H. Vise Jaw Control and Assembler Slide Mechanism to automatically set the Assembler Slide to the same measure as the L.H. Vise Jaw, when the dial is turned, or it consists of the Jaw Control only, with an em scale and a pointer mounted on the control, to set the left-hand vise jaw. Both versions of the Measure Control are offered, with the user exercising his option as to the one which best suits his needs.

8. *The Push-Button Box*, Fig. 15 which is conveniently located at the right of the keyboard has four selector or push buttons designated "Reg.", "QR", "CEN" and "QL" for control of the Hydraquadder.

The push-button box contains a four-position selector switch, a solenoid, socket and wiring.

When the operator wants to select a quadding function he merely presses down the appropriate button, which will stay in the depressed position until he presses another button or unless a tape is fed into

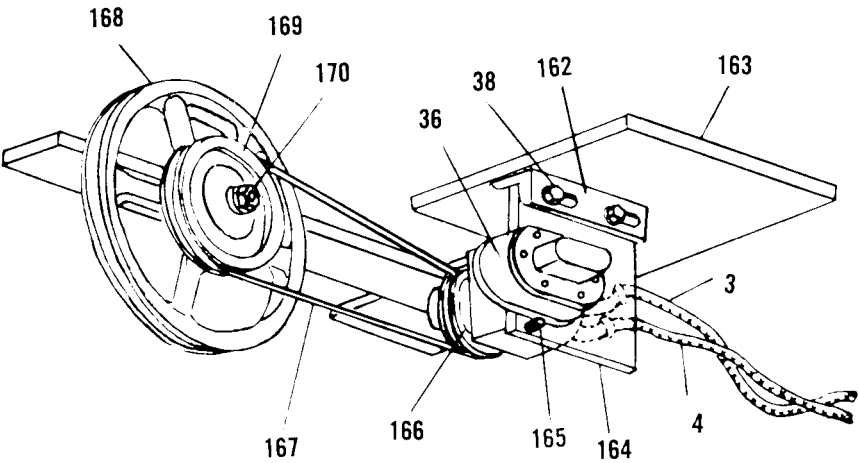


FIG. 3 View showing Pump with V-Belt Drive.

the TTS operating unit, in which case the buttons are automatically raised to the "up" position, by action of a switch S-801, Fig. 28, which energizes a solenoid in the push-button box.

If the operator does not press down any buttons or if the "Reg." push-button is depressed, the machine will operate regular.

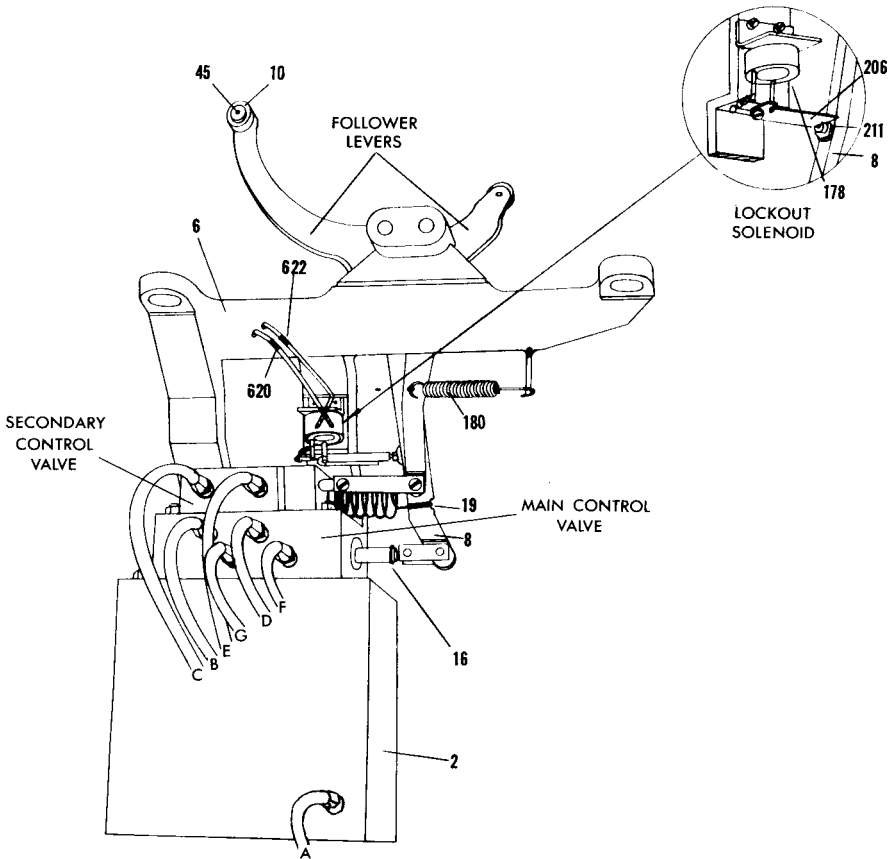


FIG. 4 Rear View of Main and Secondary Control Valves and Sump Assembly.

If the operator wants to recast lines with the same quadded function, he pulls out a spindle 183, which protrudes from below the front of the transfer switch assembly, Fig. 16 and 16A. When recasting is completed, the operator returns the transfer switch spindle to normal position and then clears the memory circuit. Clearing of the memory circuit relays is accomplished by either letting the machine turn around one cycle or by interrupting the power supply by turning off the power switch momentarily.

When the Electrically Controlled Hydraquadder is operated by tape and it is desired to set the quadder for a particular quadding function without the necessity of punching a quadding or centering signal in the tape for each line, the "Reg." button and a quad or center button is depressed simultaneously. The Hydraquadder will then quad or center each line automatically in accordance with the signal given by the push button.

The push-button box is cleared automatically when a tape is fed into the TTS operating unit. Any push-button which is depressed is returned automatically to its "up" or normal position except as noted in the paragraph above.

9. *The Power Supply Box*, Fig. 13, is fastened to the right-hand side of the Linotype base. Its purpose is to transform the incoming alternating current to low voltage alternating current and then change the alternating current to low voltage direct current. The electrical components of the Hydraquadder, such as the relays, solenoids, etc., operate on low voltage direct current supplied by the power supply box. The same power supply box also provides the power for the left-hand vise jaw safety and the TTS electrical safeties, if these are used.

10. *The Memory Relay Box*, Fig. 14 is mounted in front of the power supply box, at the right-hand side of the Linotype base. Within the box is a printed circuit, into which four relays are plugged and on which two small rectifiers are mounted. The use of a printed circuit greatly simplifies the wiring in the box since the connections of each relay socket are soldered directly to the printed circuit.

The relays comprise a memory circuit which enables three quadding signals to be in the machine simultaneously. They are of the plug-in type and are removed by simply pulling the relay out of its socket. This means a relay can be replaced in a matter of seconds if necessary. A special type of plug connects the leads from the Hydraquadder main harness to the printed circuit. The relays operate in two "stages."

The two relays on the left, Fig. 14A in the Memory Relay Box are the "first stage" relays; the upper one operating for a center signal, the lower one operating for a quad left signal and both operating for a quad right signal. When operating from tape, the first stage relay (or relays) receives the signal from the TTS operating unit bail switch

(or switches) Fig. 29 and retains the signal until the assembling elevator is raised, at which time the signal is transferred to the second stage relay (or relays) and the first stage relay (or relays) is released to await the next signal. For push-button operation the first stage relays are not used.

The two relays on the right in the Memory Relay Box are the "second stage" relays; the upper one operating for a quad left signal, the lower one operating for a center signal and both operating for a quad right signal. When operating from tape, the second stage relay (or relays) receives the signal from the first stage relay (or relays), and it is retained until the appropriate time in the machine cycle to enable the selected quadding or centering function to occur. As soon as the signal in the second stage relay has been used in the electrical circuit to result in the desired function, the relay is released to await the signal for the next line. For push-button operation, the second stage relay (or relays) receives the quadding or centering signal directly from the push-button switch by means of the transfer switch, as the

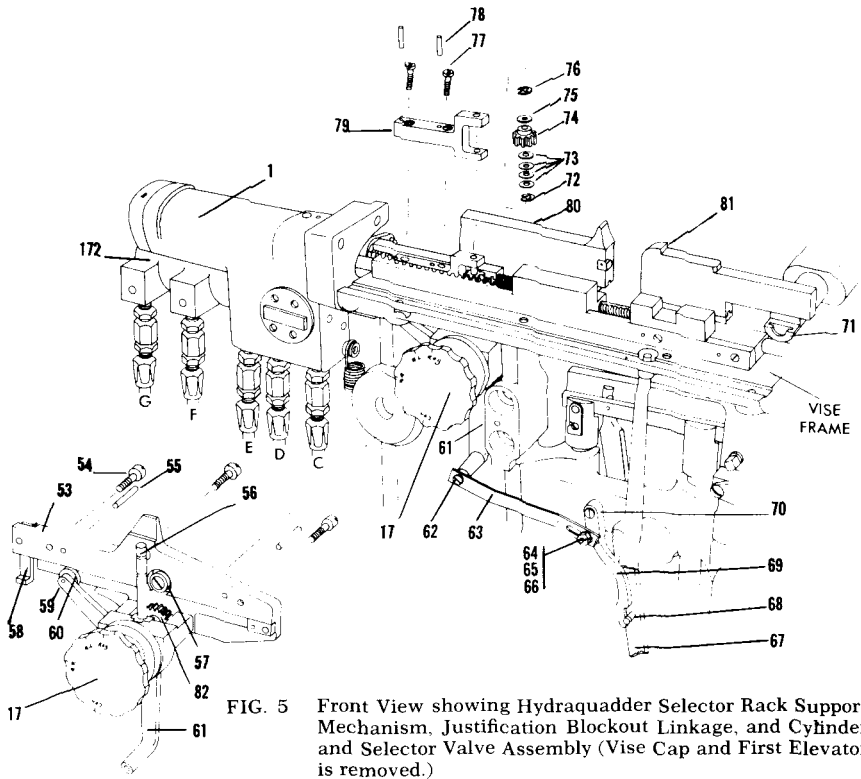


FIG. 5 Front View showing Hydraquadder Selector Rack Support Mechanism, Justification Blockout Linkage, and Cylinder and Selector Valve Assembly (Vise Cap and First Elevator is removed.)



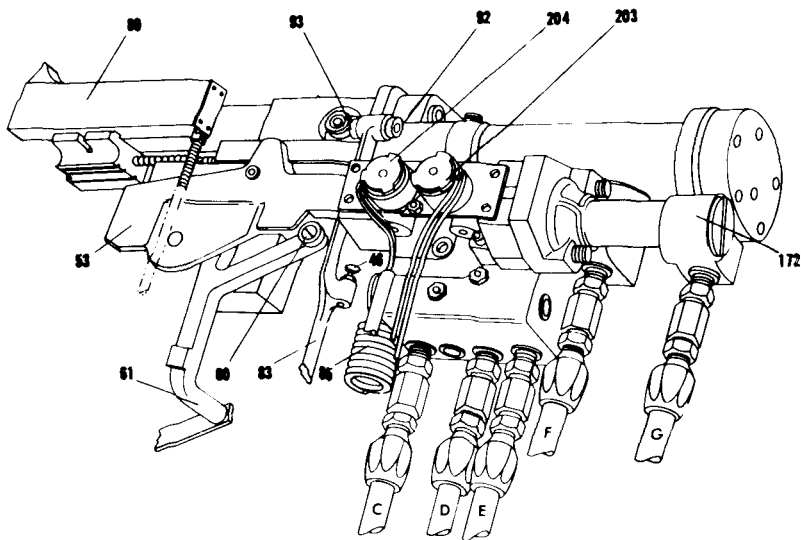


FIG. 6 Rear View of the Cylinder and Selector Valve Assembly, Selector Rack Support Assembly, Selector Solenoids and Left-Hand Vise Jaw.

assembling elevator is raised, and the first stage relays are not used.

11. *The Transfer Switch Assembly* is located at the left of the keyboard Fig. 16A, on TTS equipped Linotypes and at the right of the keyboard, Fig. 16 on push-button operated machines. It consists of a single *snap action* switch 181 which has two sets of contacts that operate in sequence, as the switch roller 182 is depressed. Included in the assembly is a plunger 183 which is moved to actuate the switch. The plunger has steps in it upon which the switch roller 182 rides to actuate the switch as the plunger is moved by the raising of the *assembling elevator*.

When the machine is operated by tape, the first movement of the plunger closes the first set of contacts in the switch, transferring the quadding signal from the first relay stage to the second relay stage. The second set of contacts of the transfer switch then open as the *assembling elevator* is raised further and release the first stage relays so that they can accept another quadding signal for the next line. When the Hydraquadder is controlled by push-button, the first stage relays are not used and the first set of transfer switch contacts complete the circuit directly to the second stage relays.

12. *The Main Control Valve Lockout Solenoid Assembly*, Fig. 4, is located at the rear of the main control valve. It consists of a solenoid 178 and stop latch 206. The solenoid causes the latch to be moved

out of the path of the main control valve operating lever 8 so that the main control valve lever and spindle are allowed to function for quadding or centering. When the quadder is set for regular, however, the solenoid is not energized and the stop latch remains in the path of the operating lever 8 to prevent movement of the main control valve spindle.

13. *The Actuating and Clearing Switches*, Fig. 17 and 17A, are mounted at the rear of the Linotype machine, and are operated by means of a shoe 189 fastened on the delivery and transfer cam as shown in Fig. 17 or on the control valve operating cam as shown in Fig. 17A. The original actuating and clearing switches were operated by cam shoe 189 on the delivery and transfer cam. This design was later changed to switches which are operated by a cam shoe on the underside of the main control valve operating cam, see Fig. 17A. The switches are snap action switches, one being normally closed and the other normally open. The actuating switch 207 is the normally open switch and is closed when the switch roller 192 is contacted by the shoe 189. This completes the circuit between the second stage relay (or relays) in the memory relay box and the selector solenoid (or solenoids). Since the appropriate relay is storing a signal in accordance with the signal given by tape or push button, the correct selector latch solenoid (or solenoids) is energized to control the position of the selector valve for the quadding or centering function desired.

Closing of switch 207 also simultaneously energizes the lockout solenoid 178, Fig. 4, to move the stop latch 206 clear of the operating lever and permit the main control valve spindle to move through its cycle.

The clearing switch 208 is a normally closed switch and is opened by its roller being contacted by the projection on shoe 189. Opening of this switch results in the circuit to the second stage relay (or relays) being opened so that the second stage relay (or relays) is de-energized and free to accept the quadding or centering signal for the next line.

14. *The Left-Hand Vise Jaw Safety*, Fig. 24 consists of an electrical switch 150 built into the L.H. Vise Jaw, a plunger 151 which protrudes from the end of the jaw and actuates the switch when it is depressed, a solenoid and bracket assembly, Fig. 8, to actuate the pump stop and the wiring harness to connect the electrical components of the circuit. The circuit is powered with low voltage direct current from the same power supply box as is used to power the Hydraquadder circuit.

When the switch plunger is depressed by a line of matrices properly held between the vise jaws, an electrical circuit is completed and the solenoid is energized to move catch lever 118, Fig. 8, out from under the pot pump lever to permit the plunger to descend for the cast.

# III. Operation

## General Sequence of Operation

The Electrically Controlled Hydraquadder can be operated by quadding signals from a Teletypesetter tape so that the quadding system is entirely automatic and controlled by the Teletypesetter operating unit, or it may be operated by push-button control so that the Linotype operator may select a quadding or centering function by pressing the proper push-button on the selector push-button box located at the right of the keyboard.

The sequence of operation of the Electrically Controlled Hydraquadder is the same for push-button operation as it is for Teletypesetter operation, except that the first stage relays are not used and the second contacts of the assembling elevator transfer switch perform no function when the Hydraquadder operation is controlled by push-button. When a push-button is depressed and the assembling elevator raised, the first contacts of the transfer switch 181, Fig. 16 close, and the signal for quadding or centering is transferred directly to the second stage relay or relays.

The sequence of operation thereafter is the same for both push-button and tape operation.

The general sequence of operation of the Electrically Controlled Hydraquadder is as follows:

1. The signal (either tape or push-button) is put into the electrical control circuit.
2. As the first elevator starts its descent, the secondary control valve Fig. 4 is closed, before the main control valve reaches the jaw closing position. Simultaneously the selector solenoid (or solenoids) 203, 204, Fig. 30 are energized by the closing of the actuating switch 207, Fig. 17 and 17A, in accordance with the quadding signal, to move the appropriate selector latch to position the selector slide. Also the lock-out solenoid is energized to move the lock-out latch clear of the main control valve operating lever, Fig. 4.
3. As the secondary control valve closes, the hydraulic system between the main control valve and the cylinder housing 1, Fig. 5 is closed off so that no jaw motion occurs. The hydraulic fluid is diverted to the selector cylinder 172 and pressure is applied against the selector piston to move the selector slide against the selector latch to position the selector valve for the predetermined quadding function.

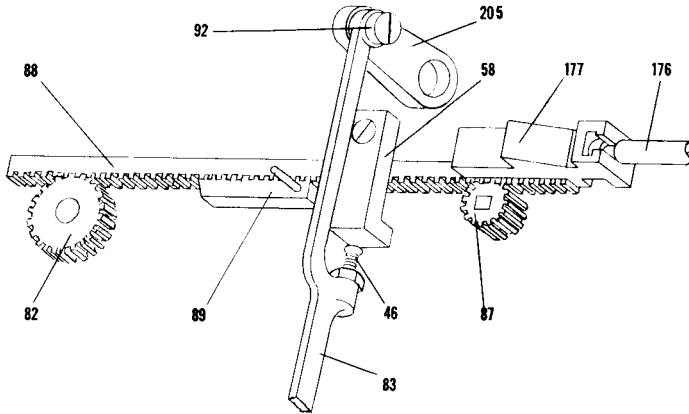


FIG. 6A Rear View showing Selector Rack, Gears and Margin Control Mechanism.

4. After the first elevator is seated on the vise cap, the secondary valve is opened and fluid then flows to the selector valve in the cylinder housing, where it is directed to the appropriate cylinder for the quadding or centering function called for.

Also after the first elevator is seated on the vise cap, the clearing switch at the back of the machine is opened, releasing the selector solenoid (or solenoids) and clearing the second stage relay (or relays) to make them available for the next line.

When the piston motion is stopped by the vise jaws contacting the line of matrices, the fluid pressure rises and the high pressure relief valve opens, permitting fluid to escape to the sump, thus maintaining the proper vise jaw force against the line of matrices.

Simultaneously with the closing of the L.H. vise jaw against the line of matrices, the detent in this jaw is actuated to close the jaw switch and the pot pump solenoid is energized to move the stop lever clear of the pot pump lever catch block which will permit the cast to be made.

5. Before the first elevator rises for matrix toe alignment, the main control valve shifts to permit the fluid to flow to the low pressure relief valve, reducing the vise jaw force sufficiently to permit vertical alignment of the matrices.

6. The main control valve again returns to the jaw closing position and high pressure is maintained during casting.

7. After the cast is completed, the main control valve is moved to the "wipe" position and the Hydraquadder fluid again flows through the low pressure relief valve, so that a low vise jaw force is exerted

against the line of matrices during the initial upward movement of the first elevator. *The low force provides a wiping action of the matrices against the jaw faces to prevent metal buildup.*

8. When the first elevator has risen a short distance above the vise cap, the main control valve is shifted to the return position simultaneously with the closing of the secondary control valve. The fluid exerts pressure on the right-hand side of the piston in the selector cylinder and the piston is moved to the left to return the selector slide and associated parts, such as the selector valve, justification blackout lever, etc., to normal position.

