INSTRUCTIONS

FOR THE

OPERATION, ADJUSTMENT AND MAINTENANCE

OF THE

M.L.CO. ELECTRIC QUADDER (TELETYPESETTER OPERATED)

Sales Service Mergenthaler Linotype Company Brooklyn 5, N. Y.

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These instructions are advance information on the operation, adjustment and maintenance of the M.L. Electric Quadder (Teletypesetter Operated) until complete instructions in booklet form are released. They should be supplemented by Service Instruction No. 8 entitled "Instructions for the Operation, Adjustment and Maintenance of the M.L. Quadder", which covers the manual quadder.

The mechanical adjustments and maintenance of the quadder are covered in Service Instruction No. 8 whereas these sheets deal mainly with the electrical circuits necessary for operating the M.L. Quadder by Teletypesetter. The manual quadder and electric quadder differ mainly in the method of selecting quadder functions desired, but the quadder proper is basically the same for both.

OPERATION

General Description of Operation:

The Mergenthaler Linotype Company electric quadder may 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 switched to manual operation so that the Linotype operator may select any quadding or centering function by pressing the proper push button on the Operating Control Switch Box located to the right of the keyboard.

Teletypesetter Operation:

The electrical control part of the quadding system permits the synchronization of an electrical quadding signal from the Teletypesetter unit with the mechanical travel of a line of matrices from the assembling elevator to the casting position. When the selector switch on the Operating Control Switch Box (Fig.12) is in the upper, or Teletype position, and the Teletypesetter tape with the proper quadding code punched in it passes through the Teletypesetter operating unit, an electrical quadding signal causes a chain of events in the memory relay system and associated switches operating from the cams and bails.

The electrical quadding signal is passed consecutively through three banks of relays. These relays are so arranged that three different electrical quadding signals paralleling the mechanical travel of three lines of matrices can be present in the machine at one time. The first bank of relays stores a quadding signal for a line of matrices in the assembling elevator. The second bank of relays stores a quadding signal for a line of matrices being elevated to and carried by the delivery slide to the first elevator jaws. The third bank of relays receives this signal and transforms the electrical signal into mechanical motion by energizing rotary solenoids which result in the proper quadder action. This takes place simultaneously with the descent of the first elevator.

The memory relays (see Fig.2) are connected so that they are in three banks and the quadding signals for left quad, center and right quad affect each bank individually as the line of matrices goes through the necessary motions from assembling to casting. Six relays of the eight relays in the memory relay box are in the actual memory system. The relays affected for each quadding operation are shown in the table below:

- Table No. 1 -

Relay Bank	Quad Left	Center	Quad Right
1	K-106	K-107	K-106 and K-107
2	K-104	K-105	K-104 and K-105
3	K-103	K-102	K-103 and K-102

Of the other two relays in the box, K-108 is the main transfer relay which, when energized, conditions the entire electrical system for Teletypesetter operation and when deenergized, for manual operation. Relay K-101 is an extra relay incorporated in the memory relay box for possible further circuit developments to increase the flexibility of the electric quadder. However it must be energized for proper operation of the system.

Manual Operation:

When the machine is operated manually, with the Operating Control Switch Box being used for quadder operation, relay banks 1 and 2 (relays K-107, K-106, K-104 and K-105) (Fig.2) and certain switches are eliminated from the circuit by the selector switch S-202 (Fig.12) on the Control Switch Box.

Since the machine operator decides what quadding function is desired for each line, only relay bank No.3 is used. This results in either or both relays K-102 and K-103 being energized when the first elevator cam closes the snap action switch S-701 (Fig.11). Relay K-102 is used for centering, Relay K-103 for quad left and both K-102 and K-103 for quad right. The push button (see Fig.12) depressed by the operator (by completing the correct circuit) determines which relay (both relays for "quad right") is to receive power when the S-701 (Fig.11) closes. Pushing the button marked "regular" results in the automatic raising of any button which may be depressed, so that the quadding circuit is inoperative. The button marked "spare" is on the box for possible future use.

General Sequence of Operation - Manual Operation

When a push button is depressed for a quad function, a certain relay circuit is selected, depending on the specific quadding function desired. As the first elevator cam revolves, switch S-701 (Fig.11) closes and the relay (or relays) in the circuit is actuated causing the appropriate rotary solenoids (Fig.7) to be energized. The rotary solenoids permit the quadder control rod to be rotated to the proper position for the quadding function selected. After the line has been cast switch S-703 (Fig.11) is opened by the first elevator cam which results in the relay (or relays) opening and the rotary solenoids are deenergized, completing the cycle.