9. The secondary control valve opens and hydraulic fluid then flows to the vise jaw cylinders, moving the jaws back to their normal position.

10. The main control valve spindle is then moved to normal position and the hydraulic fluid circulates from the sump, through the pump and back through the main control valve to the sump.

### **Description of sequence of electrical operation — TTS Tape Control**

For tape operation, the clearing solenoid in the push-button box Fig. 15, is energized when the TTS operating unit cam shaft starts to turn, by the closing of the leaf switch S-801, Fig. 28 located in the Teletypesetter Operating Unit. The movement of the solenoid actuates a button release bar and any QL, QR or CEN push-button which is depressed is returned to its "up" position. The solenoid is not energized every cycle, but only when one of these push-buttons is depressed.

#### *QUAD LEFT (Tape Code 0134)*

1. Tape code 0134 closes QL bail switch E, Fig. 29 in TTS operating unit momentarily, energizing first stage relay K-2, Fig. 14A. Holding contacts on the relay hold the relay K-2 in the closed position, retaining the QL signal in the first stage of the memory circuit.

2. *During the rise of the assembling elevator, the transfer switch 181, Fig. 16A, contacts are actuated in sequence.*

3. First the transfer switch plunger closes the normally open switch contacts and the QL signal is transferred from the first stage relay K-2 to the second stage relay K-4, Fig. 14A. Holding contacts in relay K-4 hold the relay in closed position, retaining the quadding signal in the second stage of the memory circuit.

4. Further movement of the transfer switch plunger opens the second or normally closed switch contacts and releases the first stage relay K-2, thus clearing the relay for a new quadding signal.

5. As the Linotype cams start to rotate, the actuating switch 207, Fig. 17 and 17A is closed to complete the circuit between the second stage relay K-4 and the selector latch solenoid 204, Fig. 32, energizing this solenoid.

6. The closing of the actuating switch 207 also energizes the lockout solenoid 178, Fig. 4 to move the latch 206 clear of the main control valve operating lever to permit it to function.

7. After the first elevator is seated on the vise cap, the clearing switch 208, Fig. 17 and 17A is opened. This de-energizes the second stage relay K-4, Fig. 14A, the selector latch solenoid 204, Fig. 17, and the lockout solenoid 178, Fig. 4.

#### QUAD RIGHT (*Tape Code 01234*)

The electrical sequence for obtaining Quad Right is basically the same as for Quad Left, except that both relays K-1 and K-2 in the first stage and both relays K-3 and K-4 in the second stage are energized, which results in both selector latch solenoids 203 and 204 being energized. The circuit is conditioned for the Quad Right function by the closing of bail switches A and B, Fig. 29 in the TTS Operating Unit as a result of tape code 01234.

#### CENTER (*Tape Code 02345*)

The electrical sequence for obtaining Center is basically the same as for QL and QR except that only relay K-1 in the first stage and relay K-3 in the second stage are energized, which results in selector latch solenoid 203, Fig. 32, being energized. The circuit is conditioned for the Center function by the closing of bail switch D, Fig. 29 in the TTS Operating Unit, as a result of tape code 02345.

### **Description of Sequence of Electrical Operation — Push-Button Operation First Stage Relays not used for Push-Button Operation**

#### QUAD LEFT

1. "Q.L." push-button closes switch in push-button box so current will be directed to the second stage relay K-4 when assembling elevator is raised.

2. Raising the assembling elevator then actuates the first set of contacts of the transfer switch which results in energizing relay K-4.

3. As the Linotype cams start to rotate, the actuating switch 207, Fig. 17 and 17A, is closed.

4. This completes the circuit through relay K-4 to selector latch solenoid 204, Fig. 33, energizing the solenoid.

5. With the closing of actuating switch 207, the lockout solenoid 178, Fig. 4, is energized to move the lockout latch 206 clear of the main control valve operating lever.

6. After the first elevator is seated on the vise cap, the clearing switch 208, Fig. 17 and 17A, is opened, releasing the second stage relay K-4 for the next signal.

#### QUAD RIGHT

The electrical sequence for obtaining Q.R. for push-button operation is basically the same as Q.L., except that both relays K-3 and K-4

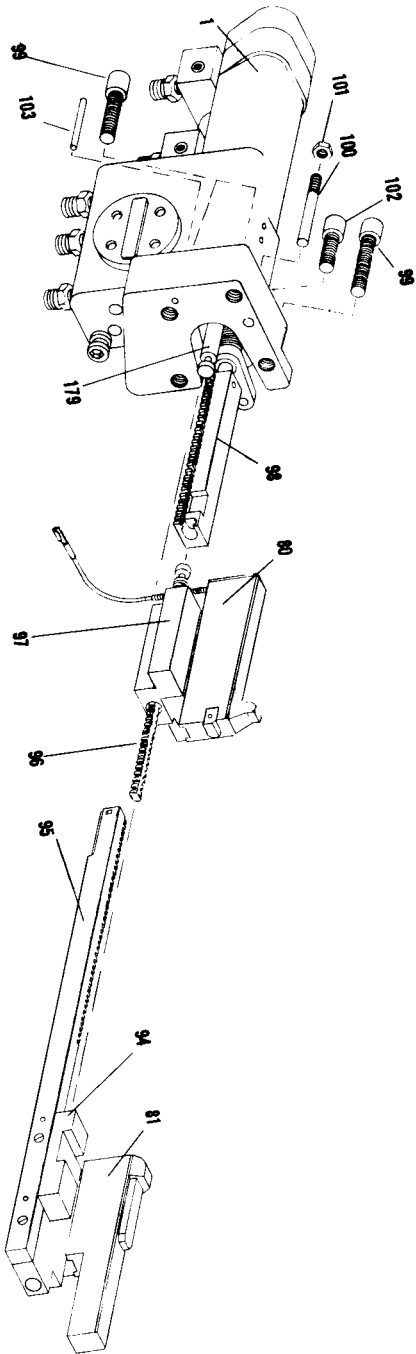


FIG. 7 Front View of the Cylinder and Selector Valve Assembly, L.H. and R.H. Vise Jaws and Blocks, and Racks.



in the second stage are energized which results in both selector latch solenoids 203 and 204, Fig. 32, being energized.

#### CENTER

The electrical sequence for obtaining Center for push-button operation is basically the same as for Q.L., except that relay K-3 in the second stage is energized which results in selector latch solenoid 203 being energized.

### Functions of Mechanical and Hydraulic Portions of Hydraquadder Control

The Electrically Controlled Hydraquadder construction is basically the same as the Manually Controlled Hydraquadder with the addition of a secondary control valve, operating levers, lockout levers, selector cylinder and slide assembly, operating cam shoes and the electrical components such as the memory relay box, transfer switch, etc.

### The Main Control Valve Operating Cam and Secondary Control Valve Shoes

The main control valve operating cam 35, Fig. 1, which is attached to the Linotype machine first elevator cam, has the function of positioning and timing the movement of the main control valve spindle 16. The secondary control valve spindle 193 is positioned by a long and a short cam shoe located on the flange of the first elevator cam. The long cam shoe 196 causes the spindle of the secondary control valve to move to a valve closing position during the descent of the

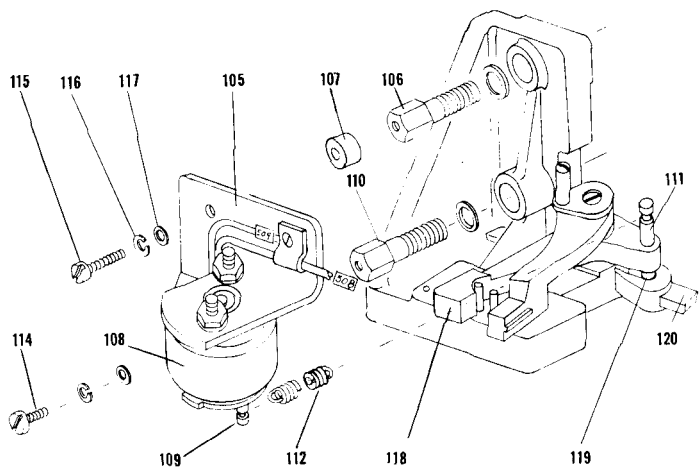


FIG. 8 View showing the L.H. Vise Jaw Pot Pump Safety Solenoid Bracket Assembly.

first elevator, while selection is taking place. The short cam shoe 195 causes the secondary control valve spindle to move to *closing position* just prior to *vise jaw opening*, after the cast, while the selector valve is returned to normal position.

### **The Secondary Control Valve**

The secondary control valve's function is to prevent hydraulic *fluid flow to the cylinder and selector valve housing* while the selector piston is being actuated to move the *selector valve* to the proper position for the pre-determined quadding function. The *secondary valve* is necessary to divert hydraulic pressure to the selector cylinder and *close off* the lines to the main cylinders during the time that selection takes place and *later in the cycle* when the selector valve is returned to normal.

### **The Main Control Valve Operating Lever Lockout Latch**

The purpose of the lockout latch 206, Fig. 4 is to prevent the operating lever from *moving* the spindle of the main control valve when the Linotype machine is sent *through a regular cycle* without a quadding or centering signal. When a quadding or centering signal is sent in, the solenoid 178 is energized to move the latch clear of the operating lever so that the main control valve spindle will function for quadding or centering.

If this latch did not prevent movement of the main control valve spindle during regular operation of the Linotype, the selector cylinder piston would move the selector rack and selector valve to quad left position whenever regular operation was desired.

### **The Selector Cylinder and Latch Assembly**

It is the function of the selector cylinder and *latch assembly* 172, Fig. 30, to provide a means of turning and locating the selector valve to the proper position for quadding or centering.

A slide 177 is attached to the right end of the selector rack 88. This slide in turn is attached to *the piston rod* 176 in the selector cylinder. When hydraulic fluid enters the selector cylinder, it exerts pressure against the piston 202, moving the piston rod 176, the slide 177 and selector rack 88. The selector rack is meshed with a gear 87, Fig. 6A, on the shaft of the selector valve. The slide 177 is stopped by the selector solenoid latches, 199 and 200, Fig. 30, in accordance with the quadding or centering signal given, so that the movement of the rack 88 on the gear 87, Fig. 6A rotates the selector valve to the proper position for the predetermined quadding or centering function.

In addition to the movement of the selector slide and rack positioning the selector valve for directing the flow of hydraulic fluid to move the vise jaws in conformity with the quadding or centering signal, three other functions are performed.

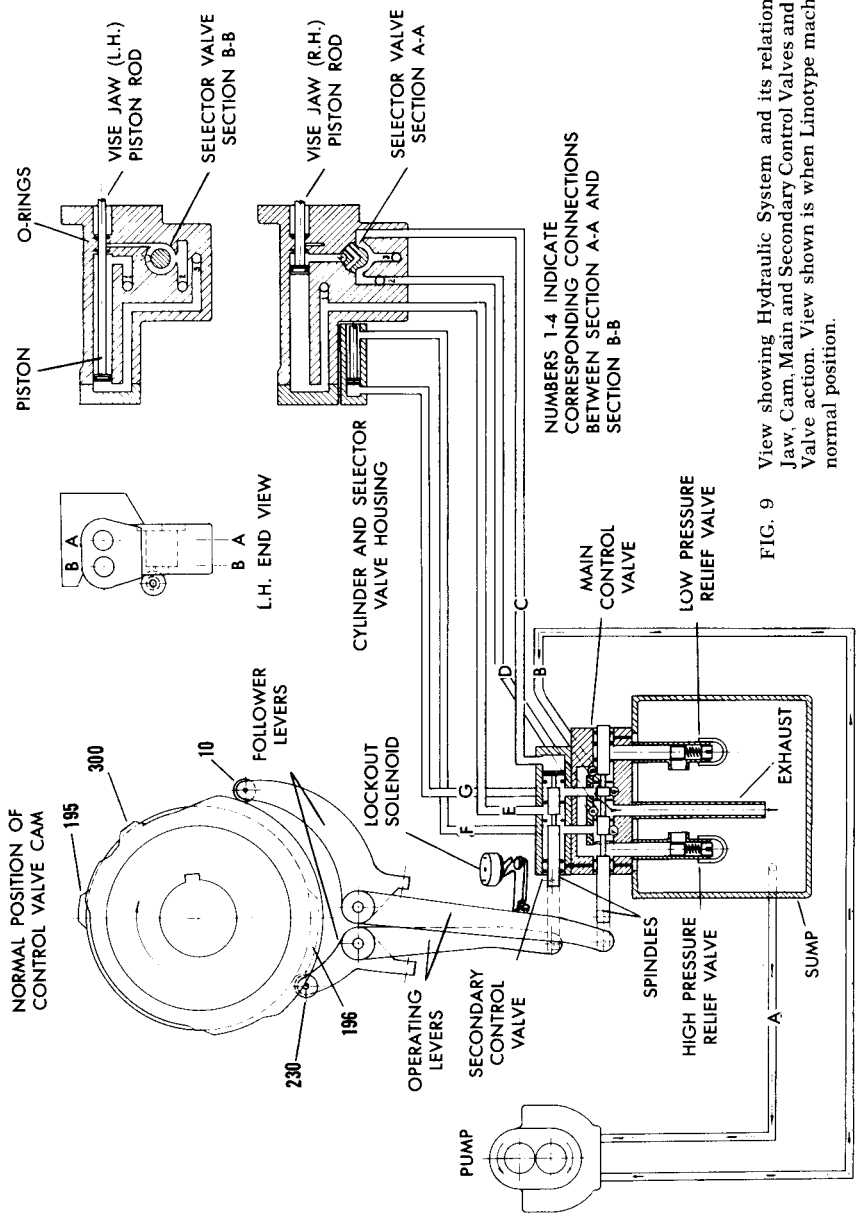


FIG. 9 View showing Hydraulic System and its relation to Vise Jaw, Cam, Main and Secondary Control Valves and Selector Valve action. View shown is when Linotype machine is in normal position.

First, when the selector valve is rotated, linkage is actuated to move the justification stop lever 69, Fig. 5, into position to block out justification during quadding or centering, in order to provide uniform word spacing.

Second, when the selector valve is rotated into position for centering, a small pinion 74 is cammed downward, meshing it with the teeth on the two racks which are connected to the vise jaws. The pinion meshed with both racks maintains the vise jaws in exact synchronization for accurate centering.

Third, when the selector rack 88, Fig. 6A moves the selector valve from regular, a stop 58 moves into position to limit movement of the left-hand banking screw arm 205 (takes the place of the wedge) so that when the Hydraquadder is set for L.H. Quad, the left-hand margin will be exactly the same as that of a justified line.

Selector Solenoids and Latches – Included in the Selector Cylinder and Latch Assembly, Fig. 30, are two solenoids and two latches which are actuated by the solenoids. The latches 199 and 200 contact or clear projections on the slide 177 attached to the piston rod and selector rack, to position the slide so that the selector valve will be rotated to the proper position for the quadding or centering function desired.

The latch 200, Fig. 30 and 32, is normally spring-pulled clear of the slide. When the solenoid 204 is energized for Quad Right or Quad Left function its latch is pivoted into position to be contacted by the slide to stop the movement of the slide and rack. The pivoting of latch 200 for the Quad Left function does not stop the slide, however, since the latch 199 which is normally in against the slide performs this function. Therefore, for the Quad Left function, although it is solenoid 204 which is energized, latch 199 actually stops the slide at the correct position for Quad Left.

The latch 199 is normally spring-pulled in against the slide and when solenoid 203 is energized, latch 199 is pivoted clear of slide. Solenoid 203 is energized for the Center or Quad Right function, see Fig. 32.

The selector solenoids are energized when the actuating switch 207, Fig. 17 and 17A completes the circuit between the second stage relays and these solenoids.

## **HYDRAULIC FLOW CHART**

To illustrate the manner in which the main and secondary control valves, the selector latch cylinder and the selector valve operate, by means of the circulating fluid, the hydraulic flow charts (Figures 9, 10 and 10A) should be consulted.

Figure 9 shows the complete Electric Hydraquadder hydraulic system as it is when the Linotype is set for regular with the machine

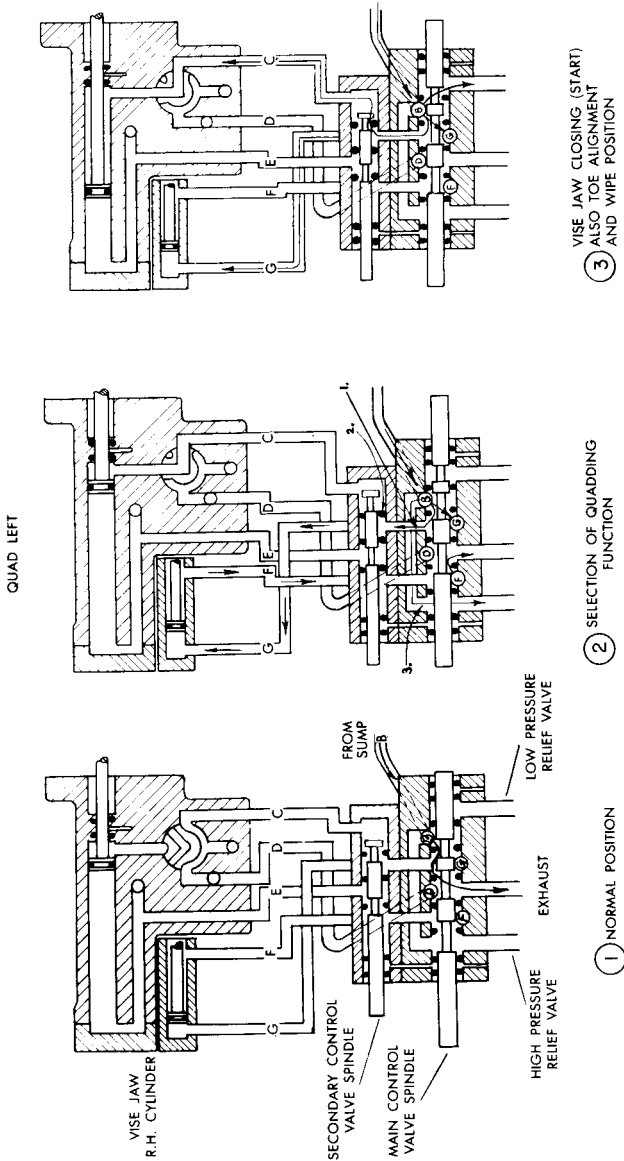
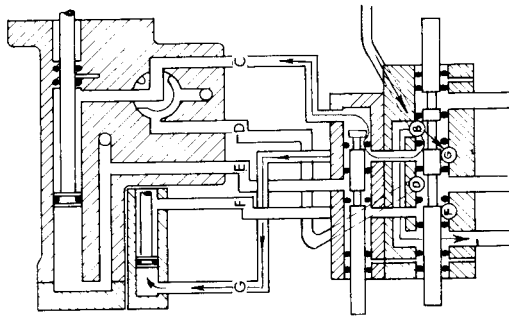
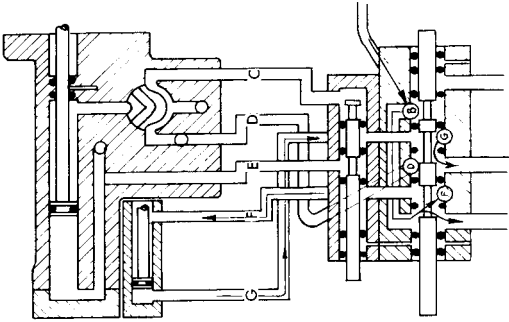


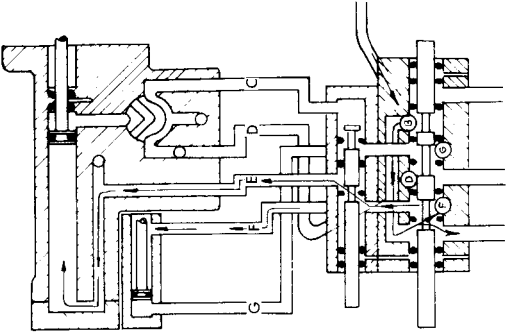
FIG. 10 View showing Sections through the Main and Secondary Control Valve Assembly and the Cylinder and Selector Valve Assembly. The relative position of these components are shown during the "Quad Left" Cycles of the Hydraquadder.



④ VISE JAW CLOSING (COMPLETION)  
AND CASTING POSITION



⑤ SELECTOR RETURN



⑥ JAW OPENING POSITION

idling. Shown are the main control valve with the secondary control valve directly above it, plus the operating cams and levers to move the control valve spindles, to time and direct the flow of fluid to quad or center the assembled line of matrices. In Figures 10 and 10A, cross section views of the main and secondary control valve and the cylinder and selector valve housing are illustrated, together with the selector cylinder which is assembled to the cylinder housing. The purpose of the selector cylinder and its piston rod is to move the selector rack by hydraulic means to position the selector valve which directs the fluid to the vise jaw pistons to quad or center the line of matrices. Selector latch solenoids attached to the selector cylinder assembly interpose stops to control the movement of the selector cylinder piston and selector rack so that the selector valve will be positioned properly according to whether the Hydraquadder is to quad or center.

The secondary valve attached to the top of the main control valve is designed to prevent the flow of fluid to the cylinder and selector valve housing to prevent movement of the vise jaws, until the selection of the quadding or centering function takes place. This is necessary so that hydraulic pressure be made available to select the quadding or centering function during the downward movement of the first elevator to the vise cap, without closing the vise jaws. The secondary control valve also prevents the vise jaws returning to normal position after the cast until the selector valve is returned to normal or regular position.

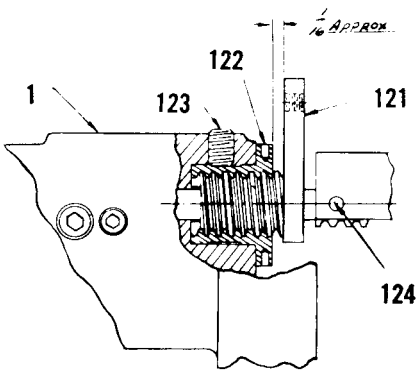


FIG. 11 Sectional View of Left-Hand Margin Adjusting Mechanism.

Referring to the flow chart illustrations, it will be noted that there are several port openings in the main or lower control valve. These lead to the four hoses B, D, F and G and to the high pressure and low pressure relief valves and to the exhaust line to the sump or fluid reservoir.

There are two port openings in the secondary control valve to which are connected hoses C and E. Two port openings in the main control valve also are connected to the cylinder opening in the secondary control valve by connecting passages in both valve housings, so that when the fluid passes through hose G to the selector cylinder, the fluid also passes to the secondary control valve but is blocked there



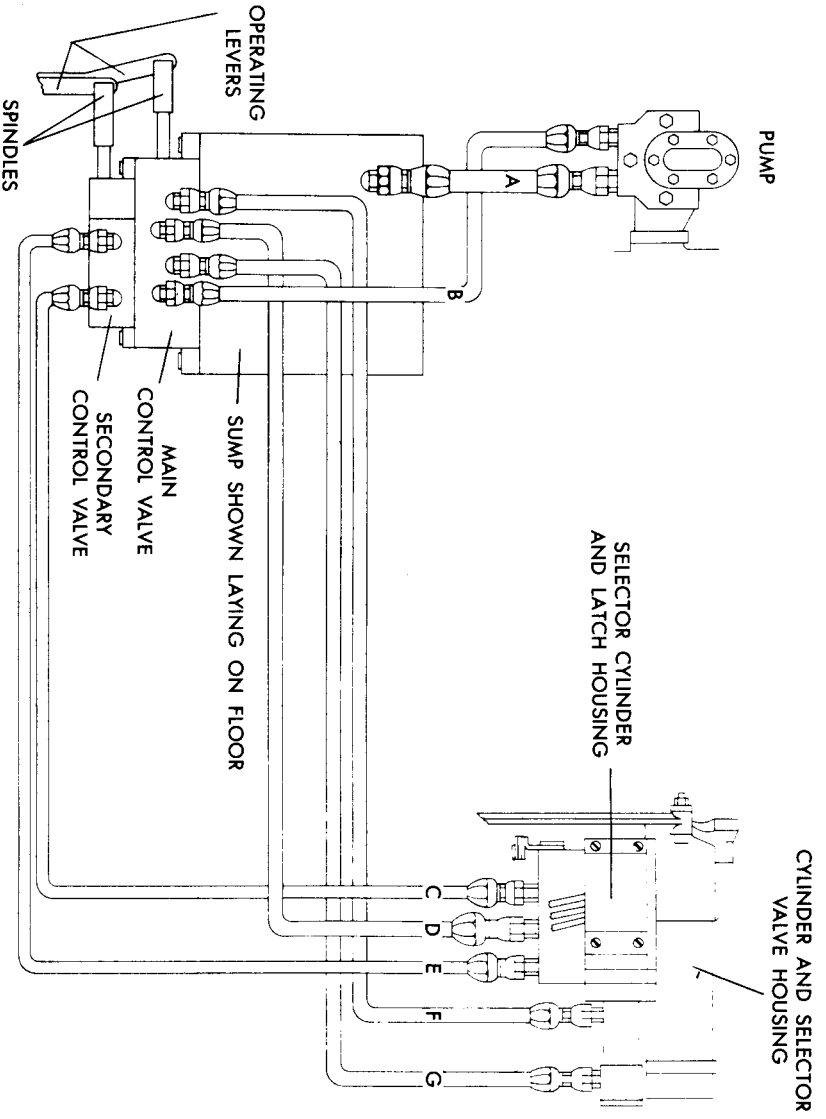


FIG. 12 Hydraulic Hose Connections.

by the position of the secondary spindle, until selection takes place. This will be explained later.

The Neoprene "O" rings shown in both control valves are fixed in their proper location by spacers which have openings to permit the passage of hydraulic fluid (see layout of "O" rings, spaces, etc. in adjustment and maintenance section). The outside surface of the "O" rings prevent fluid passage by their contact with the cylinder wall of the control valve. The two control valve spindles have cut-out portions

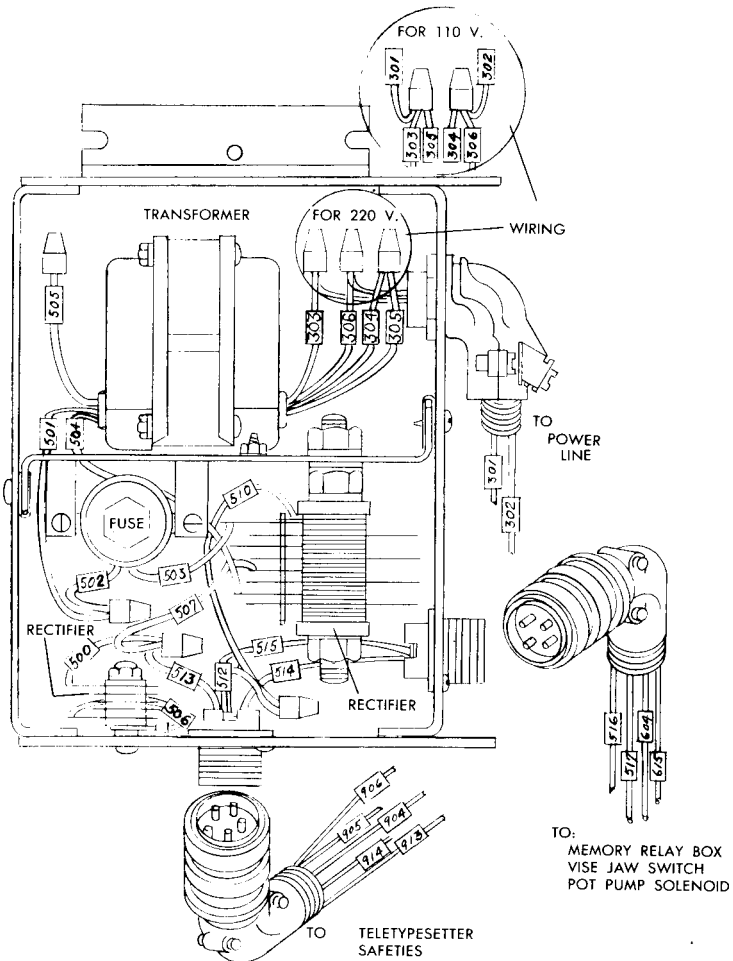


FIG. 13 Power Supply Box.

to permit fluid passage. When a larger diameter section of the control valve spindle is positioned so that one or more "O" rings encircle it, it blocks the passage of the fluid. The movement of the control valve spindle directs the fluid to the proper main and secondary control valve openings to move the selector piston rod to select the proper quadding function, to control vise jaw movement and to apply the correct jaw operating pressures at the correct time in the machine cycle.

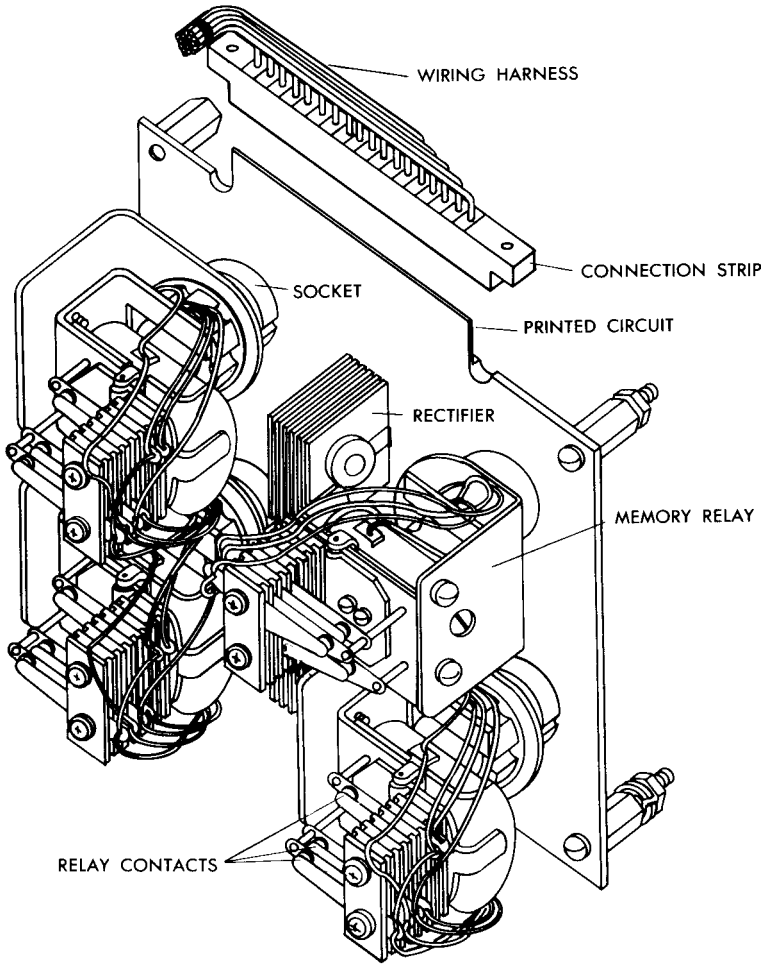


FIG. 14 View showing the Memory Relay Box Components.

Figure 9 shows the main and secondary control valve spindles in normal position with the machine idling. The fluid is drawn from the sump, through the pump, and into the main control valve through hose B. The direction of the flow is shown by the solid lines with arrows. It will be noted that when the machine is idling, the fluid passes directly through the exhaust pipe to the sump and continues to circulate in this way as long as the Linotype motor is operating to revolve the hydraulic pump.

Figures 10 and 10A show the movement of the control valve spindles when the quadder is set to quad left. Illustration (No. 1) shows the fluid circulating back into the sump when the machine is in normal position and idling. As the cam shaft revolves, the Hydra-quadder operating cam for the main control valve allows the roll 10, Fig. 9, to move inward causing the main control valve spindle to move toward the front of the machine, positioning the spindle for the selecting position (2). Shortly before roll 10 moves inward, the cam shoe 196 on the first elevator cam raises the roll 230, moving the secondary control valve spindle towards the front of the machine to the closed position as shown in the second illustration marked "Selection." By moving the main control valve spindle to its fully forward position as shown in illustration 2, the fluid is caused to pass through port opening "G" and through hose "G" to the left side of the selector cylinder located at the rear of the cylinder and selector valve housing. This forces the piston to the right and moves the selector rack against stops actuated by the selector solenoids which are controlled electrically by means of tape or push-button actuation. The selector rack turns the selector valve to Quad Left position.

It will be noted that in the "selection" position (No. 2) Fig. 10, the fluid can flow through the passage shown at 1, to the secondary control valve, but it is blocked off by the two "O" rings shown at 2, so that it cannot pass through hose "C" to move the right-hand vise jaw.

It should also be noted that the fluid passing through port opening "G" in the main control valve is also directed to the high pressure relief valve as shown by the solid line with arrows through passage 3, which maintains a pressure in the system of 150 pounds per square inch to force the selector piston rod and rack against the stop with this pressure.

As the cam shaft continues to revolve, the secondary control valve spindle assumes the open position shown in No. 3 illustration. The fluid continues to flow through port opening G and through its hose to the selector cylinder to hold the selector piston rod and rack to the right against its stop, holding the selector valve in the quad left position. The roll 230, Fig. 9, however, has dropped off the cam shoe 196 on the first elevator cam, moving the secondary control valve spindle to the rear or open position, allowing the fluid to pass out of the secondary control valve and through hose "C" to the selector

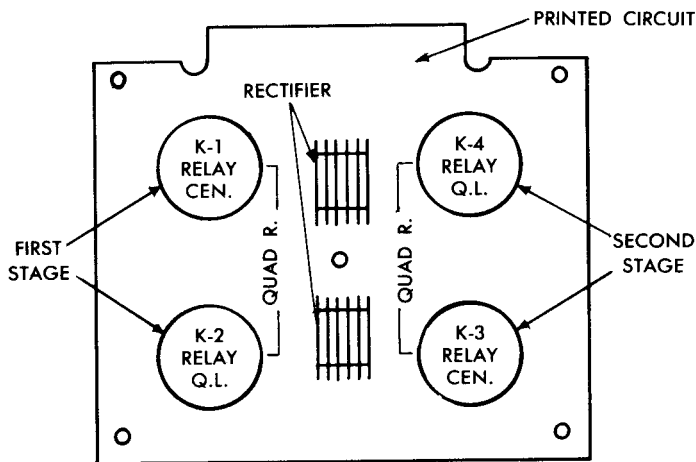


FIG. 14A Functions of Relays in Memory Relay Box.

valve which has been pre-positioned for "Quad Left," resulting in the movement of the R.H. jaw against the line of matrices. At the same time, the roll 10, Fig. 9, rides up on the cam contour 300 causing the main control valve to move to the rear and allowing the fluid to "bleed" off through the low pressure valve. This allows the initial closing movement of the vise jaws to take place at low pressure, to reduce vise jaw closing velocity. As roll 10 follows the cam contour, the main control valve moves forward again to complete the vise jaw closing at high pressure as shown in Fig. 4.

On machines which do not have the rise on the operating cam shown at 300, Fig. 9, the spindle is positioned as shown in illustration 4, Fig. 10A, for vise jaw closing and does not change position until toe alignment occurs as shown in illustration 3.

As the cam shaft continues to revolve, the secondary control valve spindle does not change position, but a rise on the periphery of the main control valve operating cam contacts the roll 10, Fig. 9 moving the main control valve spindle toward the rear (No. 3 illustration) which opens up a passage to the low pressure relief valve which reduces the pressure in the system to 40 pounds per square inch. The fluid continues to flow through hose "G" to the selector cylinder to hold the selector piston rod and rack against the stop so that the selector valve will remain in quad left position, and the fluid continues

to flow through hose "C" to the selector valve and against the piston connected to the right-hand vise jaw block so that the right-hand vise jaw continues to exert pressure against the line matrices, but the pressure is reduced to 40 pounds per square inch to permit vertical or toe alignment of the matrices to take place.

In explaining how the fluid pressure is kept at either 150 or 40 pounds per square inch, it may be said that when the selector cylinder piston is stopped by coming against the solenoid latch stop, or when the vise jaw piston is stopped by contact with the line of matrices, the fluid pressure rises until the pressure relief valve opens at a pre-determined pressure permitting fluid to escape to the sump and maintaining the proper pressure in the system.

After the pressure of the fluid has been reduced to permit toe alignment, the further revolving of the cam shaft causes the main control valve spindle to move again fully forward to casting position

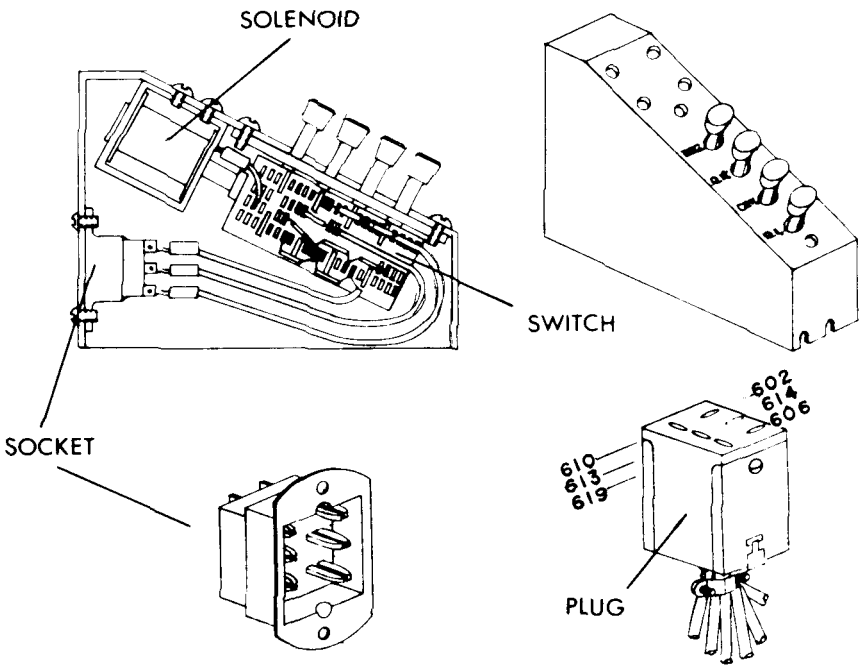


FIG. 15 Push-Button Box.