For the initial quadding function, the operator may depress the push button at any time before or during the assembling of a line of matrices up to the time the line goes to the delivery channel and the cams start turning. For each successive quadding function the operator can make his selection immediately after the cams start turning and switch S-701 has energized the relay (or relays) and solenoids for the previously selected quadding function.

Detailed Description of Sequence of Operation - Manual Operation

For manual push button operation of the electric quadder, the selector switch, S-202 (Fig.12) when set to "manual" position, eliminates relay banks 1 and 2 (relays K-107, K-106, K-104 and K-105), first and second transfer switches S-801, S-802 (in operating unit) and the first elevator cam switch S-702 from the quadding circuit. The electrical sequence of operation for the 3 quadding functions are as follows (see Fig.5):

Quad Left

1. Quad "Left" button conditions circuit so power will be directed to relay K-103.

2. First elevator cam switch S-701 is closed, energizing relay K-103 which in turn energizes rotary solenoids L-401 and L-403 for quad left.

3. First elevator cam switch S-703 is opened, de-energizing relay K-103 and rotary solenoids L-401 and L-403, completing cycle.

Quad Right

1. Quad "Right" button conditions circuit so power will be directed to relays K-102 and K-103.

2. First elevator cam switch S-701 is closed, energizing relays K-102 and K-103 which in turn energize rotary solenoids L-401, L-402 and L-403 for quad right.

3. First elevator cam switch S-703 is opened, de-energizing relays K-102 and K-103 and rotary solenoids L-401, L-402 and L-403, completing cycle.

Center

1. "Center" button conditions circuit so power will be directed to relay K-102.

2. First elevator cam switch S-701 is closed, energizing relay K-102 which in turn energizes rotary solenoids L-401 and L-402 for centering.

3. First elevator cam switch S-703 is opened, de-energizing relay K-102 and rotary solenoids L-401 and L-402, completing cycle.

General Sequence of Operation - Teletypesetter Operation

When the teletypesetter tape with the code for a particular quadding function passes through the teletypesetter operating unit, the appropriate bail switch (Fig.10) for that particular quadding function is momentarily actuated, thereby energizing the relay (or relays) in relay bank No. 1. This relay (or relays) is held closed electrically by the normally closed 2nd transfer switch (Fig.9) after the bail switch has opened. Then the "elevate" code signal in the tape causes the assembling elevator raising cam shaft (Fig.9) in the Teletypesetter operating unit to turn. When it has rotated approximately 50° the first transfer switch is cammed closed, energizing a relay (or relays) in relay bank No. 2 through relay bank No. 1. Relay bank No. 2 is held closed by normally closed first elevator cam switch S-702 (Fig.11).

Another 20° rotation of the cam shaft opens the 2nd transfer switch, deenergizing relay bank No. 1. Now relay bank No. 1 is ready to receive another quadding signal from the Teletypesetter tape.

Simultaneously with the operation of the 1st and 2nd transfer switches the line of matrices is being elevated to the delivery slide and is carried to the 1st elevator jaws. As the 1st elevator descends, first elevator cam switch S-701 is momentarily closed, energizing relay bank No. 3 through relay bank No. 2. Relay bank No. 3 is held closed electrically by means of the normally closed 1st elevator cam switch S-703. As relay bank No. 3 is energized, the appropriate quadder control rotary solenoids are energized to permit the quadding action designated by the tape code.

As the rotation of the first elevator cam continues, first elevator cam switch S-702 is opened and relay bank No. 2 is deenergized. Now relay bank No. 2 is ready to receive another signal for a subsequent line of matrices.

When the first elevator reaches the transfer position, normally-closed first elevator cam switch S-703 is opened, deenergizing relay bank No. 3 and quadder control rotary solenoids. The cycle for one particular line of matrices and one quadding function is then complete.

Detailed Description of Sequence of Operation - Teletypesetter Operation

In the foregoing general description of operation of the quadder, reference was made to the 3 relay banks and their function in controlling quadder operation. Refer to table #1 page 1 for relays pertaining to each bank. The function of each bank of relays is as follows:

Relay Bank 3 transforms electrical signals into mechanical motion by energizing the appropriate rotary solenoids for the following quad functions.

Relay Bank 2 stores the successive quad signals for a line of matrices being elevated to, and carried by the Delivery Slide.

Relay Bank 1 stores the successive quad signals for a line of matrices in the Assembling Elevator.