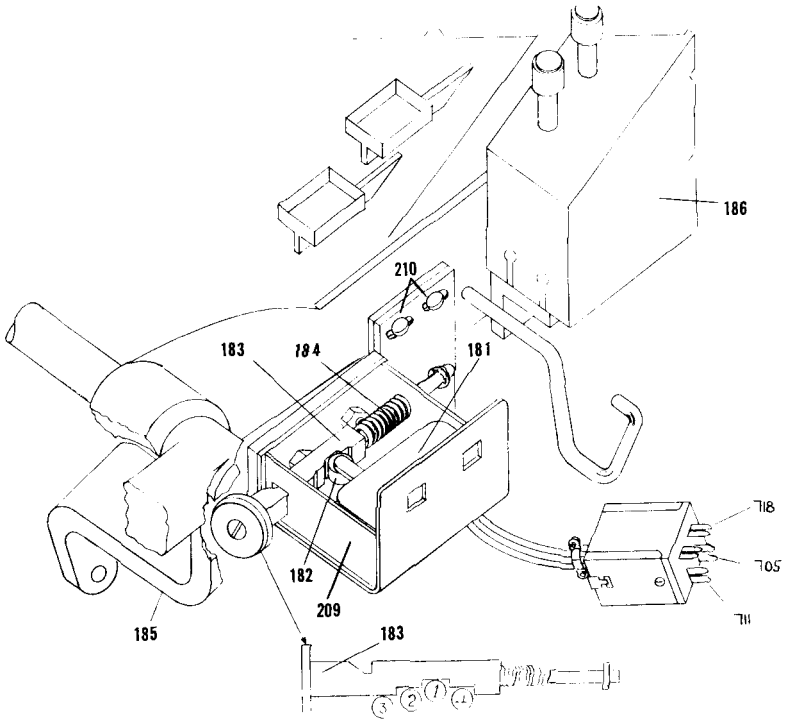


FIG. 16 View of Transfer Switch Assembly  
(for Push-Button Operation).

(No. 4 illustration). This is the same as vise jaw closing position, the secondary control valve spindle remaining in the same open position. The passage of the fluid to the low pressure relief valve, however, is now blocked off so that only the high pressure relief valve is in the flow system. Maximum pressure is thus exerted by the right-hand vise jaw against the line of matrices for the cast. The same pressure also holds the selector cylinder piston and rack against the solenoid latch stop to continue to hold the selector valve in its quad left position.

After the cast, roll 10, Fig. 9 following the contour of the cam causes the main control valve spindle to move toward the rear of the machine to wipe position (No. 3 illustration). This is the same as toe alignment position. The secondary control valve spindle does not



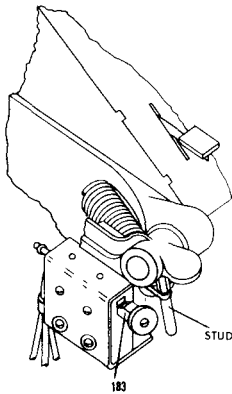


FIG. 16A View of Transfer Switch Assembly (for machines with Teletypewriter unit).

change position. However, when the main control valve spindle moves toward the rear, it opens up the passage again to the low pressure relief valve to provide reduced pressure (40 pounds per square inch) of the vise jaws against the line of matrices. As the first elevator rises after the cast, the end matrices in the line will wipe the vise jaw with a pressure of 40 pounds per square inch. This will prevent metal from accumulating on matrix contacting surfaces of the vise jaws to aid in preventing matrix sidewall damage.

While the main control valve is moving towards the rear of the machine to bring the low pressure relief valve into the flow system, the selector cylinder piston rod and rack continues to press against the solenoid latch stop holding the selector valve in its quad left position but at the reduced pressure of 40 pounds per square inch.

As the cam shaft continues to revolve, the main control valve spindle moves further to the rear to the selector return position (illustration No. 5) closing the opening to the vise jaw closing hose C, and opening the passage to the selector return hose "F." At the same time shoe 195 on the first elevator cam causes the secondary control valve spindle to move forward to closed position, closing up passage to hose "E" to prevent return of the right-hand vise jaw to normal position until the fluid passes from the main control valve through hose "F" to return the selector cylinder piston and rack and consequently the selector valve to normal position. When this is accomplished, the roll 230 leaves shoe 195, moving the secondary control valve spindle to the open position, opening up the passage of the fluid through hose "E" permitting fluid to pass to the left of the front vise jaw cylinder, moving the right-hand vise jaw to the right and back to normal position (No. 6 illustration). The Hydraquadder is then ready for the next cycle of the machine.

In the flow charts, no attempt has been made to show the fluid returning to the control valve and to the sump. When the right-hand vise jaw is forced to the left, as for "Quad Left", the fluid to the left of the piston is forced through hose "E" back to the secondary control valve and it then passes to the main control valve where it passes through the exhaust pipe into the sump. When the right-hand vise jaw moves away from the line of matrices in returning to normal position, the fluid on the right of the piston is forced back to the control valve and sump.

The various positions of the main and secondary control valve spindle during the machine cycle are exactly the same for Quad Left, Quad Right and Center. However, the position of the selector valve for the quadding or centering functions determines how the fluid is to be diverted in the vise jaw cylinder housing to Quad Left, Quad Right or Center.

When the Electric Hydraquadder is set for regular, the lockout solenoid and latch prevents the main control valve spindle from moving, so that the fluid simply flows from the pump to the main control valve and through the exhaust pipe to the sump, the same as when the machine is idling. This solenoid latch is maintained in latched position by its spring to prevent the spindle moving as the cam shaft

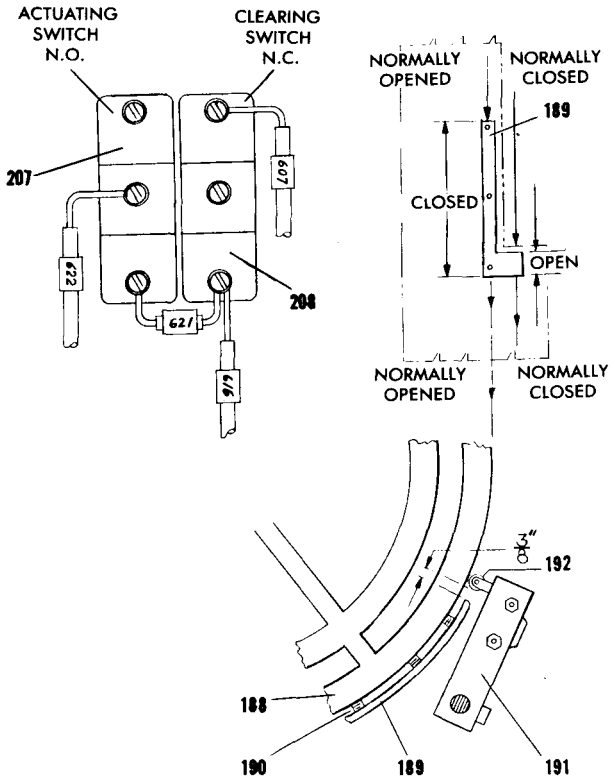


FIG. 17 Actuating and Clearing Switches operated by Shoes on Delivery and Transfer Cam.

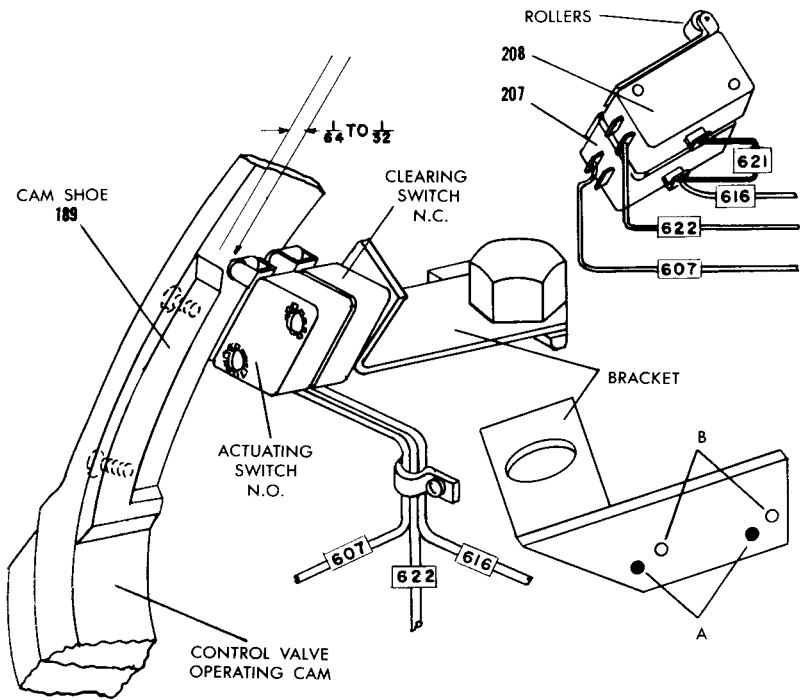


FIG. 17A View of Control Valve Operating Cam Actuating and Clearing Switches.

revolves, unless the quadder is set for quadding or centering. A quadding or centering electrical signal actuates the solenoid to pull the latch out of the way so that the main control valve spindle can operate. When the machine is set for regular and the cam shaft revolves, the secondary control valve spindle continues to operate by cam action, but since the main control valve spindle does not move, the fluid exhausts directly into the sump and does not pass to the secondary control valve.

It is pointed out that the prevention of the main control valve spindle from moving when the machine is set for regular is necessary, because if the main control valve spindle were permitted to move, the fluid would flow to the selector cylinder and move the selector valve to quad left position whenever regular operation was desired.

### The Power Supply Box, Fig. 13

Since the electrical system for controlling the Hydraquadder operates on low voltage Direct Current, it is the function of the Power Supply Unit to transform the incoming 110 or 220 volt A.C. power supply to approximately 24 volts A.C. and then convert to D.C.

The transformer in the power supply box reduces the incoming line voltage to 24 volts Alternating Current and the large disk type rectifier changes the alternating current to direct current.

A 2 ampere fusestat is located in the power supply box to protect the electrical circuit against overloads.

The small, square, four-plate rectifier in the power supply box is in the circuit to dampen any arcing which might occur across the L.H. vise jaw switch contact points when the switch opens.

There is a four-terminal socket located on the power supply box to which the harness plug from the various electrical components of the Hydraquadder and electrical L.H. Vise Jaw Safety are connected. A five-terminal socket located on the power supply box provides the connection for the harness plug from the TTS keyboard safeties.

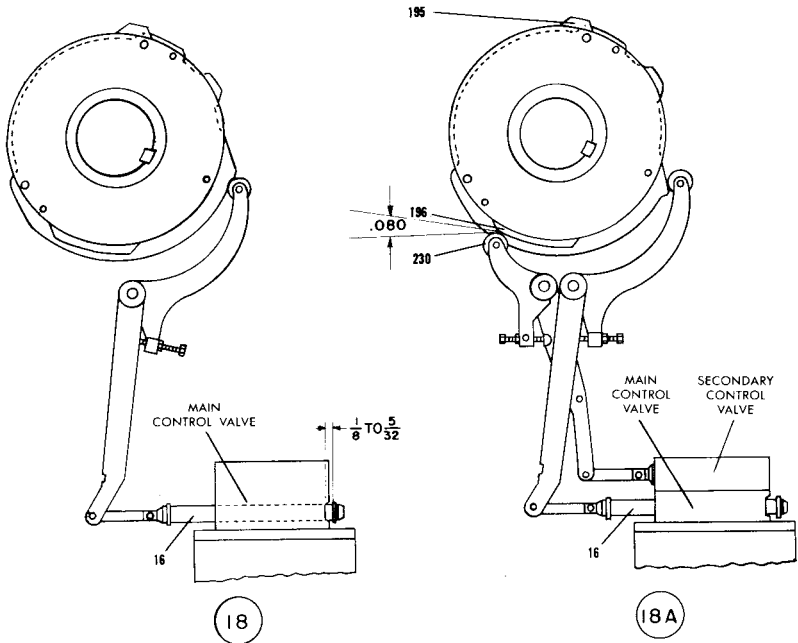


FIG. 18 Main and Secondary Control Valve Adjustments.

The primary leads of the transformer can be connected so that the same power supply box is used for either a 110 volt or 220 volt A.C. power source.

The primary leads of the transformer are connected in series for a 220 volt A.C. power source, or in parallel for a 110 volt A.C. power source, as follows:

For 220 volt power source:

Connect wires 304 and 305 together.

Connect incoming power line wire 301 to wire 303.

Connect incoming power line wire 302 to wire 306.

For 110 volt power source:

Connect incoming power line wire 301 to wires 303 and 305.

Connect incoming power line wire 302 to wires 304 and 306.

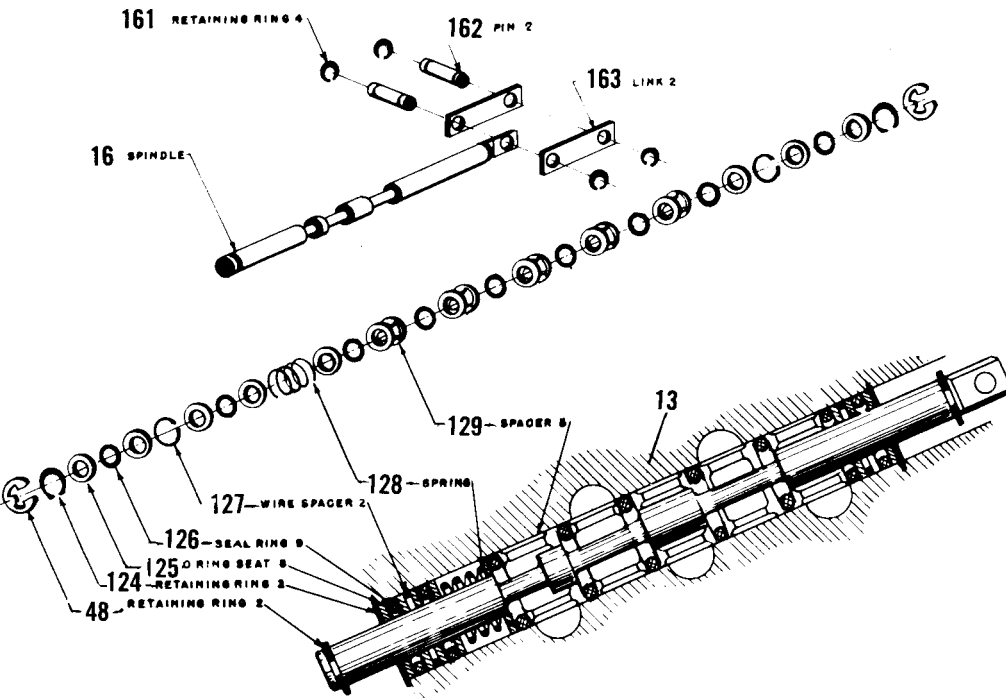


FIG. 19 View showing Assembly of Spindle, O-Rings, O-Ring Seats, Seals, etc., which are in the Main Control Valve.

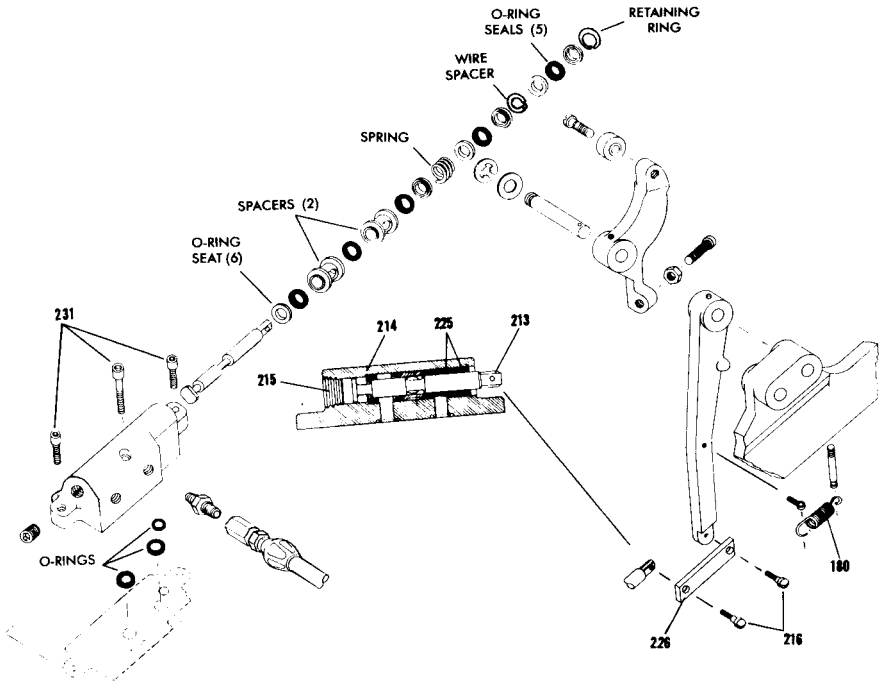


FIG. 20 View showing Assembly of Spindle, O-Rings, O-Ring Seats, Seals, etc., in the Secondary Control Valve.

### The Memory Relay Box, Fig. 14 and 14A

The function of the relays in the memory relay box is to retain or transmit the quadding or centering function, at the proper time in the machine cycle. Each of the 4 relays used is identical in its internal wiring and may be interchanged with the others.

When the Hydraquadder is operated by push-button control only, the two first stage relays K-1 and K-2 are not used in the circuit, the signal from the push-button selector box going directly to the second stage relays K-3 and/or K-4 upon actuation of the transfer switch.

When the Hydraquadder is operated by tape control, the first stage relays K-1 and/or K-2 and the second stage relays K-3 and/or K-4 are used, the signal being transferred from the first stage to the second stage relays as the transfer switch is actuated. This provides the memory feature, since two signals can be "memorized" by the first and second stage relays while a third line is being cast.

The first stage relays K-1 and K-2 are located at the left in the memory relay box, see Fig. 14A. Relay K-1 is the upper one and K-2 the lower one.

The second stage relays are located at the right in the memory relay box. Relay K-3 is the lower one and K-4 the upper one.

Relay K-1 operates for a CEN signal (for tape control only).

Relay K-2 operates for a QL signal (for tape control only).

Relays K-1 and K-2 operate simultaneously for a QR signal (for tape control only).

Relay K-3 operated for a CEN signal (for either push-button or tape control).

Relay K-4 operates for a QL signal (for either push-button or tape control).

Relays K-3 and K-4 operate simultaneously for a QR signal (for either push-button or tape control).

### The Push-Button Box, Fig. 15

The Push-Button Box is used to control the Hydraquadder functions by means of the operator depressing the proper push-button for the Quadding or Centering function desired. Construction of the switches in the box is such that a depressed push-button stays in the down position and is released only by depressing another push-button. Depressing the push-button results in the closing of switch contacts to prepare the electrical circuit for the function selected.

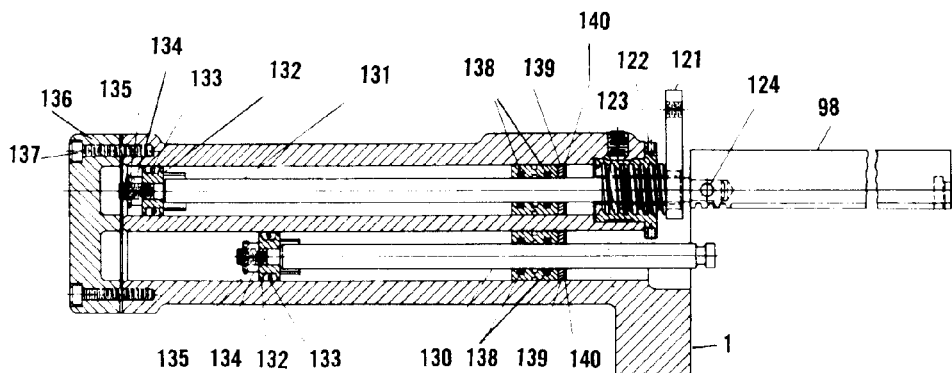


FIG. 21 Sectional View of Cylinder and Piston Rod Assembly in Cylinder and Selector Valve Housing.

The Push-Button Box also incorporates a solenoid to actuate a button release bar to automatically return any depressed push-button to "up" position whenever TTS tape is used.

*Omitting Quadding Signal in Tape*—In the case of the "Reg." push-button, the switch contact which completes the circuit to the push-button clearing solenoid is opened so that the clearing solenoid is not energized when a Teletypesetter tape is used.

With this arrangement, if the same quadded function is desired for a number of consecutive lines during tape operation and it is desired to omit the quad signal in the tape, the appropriate "quad" or "center" button and the "Reg." button are depressed simultaneously. Since the clearing solenoid will not be energized when the "Reg." button is down, the quadding signal will originate from the push-button box during tape operation; no tape signal is required.

*Recasting (Push-Button Operation)*—If the same quadded function is desired for a number of recast lines during push-button operation, the operator depresses the proper push-button, sends the line in and then after the assembling elevator returns to normal position, the operator pulls the transfer switch plunger 183, Fig. 16 forward to its limit. The plunger, thus positioned, holds the transfer switch in the closed position so that the signal is retained in the memory circuit during recasting.

After recasting is completed, the transfer switch plunger must be returned to normal position, and then the memory circuit must be cleared. To clear the memory circuit, either turn the power switch off momentarily, or allow the machine to complete an additional cycle.

### Action of Push-Button Clearing Solenoid

As previously mentioned, there is a clearing solenoid incorporated into the design of the Push-Button Box which prevents the possibility of a depressed push-button causing a signal to enter the memory circuit when quadding or centering signals from tape are being used.

A Push-Button Release switch S-801, Fig. 28, in the TTS Operating Unit is closed momentarily when the elevate signal in the tape causes the operating unit to raise the assembling elevator. The closing

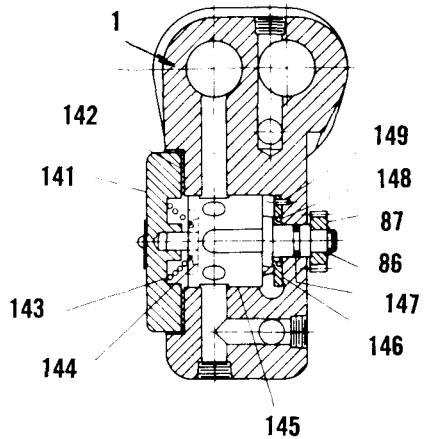


FIG. 22 Sectional View of Selector Valve Assembly in Cylinder and Selector Valve Housing.



of this switch results in the solenoid in the Push-Button Box being energized. The movement of the solenoid actuates a button release bar and if a "Q.L.", "Q.R.", or "CEN." push-button is depressed, the button is returned to its "up" position automatically.

Switch S-801 is actuated by means of a fiber pin riding on a small cam on the Teletypesetter Unit elevator cam shaft, as the cam shaft starts turning to raise the assembling elevator in response to the "elevate" signal in the tape. As the cam starts to turn, the fiber pin drops into a recess in the cam contour which allows the switch contacts to close momentarily.

The solenoid is not energized for every cycle, but only when a quadding or centering button is depressed and tape is fed into the TTS Operating Unit. Also, if the "Reg." button is depressed, the switch contact which completes the circuit to the push-button clearing solenoid is opened so that the clearing feature is inoperative and it is possible to obtain a quadding or centering function for tape operation, as described under the heading "Omitting Quadding Signal in Tape."

### Actuating and Clearing Switches

The actuating switch 207, Fig. 17 and 17A has the function of completing the circuit between the second stage memory relays (K-3 and/or K-4) and the selector solenoids 203, 204, Fig. 30, and lockout solenoid 178, Fig. 4 in accordance with the Quad or Center function selected. The switch 207, Fig. 17 and 17A, is a normally open switch and when its actuating roller contacts the cam shoe 189, the switch closes, completing the circuit between the relay (or relays) and the selector solenoid (or solenoids) and also the lockout solenoid.

After the first elevator is seated on the vise cap, clearing switch 208 (normally closed) is opened by the projection on the cam shoe. This de-energizes the selector latch solenoids, the lockout solenoid, and the second stage relays, so that they will be ready to receive the next signal.

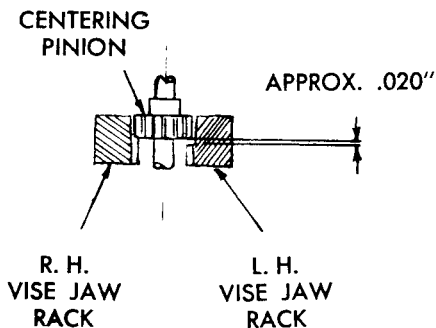


FIG. 23 View of Centering Pinion in relation to L.H. and R.H. Vise Jaw Racks when Hydraquadder is set for Reg., R.H. or L.H. Quad.

## **Transfer Switch, Fig. 16 and 16A**

The transfer switch is located at the right of the keyboard on push-button operated machines and at the lower left of the TTS operating unit when the machine is operated by tape. The transfer switch plunger 183 is operated by the assembling elevator lever handle 185 as the assembling elevator is raised. On TTS machines, the transfer switch plunger is operated by the spring stud in the TTS assembling elevator lever, Fig. 16A. It is the function of the transfer switch (TTS operation) to transfer the quadding or centering signal from the first stage relay or relays (K-1 and/or K-2) to the second stage relay or relays (K-3 and/or K-4) and then to release the first stage relay or relays (K-1 and/or K-2) so they are ready to receive the next signal.

The switch used to perform these functions is a single Micro-Switch having a double set of contacts which are actuated in sequence. The first set of contacts are normally open and are closed by the movement of the plunger as the assembling elevator rises. For tape operation closing of these contacts transfers the signal from the first relay stage to the second relay stage. The second set of contacts are normally closed and as the assembling elevator continues to rise, the plunger is moved further to actuate the switch and cause these contacts to open, releasing the relays in the first stage.

For push-button operation, closing of the first set of contacts completes the circuit between the push-button box and the second stage relays. The first stage relays are not used for push-button operation. The second set of contacts perform no function in push-button operation since the first stage relays are not used.

The Transfer Switch Plunger is returned to its normal position, as the assembling elevator returns to normal position, by means of a coil spring on the plunger.

The plunger 183, Fig. 16, is provided with steps to actuate the switch roller 182, causing the switch contacts to close and open in sequence. Step 1 is the normal position for the switch. When the switch roller is on step 1 the first set of contacts are open and the second set are closed. As the plunger is moved in, the roller rides up on step 2 and the first set of contacts are closed. Further movement of the plunger inward results in the roller riding up on step 3. The first set of contacts remain closed and the second set of contacts are opened. When the assembling elevator returns to normal position, the plunger is returned to normal or No. 1 position by spring action.

When the plunger is pulled forward by the operator for recasting, as described under the heading "Recasting (Push-Button Operation)" the switch roller is on step 4, which closes the first set of contacts in the switch to complete the circuit for recasting, thus holding the first set of contacts in closed position.

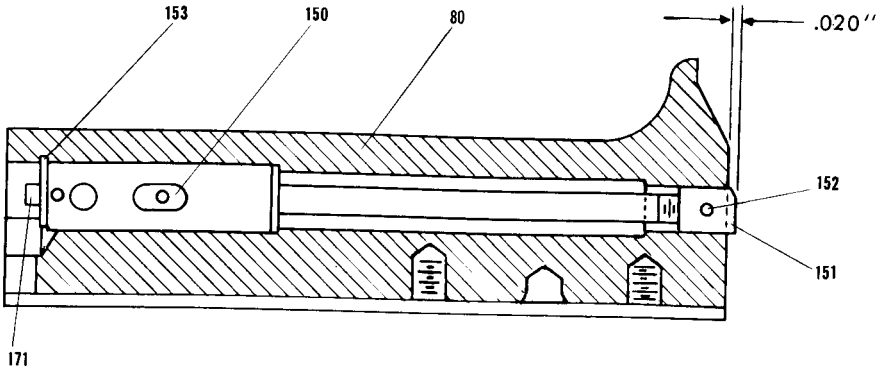


FIG. 24. Section through L.H. Vise Jaw showing Safety Switch and Plunger.

### Selector Latch Solenoids, Fig. 30 and 32

The selector latch solenoids 203 and 204, which have been mentioned previously under the heading "The Selector Cylinder and Latch Assembly", have the function of moving the selector latches 199 and 200 into position for controlling the movement of the selector slide 177. These solenoids are energized either singly or together, at the proper time in the machine cycle to cause the desired quadding or centering function.

The action of the solenoids is controlled by the lower contacts on the second stage relays K-3 and K-4 and by the actuating switch 207, Fig. 17 and 17A.

For centering, when relay K-3 is energized, the circuit to the latch solenoid 203, Fig. 32 is completed as the actuating switch contacts are closed. This results in the Hydraquadder moving the vise jaws through the centering function.

When relay K-4 is energized, the circuit to the latch solenoid 204 is completed as the actuating switch contacts are closed. This results in the Hydraquadder moving the R.H. vise jaw through the Quad Left function.

When both relays K-3 and K-4 are energized and the actuating switch contacts are closed, the circuit is completed to both latch solenoids. This results in the Hydraquadder moving the L.H. vise jaw through the Quad Right function.

When the projection on cam shoe 189, Fig. 17 and 17A, contacts clearing switch 208, the switch opens which de-energizes the selector latch solenoid (or solenoids).

#### **Lockout Solenoid, Fig. 4**

The main control valve operating lever lockout solenoid 178 has the function of moving the lockout latch 206 clear of the main control valve operating lever when a quadding or centering signal is sent through the circuit. For regular operation the lockout latch remains in normal position preventing movement of the main control valve spindle 16.

The lockout latch solenoid 178 is wired in the circuit with the second stage relays K-3 and K-4 so that the solenoid is energized when either the K-3 or K-4, or both, relays are energized and the actuating switch 207, Fig. 17 and 17A is closed by cam shoe 189. Energizing of the lockout solenoid occurs simultaneously with the energizing of the selector latch solenoid (or solenoids).

The lockout solenoid is of the rotary type. A spring returns the lockout latch to normal position when the solenoid is de-energized.

The purpose of preventing movement of the main control valve spindle during regular operation, is to prevent the flow of hydraulic fluid to the selector cylinder, at the start of the cycle, since this would move the selector valve to the Quad Left position. Instead of obtaining regular operation the machine would then be quadding left.

#### **TTS Operating Unit Bail Switches, Fig. 29**

Located in the Teletypesetter Operating Unit are 5 leaf-type switches which are actuated by the keyboard bails. Four of the five switches are used. Switch C is a spare and has no connection out of terminal 3 of the 8-prong plug on the Teletypesetter unit. The purpose of the bail switches is to transmit the tape code signal to the appropriate first stage relay (or relays) in the memory circuit to obtain the quadding function desired.

Quad Left tape code (0134) results in bail switch E closing, completing the circuit to the first stage relay K-2. Center tape code (02345) closes bail switch D which in turn energizes first stage relay K-1. Quad Right tape code (01234) closes bail switches A and B to complete the circuit to both first stage relays K-1 and K-2.

#### **L.H. Vise Jaw Safety Switch and Pot Pump Solenoid**

The Left-Hand Vise Jaw Electric Pot Pump Safety, Fig. 24, operates during both quadding and non-quadding cycles of the Linotype. The purpose of this safety is to prevent a cast from occurring if the matrices are not properly held, between the vise jaws.

When the line of matrices is held between the vise jaws, a switch plunger tip 151, Fig. 24 protruding from the left-hand vise jaw is forced flush with the face of the jaw. This closes the circuit to the solenoid 108, Fig. 8 located above the pot pump lever catch block. When the switch plunger is depressed the circuit is closed and the solenoid is energized to pull the catch lever 118 out from under the pot pump lever to permit the plunger to descend for the cast.

In order to permit the operator to hold the pump stop closed if he does not want a line to cast which normally would cast, a spring 112 is connected between the solenoid and the catch lever 118. The operator then presses the pot pump lever stop lever operating lever 120, and when the solenoid is energized it merely expands the spring instead of moving the catch lever clear of the pot pump lever.

The L.H. Vise Jaw Safety circuit receives its power from the power supply box, Fig. 13, via the four-terminal plug on the box. The circuit is a "grounded circuit" in that the Linotype machine frame is used to complete the circuit between the pot pump solenoid and the power supply box. Since there is only about 18 volts direct current being used it is completely safe.

There are two wires (516 and 517) leading from the power supply box four-terminal plug, to the L.H. Vise Jaw Safety. Wire 517 connects to the insulated contact 171, Fig. 24, on the left-hand vise jaw switch through wire 511. When the switch is closed by the plunger in the jaw being depressed, the circuit is grounded to the machine frame. Wire 516 is connected to the pot pump solenoid coil through wire 508. Wire 509 connects coil to ground on the machine frame. When the L.H. vise jaw switch is closed, the circuit is completed through the machine frame and the solenoid is energized to pull the catch lever clear of the pot pump lever, permitting the slug to be cast.

The vise jaw switch is a complete assembly in itself. It assembles into the vise jaw and is held in position by means of a retaining ring 153 which snaps into a groove in the inner wall of the vise jaw.

An insulated terminal 171 on the end of the switch is part of an insulated contact assembly. The insulated contact is held stationary with respect to the main switch assembly by a bakelite pin. The other contact is grounded to the machine by a sliding connection between the switch plunger assembly and the vise jaw. A small spring permits movement of the contact so that over-travel is allowed, to avoid damage to both contacts when they meet. The plunger contact is normally held away from the stationary contact by a spring so that there is a .010 inch gap between contacts when no pressure is exerted on the plunger.

The pot pump solenoid is a rotary type solenoid in which the lateral movement of the core is transmitted into rotary movement.

## IV. Adjustments and Maintenance

After the Hydraquadder has been installed and adjusted, there should be little necessity for making adjustments or performing any maintenance, other than routine oiling and cleaning. However, the instructions which follow pertain to the adjustments and maintenance, which will assist in understanding the function of the mechanism. Over a period of years of service, as is the case with any mechanism, it may at some time be necessary to replace or adjust some part of the mechanism and therefore the information given below will be of assistance.

### LUBRICATION

Since many of the internal parts of the Hydraquadder are moving in a bath of hydraulic fluid, which is a lubricant and rust-preventative, these parts are not subject to wear due to lack of lubrication.

The external parts should be periodically lubricated. The parts requiring periodic lubrication are:

1. Main and secondary control valve operating levers, Fig. 4
2. Cam follower levers and rollers, Fig. 4
3. Selector rack, Fig. 6A
4. Selector latches, Fig. 30, and lockout latch, Fig. 4
5. Centering pinion and shaft, Fig. 5
6. Selector handle operating shaft 161, Fig. 25
7. L.H. Vise Jaw margin adjusting mechanism 122, Fig. 11

The ball-bearing main and secondary control valve cam rolls are 10 and 230, Fig. 1. On Hydraquadders which use solid cam rolls, oil should be applied to the stud to keep the roll turning freely.

Oil should also be applied to the pivoting points of both cam follower levers. There is an oil hole provided for this purpose.

The selector rack and the gears, Fig. 6A, should be oiled occasionally.

The pivot points 62, 64 and 70 of the linkage and levers of the justification lockout mechanism Fig. 5 should have a few drops of oil applied at regular intervals. The stud of the roller 60 should also be oiled occasionally.

The pivot studs 221 of the selector latches Fig. 30 and the lockout latch 206, Fig. 4, should have a drop of oil applied at occasional intervals to keep them pivoting freely.

The centering pinion 74 and shaft, Fig. 5 can be oiled by removing the plug in the vise cap, above these parts. On some machines there is a small plate held by two screws (instead of a plug) on top of the vise cap, which permits the oiling of the centering pinion and shaft. Only a few drops of oil are necessary.

Oiling of the selector handle shaft 161, Fig. 25, is accomplished by means of a hole in the casting 154, to the rear of the handle.

The left-hand vise jaw margin adjusting mechanism should be oiled occasionally by squirting a few drops of oil between the banking screw arm 121 and the adjusting nut 122, Fig. 11.

## **ADJUSTMENTS**

### **Main and Secondary Control Valves**

The adjustments of the control valve spindles are made when the Hydraquadder is originally installed and once correctly made, should not normally require readjusting. However, if adjustments are necessary, the settings are as follows:

When setting the two control valves it is necessary to time the transition from wipe pressure to jaw opening pressure in proper relation to the withdrawal of matrices from between the vise jaws as the first elevator rises.

Both valves can affect this relationship. However, in order to guarantee proper wipe action, the cams of both valves have been designed with the timing of the transition more apt to cause an inward motion of the jaws than not. An adjustment which just eliminates the inward motion of the jaws will supply an optimum wipe action.

The main control valve should be so timed that after wipe action, inward movement of the jaws does not occur. If the wipe pressure is held too long, the jaws will move in, and it is necessary to advance the timing of the valve by shifting the location of the follower roller with respect to the cam.

The secondary control valve should be so timed that no pressure exists in the lines to the vise jaw cylinders when the secondary valve closes. Secondary valve closing occurs as the main control valve spindle is moved from wipe position to jaw opening position. If the secondary valve closes too early, wipe pressure is locked in the lines leading to the vise jaw closing cylinders and as the matrices are withdrawn from between the jaws this "locked in" pressure results in a small inward motion of the jaws. This condition is corrected by retarding the timing of the secondary valve, which is accomplished by adjusting the relationship of the follower roller with respect to the cam.

The function of the secondary control valve is to prevent the flow to the vise jaw cylinders while the selector mechanism is being actuated. During the descent of the first elevator, the long cam shoe

causes the secondary valve to close, preventing vise jaw motion. The short cam shoe closes the secondary valve and prevents flow to the vise jaw cylinders during the beginning of vise jaw opening. During this same period the selector mechanism is returned to regular position.

Specific procedures for setting and adjusting the timing of the two control valves are as follows:

A. *Initial Settings.* With the machine in normal position, the main control valve spindle 16, Fig. 18, is set with 1/8 inch to 5/32 inch clearance between the e-ring on the front end of the spindle and the snap ring at the front of the valve housing.