The electrical sequence for teletypesetter operation of the quadder for the 3 quadding functions is as follows (see Fig. 5):

Note: For all functions selector switch S-202 (Fig.12) closes relay K-108 when switch is in "teletypesetter" position.

Quad Left

1. Tape code 0134 closes bail switch 5 momentarily, energizing relay K-106; relay K-106 is held closed by 2nd transfer switch, S-802.

2. Relay K-104 closed by 1st transfer switch S-801 through relay K-106 and is held closed by first elevator cam snap action switch S-702.

3. Relay K-106 is deenergized by opening of 2nd transfer switch S-802.

4. First elevator cam switch S-701 closes relay K-103 through relay K-104 and K-103 is held closed by first elevator cam snap action switch S-703. Relay K-103 energizes rotary solenoids L-401 and L-403 for left quad.

5. First elevator cam switch S-702 opens relay K-104.

6. First elevator cam switch S-703 opens relay K-103 and rotary solenoids L-401 and L-403 are deenergized, completing cycle.

Centering

1. Tape code 02345 closes bail switch 4 momentarily, causing relay K-107 to be energized; relay K-107 held closed by 2nd transfer switch S-802.

2. Relay K-105 closed by 1st transfer switch S-801 through relay K-107 and is held closed by first elevator cam switch S-702.

3. Relay K-107 is deenergized by opening of 2nd transfer switch S-802.

4. First elevator cam switch S-701 energizes relay K-102 which is held closed by first elevator cam switch S-703; relay K-102 energizes rotary solenoids L-401 and L-402 for centering.

5. First elevator cam switch S-702 deenergizes relay K-105.

6. First elevator cam switch S-703 opens relay K-102, and rotary solenoids L-401 and L-402 are deenergized, completing cycle.

Quad Right

1. Tape code 01234 closes bail switches 1 and 2 momentarily, causing relays K-106 and K-107 to be energized; relays K-106 and K-107 are held closed by the 2nd transfer switch S-802.

2. Relays K-104 and K-105are energized by 1st transfer switch S-801 through relays K-106 and K-107. Relays K-104 and K-105 are held closed by first elevator cam switch S-702.

3. Relays K-106 and K-107 are deenergized by opening of 2nd transfer switch S-802.

4. First elevator cam switch S-701 energizes relays K-102 and K-103 which are held closed by first elevator cam switch S-703; relays K-102 and K-103 energize rotary solenoids L-401, L-402 and L-403 for right quad.

5. First elevator cam switch S-702 deenergizes relays K-104 and K-105.

6. First elevator cam snap action switch S-703 opens relays K-102 and K-103 and rotary solenoids L-401, L-402 and L-403 are deenergized, completing cycle.

It should be noted that while the electrical sequences outlined above are going on, 3 lines of matrices are simultaneously being cast, delivered and assembled. The correct quadding information for all three lines is synchronized with the mechanical travel of the matrices to accomplish the desired quadding function for each line.

Operation of Quadder Control Rotary Solenoids

The 3 rotary solenoids, L-401, L-402, L-403, in the control unit assembly (Fig.7) permit rotation of the quadder control rod to the proper position for a particular quadding function. Along with a slide link and stop levers they are located in an enclosed box which is fastened to the right-side of the quadder housing. When a particular

quadding action is chosen, either by coded Teletypesetter tape or by push button, the resultant electrical sequences cause the energizing of the appropriate rotary solenoids for that function. Attached to each of the three solenoids is a stop lever (19) which is normally pulled by a small spring (21) into a slot of the slide link (20) to which the cable (8) for revolving the quadder control rod is attached.

When it is desired to quad left, right or center, the proper solenoids will be energized to withdraw their stop lever and allow the slide link and cabling to rotate the control rod to the proper position.

A cam (3) (Fig.6) on the left-hand side of the first elevator slide acts on the lever mechanism (4) to which one end of the slide link cable (9) is attached. This occurs at each cycle of the machine and results in the movement of the cable and slide link to the position allowed by the rotary solenoid stop levers. The opposite end of the cable, (8) which passes over pulleys and wraps around a double grooved pulley on the quadder control rod shaft, is fastened to an anchored spring on the quadder housing. The purpose of the spring is to rotate the control rod to its normal, non-quad position after each quadding or centering rotation of the control rod.