With the machine in selection position Fig. 18A, and while the secondary valve follower roller is still on the long cam shoe 196, the secondary valve spindle is adjusted for .080 inch clearance between

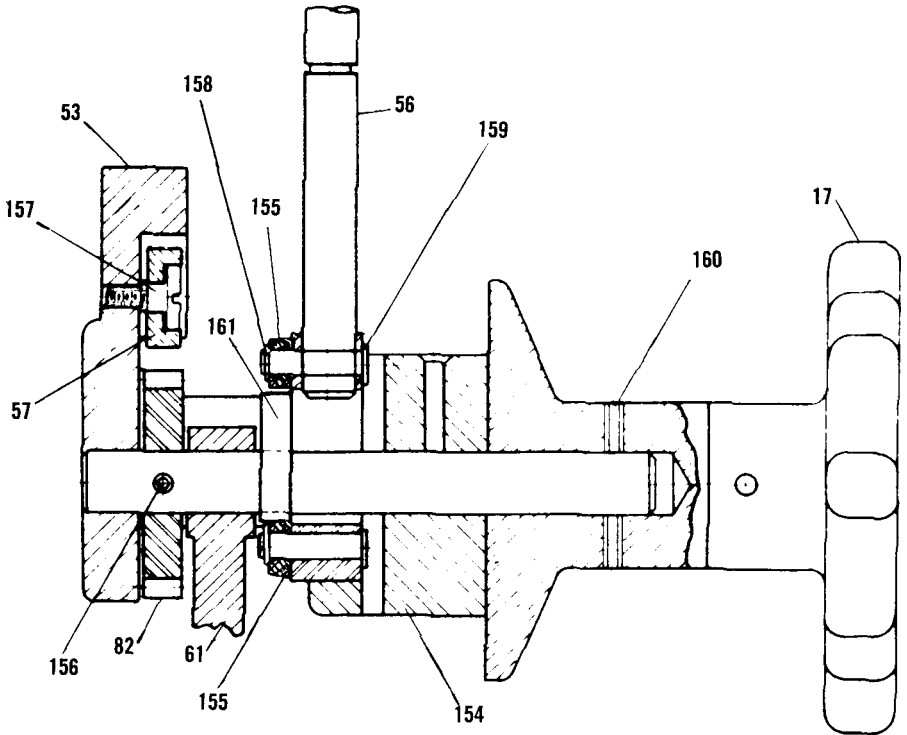


FIG. 25 Section through Selector Handle Assembly showing Line Centering Pinion Shaft Camming Mechanism.



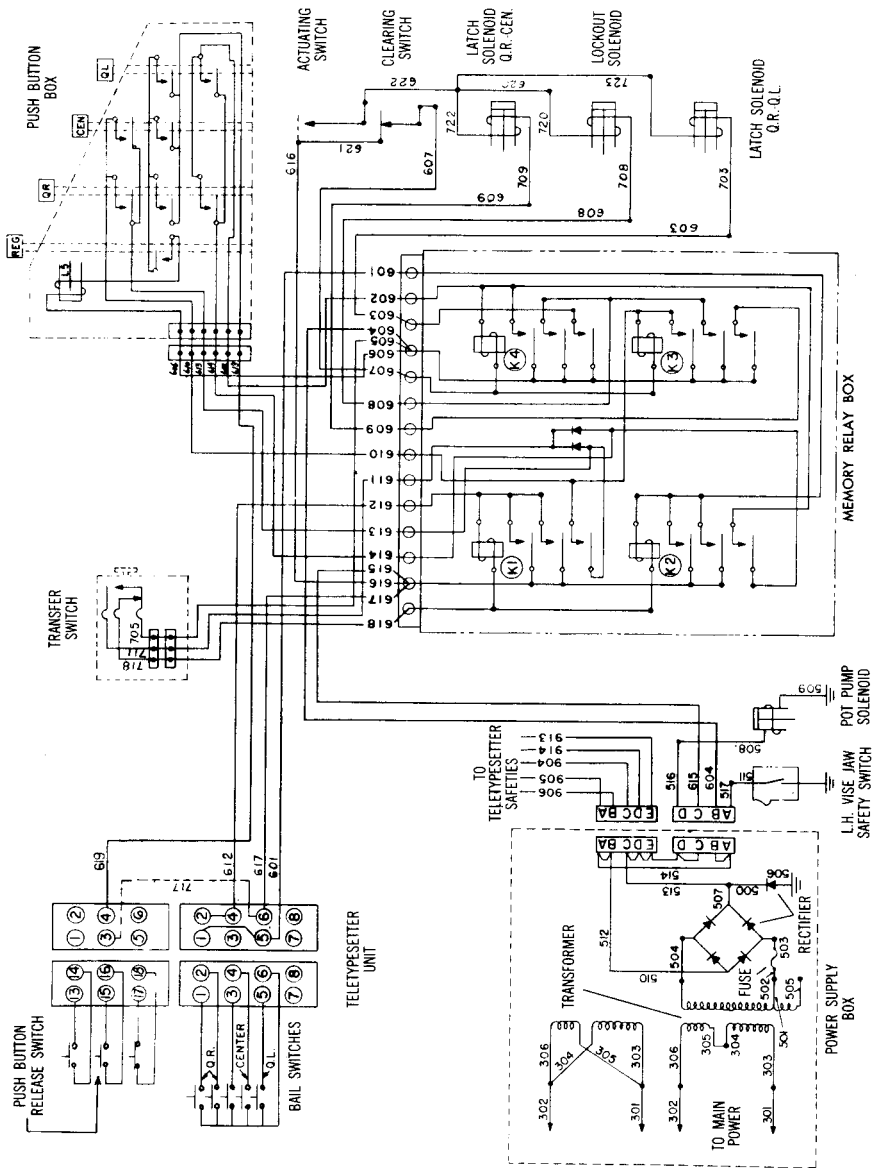


FIG. 26 Schematic Wiring Diagram of Electric Hydraquadder Circuit.

the follower roller 230 and the cam shoe 196 when the secondary valve spindle is held in its maximum forward position. Remove spring when making this setting.

Care should be taken that the main control valve lever adjustment is checked while the cam roll is on the high spot of the cam in order to avoid breakage of the lever.

B. *Final Settings.* While making these adjustments it should be remembered that each machine may vary slightly and a minor adjustment to the main control valve spindle or secondary control valve spindle may be necessary.

In some cases, the vise jaws may start to close prematurely. If the vise jaws close before the first elevator is fully down on the vise cap, then the secondary control valve does not close completely and must be adjusted with less than the .080 inch clearance as previously described.

In other cases, the vise jaws may have a slight inward motion as the line is withdrawn from between the vise jaws. The secondary control valve should then be readjusted for more than the .080 inch clearance. This will retard the secondary control valve closing and advance the valve opening.

If proper vise jaw motion is not obtained after following the fore-mentioned instructions, additional valve adjustment will then be necessary. Remove the short cam shoe 195 which actuates the secondary valve and cycle the machine in Quad Left and Quad Right, observing if the vise jaws move in as the matrices are withdrawn from the vise jaws. If the vise jaws move in with the short shoe removed, the main control valve timing should be advanced by placing a washer or washers under the front end of the control valve support bracket Fig. 4, until the movement is corrected. Readjustment of both the levers is necessary after each washer addition, following procedure previously given in "Initial Settings," in order to prevent lever breakage.

Replace the short shoe and cycle the machine in Quad or Center and observe vise jaw action. If the jaws move in then the secondary valve timing should be retarded by adding washers under the rear end of the valve support bracket 6, Fig. 4 until the timing is corrected. The valve levers should be reset after each washer addition.

## **Vise Jaw Adjustments**

1. *Right Hand Margin.* The setting of the right-hand vise jaw to bring the type face to correct position on the slug is done in the usual manner by means of the adjustment screw at the top of the knife block.

2. *Centering.* After the right-hand vise jaw has been set for correct margin, cast two blank slugs with the Hydraquadder set for centering. Turn slugs back to back to check for centering. If centering

is not correct, move the left-hand vise jaw by means of the Mohr Measure Control hand dial, until centering is satisfactory. Then reposition the Mohr Measure Control hand dial to conform with the length of slug. Next set left-hand vise jaw for margin as follows.

3. *Left-Hand Margin.* Adjust the banking arm adjusting nut 122, Fig. 21 for proper left-hand margin. Cast slugs using spacebands with the Hydraquadder set for regular.

After the above adjustments have been made, check to make certain that the centering pinion, Fig. 23 engages with the vise jaw rack without interference when the selector handle is rotated to centering position. If the pinion does not engage the rack properly, it will be necessary to change the mesh of the pinion one tooth in relation to the vise jaw rack, by means of the banking arm adjusting nut 122, Fig. 21. Then repeat adjustments for Centering and Left-Hand Margin.

4. *Centering Pinion.* The centering pinion should clear the top of the teeth of the left-hand vise jaw rack by .020 inch as shown in Fig. 23, when the selector handle is at Reg., L.H., or R.H. Quad.

If it is necessary to remove the centering pinion 74, Fig. 5 and the spacing washers 73 and 75 above and below the pinion, make sure that the washers are replaced in the same arrangement so that the .020 inch clearance will be maintained.

5. *L.H. Margin Control.* Adjust the screw 46, Fig. 6 in the vise closing link 83 so that the left-hand margin is exactly the same as that of a justified line. Cast slugs using a short line of matrices with the selector handle set for L.H. Quad.

### **Justification Lockout Adjustment**

The justification lockout lever 69, Fig. 5 is adjusted to contact the stop stud 68 in the vise justification bar brace 67 by means of the screw 64 which passes through the elongated hole in the link 63 which joins the lockout lever 69 and the selector handle lever 61.

This adjustment should be made so that the lockout lever swings over the stud 68 when the selector knob is rotated to the Q.L., Q.R., or Cen. position and swings back clear of the stud when the selector knob is in "Reg." position.

### **Transfer Switch Adjustments**

There are two adjustments for the assembling elevator transfer switch, Fig. 16. The first is the adjustment for correct position of the micro-switch 181 in the assembly with respect to the plunger 183. The second adjustment is the positioning of the complete transfer switch and bracket assembly.

The transfer switch assembly is located on the right side of the keyboard for non-Teletypesetter operation, and on the left side of the operating unit for Teletypesetter operation.

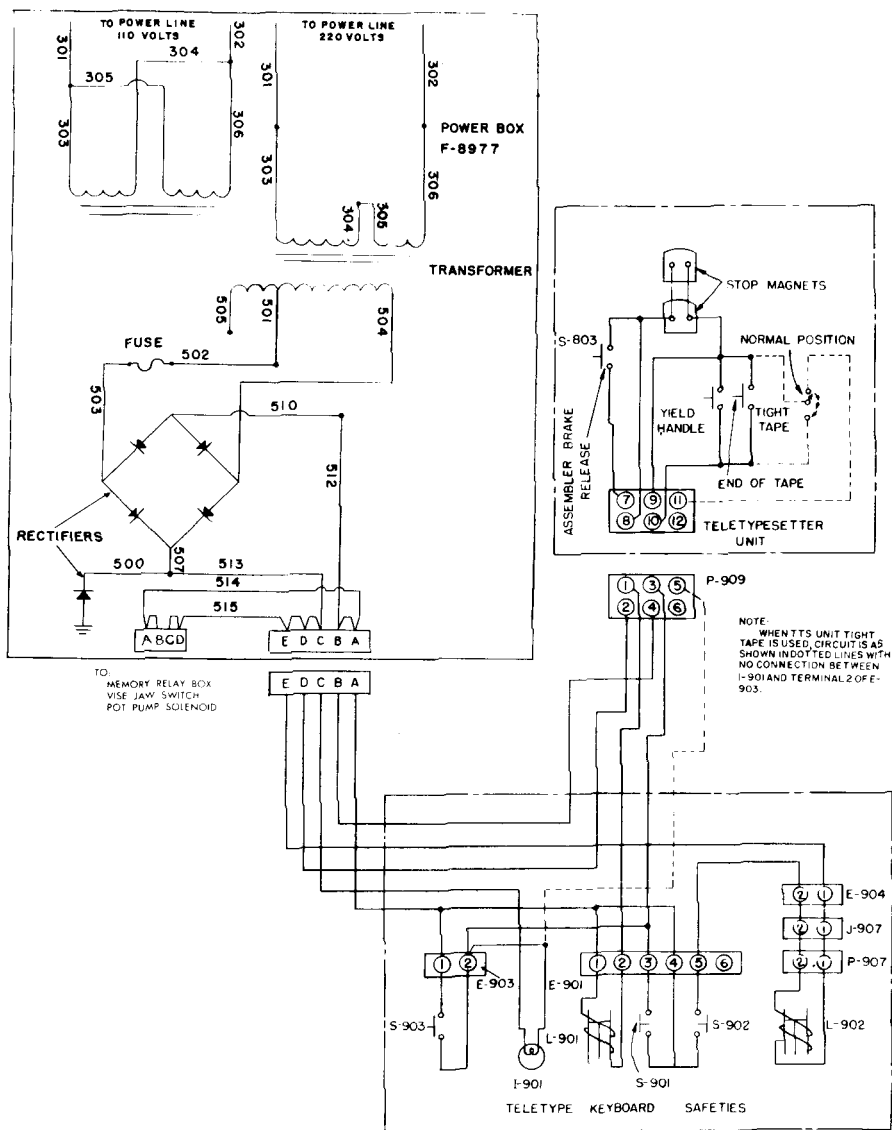


FIG. 27 Schematic Wiring Diagram of Teletypesetter Safeties.

The first adjustment is made by shifting the switch 181 on its bracket 209, by loosening the screws holding the switch, so the following sequence takes place as the plunger 183 is pushed in. As the plunger is pushed in, there should be two audible clicks in sequence, the first click when the roller rides on step 2 of the plunger, and the second click when the roller rides on step 3. The plunger and switch function as follows:

1. When the roller is on step 1, the switch is in normal position.
2. When the roller is on step 2, the first set of contacts of the switch are closed (first click).
3. When the roller is on step 3, the second set of contacts of the switch are opened (second click).
4. When the plunger is pulled out for recasting, the switch roller 182 rides up on step 4, so that the first and second contacts are actuated.

The second adjustment is made by positioning the complete transfer switch and bracket assembled so that when the assembling elevator is raised and the plunger 183, Fig. 16 is moved inward, two audible clicks are heard. The transfer switch assembly is positioned for push-button operation by loosening screws 210 and shifting the complete switch and bracket assembly. Two screws on the underside of the transfer switch and bracket assembly are loosened when positioning the transfer switch assembly Fig. 16A for Teletypesetter operation.

When the transfer switch assembly is positioned correctly for either operation, the plunger can be pulled out sufficiently to remain in the recast position.

The action of the transfer switch first and second contacts can also be checked by connecting an ohmmeter or "lamp in series" to the micro-switch terminals when the power is turned off.

### **The Actuating and Clearing Switch Adjustment**

The two snap action switches 207, 208, Fig. 17 are adjusted after the cam shaft of the Linotype is rotated slightly to have both switch rollers 192 contact the shoe 189 on the cam. At this position the switch mounting bracket is moved until both switches are actuated. A small clicking noise will be heard as the switches are actuated. Then the bracket screw is tightened to hold the switches in position. Check to see that the switches go back to normal position when the rollers leave the cam shoe.

The switch roller should contact only the shoe and not the periphery of the cam. If necessary, remove the shoe out from the cam by inserting washers under the shoe.

The cam shoe 189 is positioned on cam 188 so that it will contact the roller of the actuating switch 207 after the cam has turned 3/8 inches from normal position.

On machines which have the actuating and clearing switches operated by a shoe on the inside of the main control valve operating cam, Fig. 17A, the switch bracket is adjusted so that there is 1/64 to 1/32 inches between the actuating switch roller and the cam as shown in Fig. 17A. Adjustment is made by loosening the bolt holding the bracket and positioning the bracket.

The switch bracket has two sets of mounting holes. Holes A are used for Comet machines and also other model machines using the Comet type first elevator cam. Holes B are used for all other models.

### The Selector Latch Solenoid and Latch Adjustment

The selector latch solenoids 203, 204 Fig. 30 are mounted on plates 218 which can be adjusted to obtain the correct relationship between the solenoids and the latches. The plates are adjusted by means of the two nuts on the screw stud 224 which pass through each plate. The solenoid should be so located that the solenoid motion actuates the latches 199 and 200 at the limit of the solenoid stroke. Maximum actuating force exists at the end of the solenoid stroke and for this reason optimum action occurs at this setting.

Latch 199 is normally spring-pulled in against the slide when solenoid 203 is not energized and latch 200 is normally spring-pulled clear of the slide when solenoid 204 is not energized (see Fig. 32). Check the action of the latches in conjunction with the slide by energizing each solenoid and observing the relationship of the latches with the slide. If necessary, adjust the position of the solenoid plates by means of the nuts on the stud to obtain the proper latch movement.

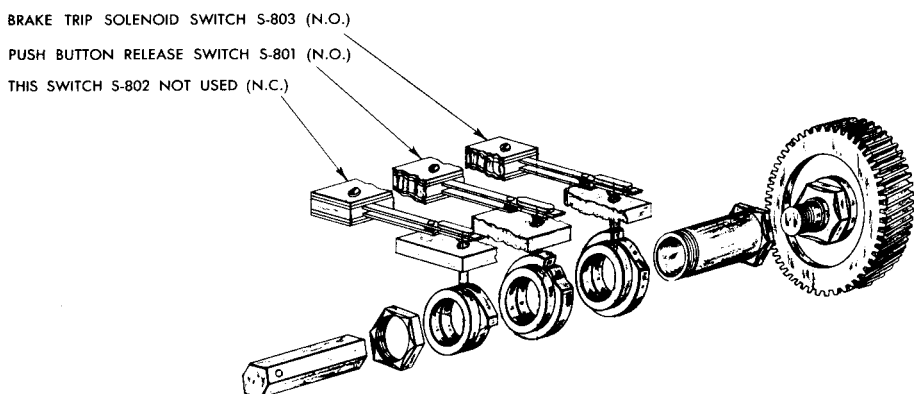


FIG. 28 Teletypesetter Operating Unit Cam Switch Assembly.

### **Lockout Solenoid and Latch Adjustment**

The relationship of the lockout latch 206 Fig. 4 to the operating lever 8 is fixed by the mounting holes in the sump and control valve bracket 6 and it is necessary to adjust only the screw 211 (with machine in normal position) so that there is a slight clearance between the screw head and the lockout latch to permit the lockout latch to pivot clear when the solenoid is energized.

### **Left-Hand Vise Jaw Safety Switch Plunger Adjustment**

When the plunger 151 Fig. 24 in the face of the left-hand vise jaw is depressed, the circuit is completed to ground through the machine frame, and the pot pump solenoid 108 Fig. 8 is energized to permit the descent of the pot pump plunger.

To adjust, first remove the four screws from the guard at left of vise jaw and remove the wire connection. Then loosen the Allen set screw 152, Fig. 24, using a 1/16 inch Allen wrench.

Plunger 151 can then be moved in or out with relation to the vise jaw face by turning the left end of the switch 171 which is slotted for this purpose. The plunger adjustment should be made so that the pot pump solenoid is energized when the end of the plunger is flush with the face of the vise jaw. When the plunger is set correctly, it should protrude approximately .020 inches from the face of the jaw.

## **CARE AND MAINTENANCE**

### **The Pump**

The pump 36, Figs. 2 and 3 requires little or no maintenance after the pinion mesh has been made, or the V-Belt is adjusted on the pulleys, 166 and 170. The pump bearings are self-lubricated so that there is no necessity for oiling. Since the internal moving parts of the pump are lubricated by the hydraulic fluid, comparatively little wear should result due to friction. However, for this reason, the pump should not be allowed to run anytime when the hydraulic fluid is not present in the system.

If it is desired to make the Hydraquadder inoperative for any reason, the pump can be pivoted on its bracket to disengage the pinion 42 or the pinion can be slipped off the shaft by removing the screw 41 and washer 42 which holds it on the pump shaft. Removing the pinion in this manner eliminates the necessity for readjusting the pinion mesh when it is desired to make the quadder operative again. On machines equipped with the Linotype V-Belt motor drive, the Hydraquadder pump driving belt is removed to make the quadder inoperative.

The pump pinion supplied for use with the Emerson overhead motor is a 28 tooth fibre pinion. If the Linotype is driven by a Cline

Motor, a 24 tooth pinion is used and for a Cushman Motor a 23 tooth pinion is supplied.

Since the pump speed will increase if the Linotype machine speed is increased the pump will automatically compensate for the increase in machine speed without the necessity of changing the pump driving pinion 42, Fig. 2 or the pump driving pulley 166, Fig. 3.

## **Main and Secondary Control Valves and Sump**

### MAIN CONTROL VALVE, Fig. 19

Maintenance requirements of the main control valve should be practically nil except for possible replacement over long period of time of the oil seals.

These seals consist of two O-rings 126 located at each end of the spindle 16 in the control valve casting 13. They serve to prevent the hydraulic fluid from leaking out the ends of the control valve. Any fluid which reaches these seals is redirected back to the sump through a leakage return in the valve.

If necessary to replace these oil seals 126, the spindle 16 should be taken out of the valve. This is done by removing one retaining ring 161 on the pin 162 which connects the link 163 to the spindle, and sliding out the pin to disengage the link from the spindle. The retaining ring 48 at the rear of the spindle 16 is then removed and the spindle can be slipped out of the control valve towards the front of the machine.

The retaining or snap ring 124 on each end of the control valve is then removed and the O-ring seats 125, spacer and O-ring seals can be slipped out of the valve. New O-ring seals can then be inserted, being careful to insert the O-ring seat so that it fits the O-ring with the lip on the seat in towards the O-ring seal.

Care should be exercised in handling the spindle to avoid nicking or scratching it. Also, the O-ring seals should be carefully handled to prevent damaging them. Since these parts are controlling the flow of a fluid, any nicks in the spindle or cuts in the O-rings could influence the Hydraquadder operation.

If it is necessary to replace the other internal parts of the control valve, they should be arranged according to Fig. 19.

In the left side of the main control valve casting is a plug 212, Fig. 1 which can be removed so that a pressure gauge can be inserted, if necessary, to check the hydraulic pressure. The pressure reading should be approximately 150 lbs. per square inch for high pressure and 40 lbs. per square inch for low pressure.

### SECONDARY CONTROL VALVE

The mechanism of the secondary control valve Fig. 20 is similar to that of the main control valve. However, the spindle 213 only protrudes from one end of the valve housing, the other end being closed



off with a screw plug 215. In the rear end of the housing 214 are two O-ring seals 225 which keep the hydraulic fluid from coming out that end of the housing.

If necessary to replace any of the internal parts of the secondary control valve, this is done as follows:

1. Disconnect the two wires from the lockout solenoid at the knife connector.
2. Remove the two bolts which fasten the control valve and sump assembly to the machine. If there are any washers used underneath the bolts, these must be replaced when reapplying the assembly.
3. Place the assembly on the floor and remove the two hoses from the secondary control valve. Remove spring 180 and connecting screw 216 which connects the link 226 to spindle.
4. Remove the three screws 231 so that the secondary control valve can be removed.
5. Place secondary control valve in vise, making sure that the bottom finished surface is not damaged. Remove plug 215 at the end of the housing and slide the spindle out of the front of the housing.
6. Insert a 1/4 inch carriage bolt, 4-1/2 inches long through the housing so that the head of the bolt fits inside the retaining ring and bears against the O-ring seat.
7. Place 1-1/8 inch washer and the nut on the end of the bolt which extends out the plug end of the housing and tighten up the nut to compress the spring which separates the components in the housing, in order to permit removal of the retaining ring.
8. Remove retaining ring, take bolt out of housing and slip components out of housing, using a wire if necessary, to pull them out.
9. Dip the new O-rings and spindle in hydraulic fluid, replace necessary parts and assemble as shown in Fig. 20. When tightening up the nut on the carriage bolt in order to compress the spring which separates the O-ring seats, spacers, etc., in the housing, in order to permit application of retaining ring, do not compress further than is necessary to allow insertion of the retaining ring. Putting too much pressure on these parts might cause damage.

#### SUMP

There is practically no maintenance involved with the sump except for checking the level of the hydraulic fluid occasionally. This is easily done by removing one of the screws which fastens the sump 2, Fig. 4 to the main control valve casting and loosening the other

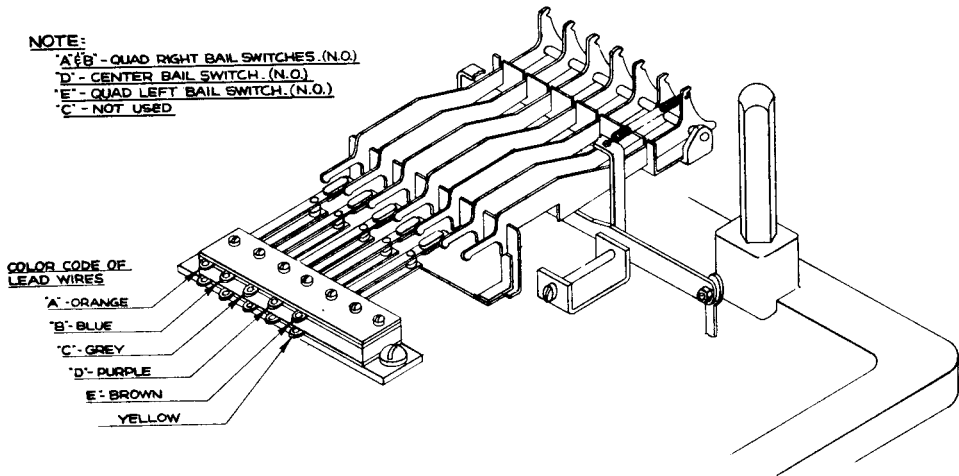


FIG. 29 Teletypesetter Operating Unit Bail Switch Assembly.

screw so that the sump can be pivoted outward. Care should be exercised in doing this to avoid damaging the gasket which is between the sump casting and the main control valve casting.

With the sump pivoted out it is possible to see and measure the level of the hydraulic fluid. The fluid level normally should be about 2-1/2 inches from the top of the sump.

The sump holds one gallon of hydraulic fluid. It is essential that the hydraulic fluid be of the specific selected type for the Linotype Hydraquadder. This fluid has low viscosity, good lubrication properties and is an oxidation and rust preventative. Also, this hydraulic fluid is of the type which will not cause swelling or shrinking of the O-rings. Therefore, it is essential that only the hydraulic fluid supplied by the Mergenthaler Linotype Company for use in the Hydraquadder be used. This is part number X-1870 which consists of a gallon of fluid.

Located in the sump are the high and low pressure relief valves which should not require attention, since they are set in the factory for the required pressure. They are immersed in the hydraulic fluid, so are not subjected to wear or corrosion.

## Cylinder and Selector Valve Housing

### REPLACING PISTON O-RINGS

If necessary to replace the O-rings 133 Fig. 21 on the pistons 132 in the housing 1 located to the left of the vise frame, proceed as follows:

1. Turn off the motor. Remove the cylinder and selector valve housing cap 136 and gasket from the left-hand end of the housing. The cap is fastened to the end of the housing with six Allen-head screws 137. It is suggested that a few sheets of paper be spread on the floor to absorb the slight amount of oil which will drop from the housing when the cap is removed.

2. Open the vise jaw measure to its limit or 30 ems. Remove the R.H. vise jaw from its jaw block. Push the L.H. vise jaw and R.H. vise jaw block to the left as far as possible. Removing the R.H. vise jaw from the block permits the jaw block to be moved further to the left. This allows the front piston 132 to protrude sufficiently from the cylinder for the removal of the cotter pin 135 and the nut 134, which fastens the piston 132 to the piston rod 130.

3. Remove the cotter pins 135 and nut 134 from the ends of the piston rods 130 and 131.

4. Push both vise jaw blocks with piston rods to the right. This should separate the pistons 132 from the rods 130 and 131. If the rods do not separate from the pistons at the first attempt, move the vise jaw blocks to the left and right alternately until they do separate.

5. Remove the pistons 132 from the cylinders with a hook bent from a piece of wire. If necessary, insert the hook in the hole of the piston and then push the vise jaw block and piston rod to the left. The hook will prevent the threaded end of the piston rod from re-entering the pistons so that the pistons can be moved sufficiently to the left for removal. Exercise care so as not to damage the cylinder walls. Remove O-rings 133 from pistons 132 and apply new O-rings.

6. Before replacing pistons, rub hydraulic fluid over the O-rings so that the pistons can be inserted without difficulty.

7. After pistons have been applied, set Hydraquadder for centering and run machine for a few minutes to eliminate any air which might have entered the system.

When piston rods are exposed, use care to avoid scratching or damaging them in any way, since a nick or scratch might result in damaging the O-ring seals 138 at the right end of cylinder housing.

### REPLACING OIL SEALS IN CYLINDER AND SELECTOR VALVE HOUSING

The piston rod seals 138 Fig. 21 are applied in such a way that double protection against leakage is provided. Two O-rings 138 are applied at the right-hand end of each cylinder. Between the two O-rings is a small port opening in the piston cylinder casting 1, so that

if any fluid should get by the first seal, it is blocked by the second seal and drains off through the port in the casting, back to the sump through the return hose. In addition to the two O-ring seals 138 located at the right-hand end of the cylinder housing there is a felt wiper 139 located at the right-hand end of the cylinder. Its purpose is to wipe the piston rod clean of hydraulic fluid and it also acts as an auxiliary seal.

To replace the piston rod seals 138 Fig. 21, proceed as follows:

1. Remove the cover guard which is held in place over the latch solenoids by two screws, then remove the three Allen-head screws holding the selector cylinder and latch assembly to the cylinder and selector valve housing Fig. 6 and pull the selector

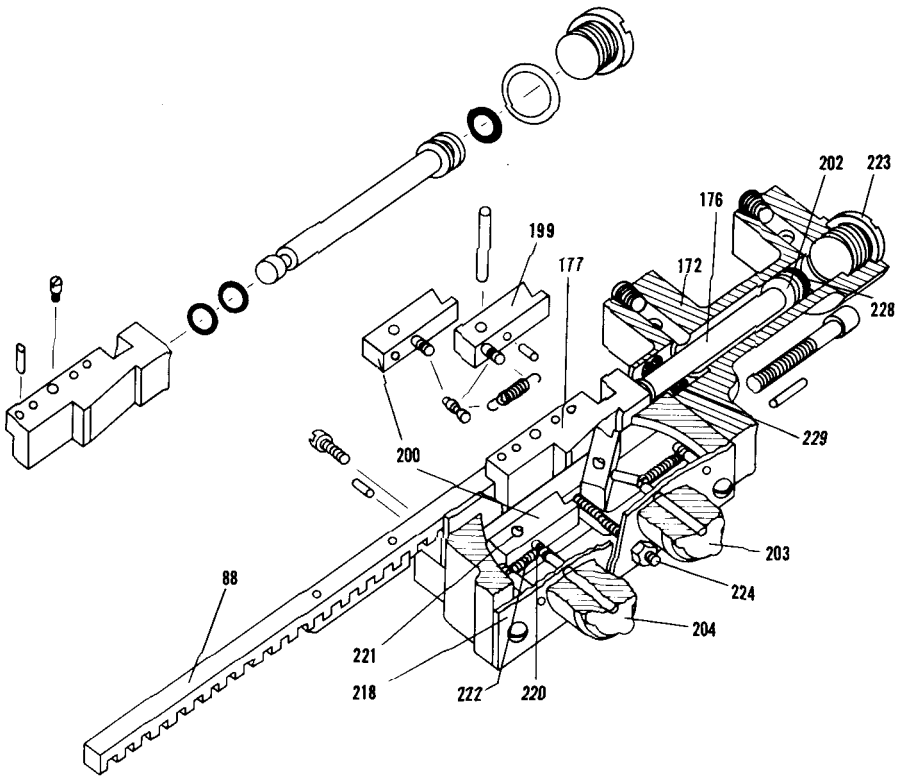


FIG. 30 Section through Selector Cylinder showing Piston Rod, Rack, Slide and Selector Solenoids Assembly. Viewed from rear of machine.

cylinder assembly out of the way. Two of the Allen-head screws are located above the latch solenoids and two below.

2. Remove the selector rack 88 Fig. 30, taper draw pin 100 Fig. 7 and four screws 99 and 102.
3. Set the measure control for zero pica line length.
4. Pull cylinder casting 1 Fig. 7 to the left until piston rod connections to the racks 95 and 98 are seen.
5. Rotate the cylinder housing 1 to disengage the piston rods from the racks Fig. 7 and remove cylinder housing.
6. Remove the cylinder housing cap 136 Fig. 21 and gasket at the left of the cylinder.
7. Remove the cotter pins 135 and pistons 132 from the left end of the cylinders. Then remove piston rods from the right.
8. Remove the left-hand vise jaw closing adjustment parts 121 and 122 Fig. 21 from the rear cylinder and the snap rings 140 and felt wipers 139 from the right-hand end of the two cylinders.
9. Using a blunt hook eye or a piece of wire formed into a hook, remove the four O-ring seals 138 (2 in each cylinder). A light at the other end of the cylinder will be helpful.
10. Push the new O-ring seal 138 into position in the cylinder so that it is lying horizontal to the seal grooves. Then with a piece of wire, having a slight hook on the end and beveled to eliminate sharp edges, work the O-ring seal into the furthest groove. Be careful not to tear or cut the O-ring while doing this. Also be sure that O-ring is not inadvertently seated in the center groove, as this groove has the small port openings in it, to drain off and return to the sump, any hydraulic fluid which might escape past the first O-ring seal. The second O-ring seal is inserted in the outer groove in the same manner.
11. When replacing the cylinder and selector valve housing reverse the procedure outlined for removing. However, before replacing the selector rack 88 Fig. 6A, it will be necessary to proceed as follows:
  - A. Remove gear 87 from selector valve shaft.
  - B. Insert selector rack 88 to mesh with gear 82 so that when the selector handle 17 Fig. 5 is in regular position, the cam 89 Fig. 6A attached to the rack 88 will be just touching roller 60 Fig. 5.
  - C. With the selector handle set at regular and the timing notch on the end of the selector valve shaft in vertical position at the top, place gear 87 Fig. 6A in position to mesh properly with rack 88. It may be necessary to remove gear 87 and rotate it to a different position to obtain the proper mesh.
  - D. The notch in the selector valve square shaft must be in vertical at the top when the selector handle is set at "regular."

## REPLACING SELECTOR VALVE SEAL

On the rear of the selector valve 145 Fig. 22 is located an O-ring 148 in a seal 146 which looks very much like a brass washer. Its purpose is to prevent leakage of hydraulic fluid. (The front end of the selector valve has a cover 141 and gasket 142 which prevents leakage from this point.)

If necessary to replace the selector valve seal, proceed as follows:

1. Remove the cover guard which is held in place over the latch solenoids by two screws, then remove the three Allen-head screws holding the selector cylinder and latch assembly to the cylinder and selector valve housing Fig. 6 and pull the selector cylinder assembly out of the way. Two of the Allen-head screws are located above the latch solenoids and two below.
2. Remove the retaining ring 86 Fig. 22 and pinion from the selector valve 145.
3. Remove the four screws which hold the cover 141 and gasket 142 in position on the front of the selector valve housing.
4. Tap the selector valve lightly at the point where the gear 87 was removed, which will loosen the cover 141 so it can be removed, along with the gasket 142 and spring 143.
5. Slide the selector valve 145 out of its housing. There is a small O-ring 147 in a groove on the selector valve shaft. This should be replaced if necessary.
6. Using a piece of wire formed into a hook, reach into the selector valve casting and pull out the selector valve seal 146. The O-ring 148 is in a groove in the seal and will come out with the seal.
7. Put a new O-ring in the groove in the seal.
8. When replacing the seal make certain that the pin 149 in the seal 146 goes into the hole provided in the casting so that the seal will not turn when the control valve is turned. As a check on this the O-ring 148 should be bearing against the casting.
9. When replacing the gear 87 on the back of the valve 145, the selector handle should be in "Reg." position and the timing notch on end of selector valve shaft should be on top.

## Selector Cylinder and Latch Housing

### REPLACING SELECTOR LATCH SOLENOIDS

If it is necessary to replace these solenoids remove the cover guard 217 Fig. 31 which is held in place over the solenoids by two screws. Then remove the nut 227 and two screws which hold the plate 218 on which the solenoid is mounted and remove the two nuts from the studs which hold the solenoid to the plate. The solenoid wires are connected by knife connectors 219. After replacing the solenoid the mounting plate 218 should be adjusted by means of the nuts 227

on the stud so that the correct relationship is obtained between the pin in the latch 220 Fig. 30 and the solenoid pin 221 Fig. 30 to obtain proper actuation of the latch when the solenoid is energized (also see under "Selector Latch Solenoid and Latch Adjustment").

#### REPLACING SELECTOR LATCHES

The selector latches 199, 200 Fig. 30 which pivot on studs 221 are held in position by a small dowel pin. In order to remove the latch from the assembly, first remove the Selector Cylinder and Latch Housing from the Cylinder and Selector Valve Housing by removing the three Allen-head screws as described under "Replacing Selector Valve Seal." The small dowel pin which holds the latch stud 221 in position can then be driven out and the stud can be slipped out of the casting and latch. When replacing the latch do not neglect to connect the small spring 222 between the stud in the housing and the stud in the latch so that the latch is spring-pulled into position.

#### REPLACING SELECTOR PISTON O-RING

To replace the O-ring 228 Fig. 30 on the selector piston 202, proceed as follows:

1. Remove the two hoses F and G Fig. 30. Spread some cloths or newspaper on the floor under the housing to absorb the slight drip of hydraulic fluid when the hoses are disconnected. Remove the three Allen-head screws which fasten the Selector Cylinder and Latch Housing to the Cylinder and Selector Valve Housing, as described under "Replacing Selector Valve Seal," and remove the Selector Cylinder and Latch Housing assembly.
2. Remove the large screw plug 223 at the end of the cylinder and push the piston rod 176 from the opposite end to expose the piston 202. Replace the O-ring on the piston, exercising care to avoid cutting or tearing the O-ring.
3. Rub some hydraulic fluid on the replacement piston O-ring to facilitate replacement of the piston and piston rod in the cylinder. Exercise care to avoid damaging the two O-ring seals 229 at the opposite end of the cylinder when pushing the piston rod through the cylinder.

#### REPLACING SELECTOR CYLINDER O-RING SEALS

In order to replace the two O-ring seals 229 which are located in the Selector Cylinder the three items given under "Replacing Selector Piston O-ring" should be followed since it is necessary to remove the piston and piston rod from the cylinder. Then with a hooked piece of wire the two O-ring seals should be removed from the grooves in the selector cylinder. A light at the other end of the cylinder will be helpful.

Push the new O-ring seal into position in the cylinder so that it is lying horizontal to the grooves in the cylinder. Then with the piece

of wire, having a slight hook on the end and beveled to eliminate sharp edges, work the O-ring seal into the furthest groove. Be careful not to cut or tear the O-ring while doing this. The second O-ring seal is inserted in the outer groove in the same manner.

## **General Maintenance Information on the Electrical Control Circuit**

### TESTING EQUIPMENT

A circuit analyzer or multimeter, which is capable of measuring voltage, current and resistance for AC and DC circuits, is the most useful instrument for trouble-shooting the Hydraquadder electrical equipment.

### GENERAL CHECK POINTS FOR SERVICING

In the event of difficulty with operation of the Hydraquadder, time can be saved in correcting the trouble by using a methodical system to check the functions of the mechanism in logical sequence.

The first thing to do, is to determine whether the difficulty is of an electrical, mechanical or hydraulic nature or a combination of these.

Since the electrical circuit involved is more simple when operating by push-button than by tape, the quadder should be put through its functions using the push-buttons and the action of the relays and solenoids observed to see if they are being energized and de-energized in accordance with the sequence of operation given in the chapter entitled "Operation." If the sequence is correct then the tape-controlled function should be observed in like manner, to see if that portion of the circuit which is involved when operating by tape may contain the source of difficulty. If all electrical functions are occurring in proper sequence for both tape and push-button operation, it can be assumed that the electrical circuit is all right and trouble is of a mechanical or hydraulic nature.

Items of a mechanical nature which may be checked rather quickly are the adjustments of the primary and secondary control valve operating levers, condition of cams and cam rollers, movement of the selector rack and slide, justification lockout linkage adjustment, left-hand margin adjustment, measure control action and movement of the centering pinion when the center function is selected.

In checking hydraulic difficulties the logical place to start is the sump, to see if there is enough hydraulic fluid available. Next, the action of the vise jaws should be observed to see that pressure is being exerted at the proper time in the machine cycle, in accordance with the information given in the section entitled "Operation." The pump action should also be checked to see that it is operating correctly.



### CHECKS FOR DIFFICULTY IN OPERATION

When difficulty with the operation of the Hydraquadder is encountered it is possible that one of the following symptoms will be evident, in which case there are definite checks which can be made in an effort to eliminate the difficulty. When operating by push-button,

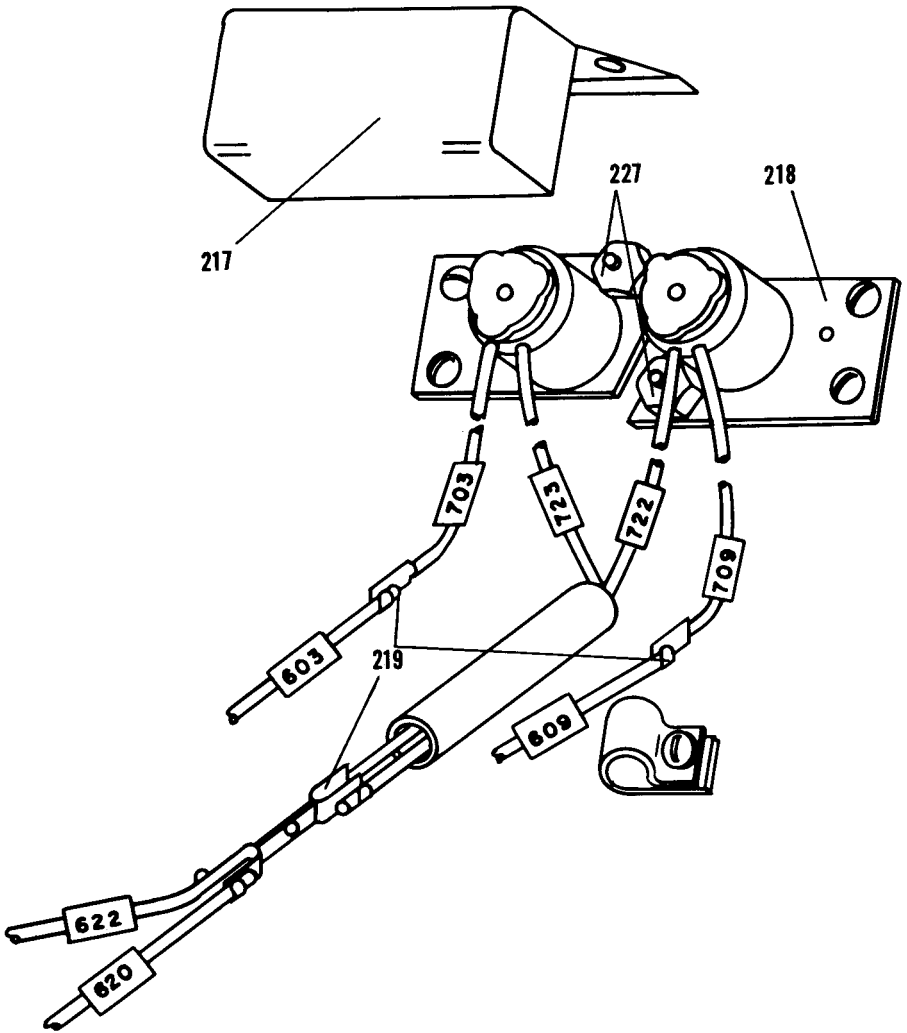


FIG. 31 View showing the Wiring of Selector Solenoids.

the first stage relays, the TTS operating unit bail switches and wiring between these units are not used. Where difficulty with tape operation is encountered, the *quadder* should be first tested by using the push-buttons. If it then operates correctly, *it can* be assumed that the difficulty is in either the first stage relays, the bail switches or the wiring.

*Symptom:* No quadder function occurs for QR, QL or Center signal.

#### CHECK FOR PUSH-BUTTON CONTROL

1. Depress QR push-button and check action of the second stage relays K-3 and K-4, Fig. 14A. Both relays should close as the transfer switch plunger is pushed in.
2. If relays do not close, *check* the following:
  - (a) Transfer switch action as explained in *step* 1 to 4 under "Transfer Switch Adjustments."
  - (b) Examine fuse in power supply box.
  - (c) *Voltage* output of power supply box. Minimum voltage of 18 volts DC should be read across wires 507 and 510 in the power box, Fig. 13. If voltage is less than 18 volts DC, disconnect wire 501 from wire 502 in the power box and connect the 28 volt tap wire 505 on transformer to wire 502 in place of wire 501. Recap wire 501.
  - (d) Wiring between transfer switch and relay box and selector switch box should be checked for *continuity*.
  - (e) Relays should be examined for possibility that contact actuating pins are binding. Substitute relays K-1 or K-2 or *both* to determine if relays K-3 and K-4 are functioning properly.
  - (f) Clearing switch 208, Figs. 17 and 17A, should be checked to be sure the switch contacts are closed, until contacted by the cam shoe.
3. If *both* relays K-3 and K-4 close as transfer switch is actuated by raising the assembling elevator, check the following:
  - (a) Observe the action of the two selector solenoids 203 and 204, Fig. 30, as the actuating switch 207, Figs. 17 and 17A, is closed. The two selector latch solenoids and the lockout solenoid 178, Fig. 4, should be energized as the switch 207 is closed.
  - (b) If solenoids are not energized, check *the* actuating switch 207 and the wires 616 and 622 for continuity.
4. Cycle machine through the Q.R. function and observe action of *the* operating levers and the main and secondary control valve spindles. Make certain the lockout latch clears the operating lever and the lever rollers follow *the* contour of the cams. Be sure the springs are on the operating levers.

#### CHECK FOR TAPE CONTROL

1. If Hydraquadder operates satisfactorily when controlled by push-button, but does not function properly when using tape, proceed as follows:
  - (a) Remove TTS operating unit driving belt. Then put a tape with a QR code combination into the operating unit and turn the operating unit pulley by hand, observing the action of first stage relays K-1 and K-2. Relays K-1 and K-2 should close as the code signal for QR is read by the TTS operating unit tape pins.
  - (b) If relays K-1 and K-2 do not close in response to the tape code signal, check the bail switches Fig. 29 in the TTS operating unit to be sure they are functioning properly. Temporarily substitute relays K-3 and K-4 to determine if the relays are at fault. Check wiring between operating unit and memory relay box.
  - (c) Check action of clearing switch 208, Figs. 17 and 17A. This is a normally closed switch and is opened by contact with the cam shoe.
  - (d) Check the transfer switch action. As the plunger is pushed forward, there should be two audible clicks. At the first click, the first set of contacts is closed to complete the circuit which energizes the second stage relays. At the second click, the second set of contacts is opened which de-energizes the first stage relays.

*Symptom:* QL function occurs when signal for QR is given, or Center function occurs when signal calls for QR.

#### CHECK FOR PUSH-BUTTON CONTROL:

1. With the QR push-button depressed, push in transfer switch plunger and observe action of second stage relays K-3 and K-4. Both relays should close as the transfer switch is actuated. If only relay K-4 closes, a QL function will occur. If only relay K-3 closes, a Center function will occur.  
If this is the case, check the following:
  - (a) Relays—Temporarily interchange first stage relays with second stage relays to determine if K-3 or K-4 relays are at fault.
  - (b) Relay socket terminal connection to underside of printed circuit may be open.
  - (c) Insufficient voltage in circuit to operate both relays simultaneously. If voltage is less than 18 volts D.C., use wire 505 in place of wire 501 to increase voltage as previously explained.
2. If both relays K-3 and K-4 close as the transfer switch plunger

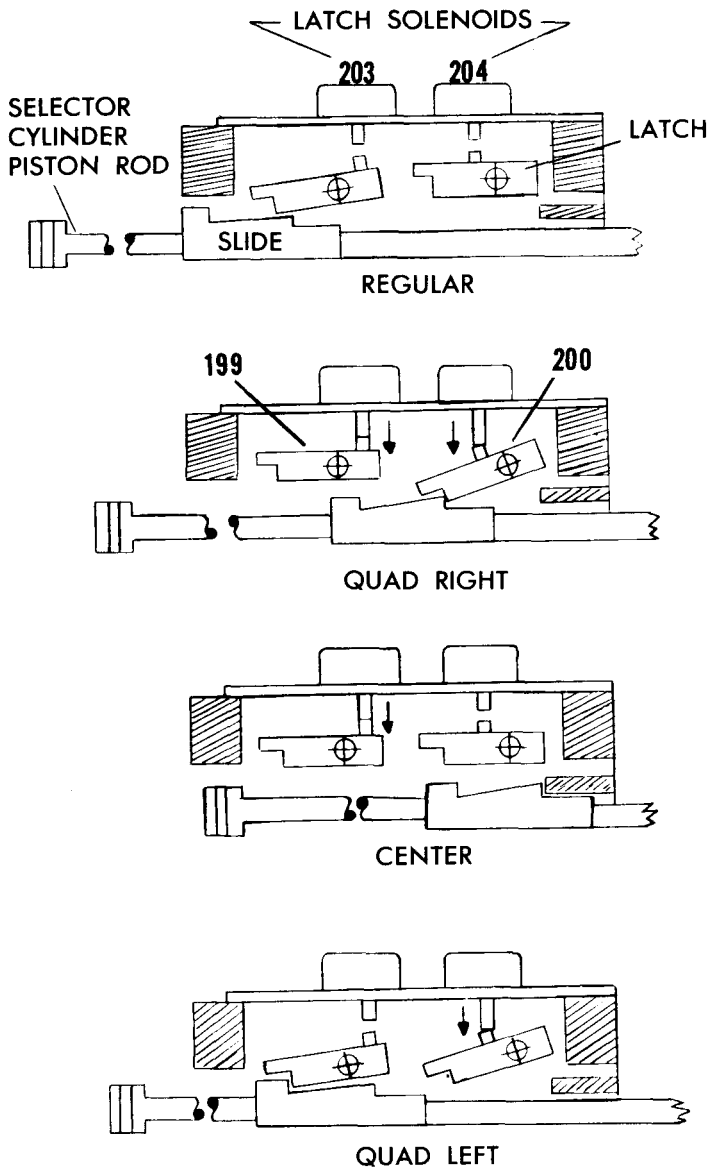


FIG. 32 Front View showing action of the Selector Solenoids and Latches to locate the Slide and Rack for the Quadding or Centering Function desired.

is pushed in and with the QR push-button depressed, check the following:

- (a) Close the actuating switch 207 Figs. 17 and 17A manually and observe action of the selector latch solenoids. Both solenoids should energize as the switch is actuated. Also check to see that the latch pivots freely and that the latch spring pressure is not too strong.
- (b) Check wires to the solenoids for continuity.

#### CHECK FOR TAPE CONTROL:

If the Hydraquadder operates satisfactorily when controlled by push button, but does not function properly when using tape, proceed as follows:

- (a) Remove TTS operating unit driving belt. Then put a tape with QR code combination into the operating unit and turn the operating unit pulley by hand, observing the action of the first stage relays K-1 and K-2. Relays K-1 and K-2 should close as the code signal for QR is read by the TTS operating unit tape pins.
- (b) If relays K-1 and K-2 do not close in response to the tape code signal, check the bail switches, Fig. 29 in the TTS operating unit to be sure they are functioning properly. Temporarily substitute relays K-3 and K-4 to determine if the relays are at fault.
- (c) Check wiring between TTS operating unit and memory relay box.
- (d) Check push-buttons to be certain they are in "up" position.

#### *Symptom:*

1. QL, QR or Center function recurs after push-button selection is made for regular, or when no quadding or centering code is in the tape.
2. QR function repeats even though push-button selection or tape code is changed.
3. QR function occurs when QL push-button selection or QL tape code is used following Center selection.
4. QR function occurs when Center push-button selection or Center tape code is used following QL selection.

#### CHECK FOR BOTH PUSH-BUTTON AND TAPE OPERATION

1. Check the clearing switch 208 Figs. 17 and 17A to be certain it is being properly actuated by the shoe on the cam. This switch clears the second stage relay(s) for the next signal. If this switch is not functioning properly to de-energize the second stage relay(s) any of the above symptoms will occur.
2. Check the action of the transfer switch. See that spring on plunger is returning plunger to normal position after assem-

bling elevator descends, and that the two sets of contacts of the transfer switch are functioning properly in sequence. Make sure the relationship of the switch roller to the plunger is correct as outlined under the heading "Transfer Switch Adjustment."

#### ADDITIONAL CHECK FOR TAPE CONTROL:

1. Check TTS operating unit bail switches. If one or more fail to open after being actuated momentarily for a quad or center function, then any of the above symptoms will occur.
2. Check to determine if a Quad or Center button remains depressed during tape operation when the assembling elevator starts to rise after an "elevate" signal in the tape. Any depressed Quad or Center button in the push-button box should automatically return to the "up" position by action of the switch S-801 in the TTS unit, Fig. 28, and the push-button clearing solenoid in the push-button box, Fig. 15. If this clearing action does not occur and a Quad or Center push-button remains depressed after an elevate signal is received during tape operation, then the push-button signal will enter the memory circuit. The action of switch S-801 and the push-button clearing action are explained under "Action of the push-button clearing solenoid" under III Operation.
3. The first stage relays should de-energize when the second set of contacts of the transfer switch open (second click). Check the transfer switch for proper action of the first and second set of contacts.

*Symptom:* Quad or Center signal is lost on waiting line.

*Check:* Clearing switch 208 Figs. 17 and 17A. This switch may be opening momentarily at the improper time in the cycle due to vibration or interference.

On mixer Linotypes, where the switches 207 and 208 are attached to the second elevator safety pawl switch 208 may open momentarily, if there is excessive vibration of this pawl during operation, and the signal for the waiting line will be lost.

Weakening the second elevator safety pawl spring will reduce the vibration of the pawl. It is also suggested that the spring of the switch 208 be strengthened.

Make sure that the switch 208 is not actuated by interference with the cam.

*Symptom:* Selector handle turns to proper position for the quadding function selected by the tape or push-button and selection is made, but the vise jaw(s) do not close for quadding or centering.

*Check:* Examine secondary control valve lever and spindle for a possible bind which is preventing the valve from returning to normal position after selection is made. Also see that the return spring is on the lever and exerting sufficient tension to bring the lever and secondary control valve spindle back to normal position after the selection occurs. If the secondary control valve spindle remains in the closed or forward position after the selection has occurred, the hydraulic fluid is prevented from flowing to the vise jaw piston cylinders to move the vise jaws.

*Symptom:* Electric Left-Hand Vise Jaw Safety does not operate.

*Check:*

1. Check vise jaw switch action by disconnecting the wire 511 at the knife connector and connecting it to one test lead of an ohmmeter. The other ohmmeter test lead should be grounded to a clean part of the Linotype machine. When vise jaw switch detent is depressed, the resistance should be zero ohms and when the detent is in normal position the resistance should be infinity. If switch is sticking, disassemble and inspect for bind.
2. Check the pot pump solenoid for possibility of a bind which is preventing the rotary movement of the solenoid. Check the spring which connects the solenoid to the pot pump stop lever for the possibility that the spring has not sufficient tension to move the stop lever when the solenoid is energized.
3. To check the solenoid electrically, disconnect the wire 508 at the knife connector and wire 509 from ground and measure the resistance with an ohmmeter from either lead to the machine frame. If the solenoid is not grounded within the casing the resistance should be infinite. The resistance of the solenoid between wires 508 and 509 when disconnected from the knife connectors should be between 17 and 21 ohms.
4. Check the wiring from the power box to the vise jaw switch and solenoid for continuity.
5. If the pot pump solenoid is energized at the wrong time in the cycle and for no apparent reason, it is possible that a ground condition in some other electrical component on the machine is permitting current to flow to the solenoid. In this case all wiring on the machine should be carefully examined for a grounded wire, especially under the harness clamps which hold the harness to the machine.

*Symptom:* Centering is not correct.

*Check:* 1. Check adjustments as given under heading "Vise Jaw Adjustments."

2. Check centering pinion 74, Fig. 5 and vise jaw racks for binds. See that the pinion engages properly with the racks.
3. Check centering pinion to be certain it is turning freely on the shaft. The shaft should be oiled at regular intervals by removing plug in vise cap.

*Symptom:* Vise Jaws closing too soon.

*Check:* Check adjustments under heading "Adjustments—Main and Secondary Control Valves."

*Symptom:* Matrices spill as they are withdrawn from the Vise Jaws.

*Check:* This may be caused by the vise jaws having a slight inward motion as the line of matrices is withdrawn from the vise jaws. Check timing of the control valves as explained under "Adjustments—Main and Secondary Control Valves." A worn or misadjusted first elevator jaw which permits excessive matrix clearance could also be the cause of matrices falling out of the first elevator jaw.

*Symptom:* Selector Handle does not return to regular position.

*Check:* This is an indication that the secondary control valve is not fully closing. A partial clockwise turn of the secondary control valve adjustment screw should correct this condition.

After readjusting the secondary control valve, check vise jaw action to make certain it is correct.



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