Justification Lockout

For quadding or centering, justification lockout is accomplished by means of the lockout lever (27) (Fig.8). The action of the lockout lever is controlled by the movement of the lever mechanism (4) to which one end of the slide link cable (9) (Fig.7) is attached. When quadding or centering takes place, the stop levers (19) withdraw, allowing the movement of the slide link (20). Consequently the lever mechanism (4) moves downward, permitting a spring (32) (Fig.8) to pull on the linkage (25,26) and the lockout lever (27) swings into locking position. When no quad occurs, the lever mechanism (4) (Fig.6) by means of an adjustable torsion spring (40) is allowed the necessary movement caused by the action of cam (3), but does not allow movement of the Lockout Lever Linkage. Refer to maintenance section for more detailed description.

Electrical connection between the quadder control unit assembly E-5366 (1) (Fig.6) and the other electrical components of the circuit is made with a 4 prong connector P-604 (Fig.3) to which the necessary wire leads from the harness are attached by means of a female connector J-404.

A Quad Left signal results in solenoids L-401 and L-403 being energized.
A Quad Right signal results in solenoids L-401 and L-402, L-403 being energized.
A Center signal results in solenoids L-401 and L-402 being energized.

Operation of Teletypesetter Keyboard Safeties

The machine safeties are applied as a separate electrical system but draw their power from the same power supply box F-8608 (Fig.13) as the electrical quadder does.

Connection for the Teletypesetter Safety Circuit (Fig.13) to the power supply box is easily made by plugging in the harness plug P-910 to the receptacle J-309 in the power supply box.

The Left-Hand Vise Jaw Electric Safety Circuit (Fig.4) is connected to the power supply box F-8608 by simply inserting the plug P-201 into the receptacle J-308 in the power supply box.

All the safeties operate on 18 volts direct current.

The Teletypesetter Safeties prevent the following:

1. Stop Teletypesetter if Linotype Distributor stops.
2. Stop Teletypesetter if Linotype Assembler is stopped.
3. Prevent Assembling Elevator from rising if line of matrices is too long.
4. Insure last matrix being in front of Assembling Elevator Pawls as Assembling Elevator rises.

The electrical components provided for the above are (see Fig. 13):

1. Distributor stop safety switch, S-903.
2. Assembler belt safety switch, S-901.
3. Long line safety switch, S-902.
4. Indicating lamp, XI-901.
5. Assembling elevator catch solenoid, L-902.
6. Assembler brake release solenoid, L-901.

There are three other units in the safety system and these are located within the Teletypesetter Operating Unit. They are: (Fig.3)

1. Brake release solenoid switch, S-803.
2. Elevator handle yield safety switch.
3. Stop magnets to disengage the Teletypesetter clutch.

A Tight-Tape Switch and an End-of-Tape Switch may also be located in the Teletypesetter Unit but these are optional safeties.

The Tight-Tape Switch is actuated whenever the code tape entering the Teletypesetter Unit becomes too tight. The closing of this switch results in the stop magnets being energized to stop the Teletypesetter Unit, but the Indicating Lamp I-901 will not light. This is an intentional design feature because the tight-tape condition does not require a monitor to correct any difficulty. The difficulty clears itself when the reperforator begins operating again.

The End-of-Tape Switch is actuated when the tape ends or breaks, causing the stop magnets and Indicating Light XI-901 to be energized.

The distributor stop safety switch S-903 (Fig.13), the assembler belt safety switch S-901 and the elevator handle yield safety switch (located in the Teletypesetter Unit) are all connected in parallel and are in series with another parallel combination consisting of the indicating lamp XI-901 and the stop magnets (Located in Teletypesetter Unit) (Fig.3). This results in the action of any one of the above switches causing the Teletypesetter to stop and the indicating light to go on.

The Distributor Stop Safety

When a distributor stop occurs the distributor clutch throwout action results in the closing of the distributor stop safety switch S-903 (Fig.13) which causes the stop magnets in the Teletypesetter operating unit to be energized, stopping the Teletypesetter. The indicating lamp I-901 on the distributor bracket lights up simultaneously and remains lighted until the distributor has been cleared and the clutch is engaged.

The Assembler Belt Safety

When the operator pushes in the assembler belt shifter rod (52) (Fig.13) to stop the assembler, the same action as above occurs. The assembler belt safety switch S-901, located on the back of the swinging front is a normally-closed switch which is held open by a pawl (53) on the shifter rod. Pushing the shifter rod to stop the belt results in the pawl allowing the snap action switch S-901 to close, thereby energizing the stop magnets and indicating lamp I-901. The Teletypesetter is stopped so that matrices will not be released from the magazine.

The Long Line Safety

The long line safety switch S-902 (Fig.13) which is located on the back of the "Swinging Front" is actuated by a lever (45) which goes through the front plate to the assembler slide stop (48). When a line of matrices longer than the preset jaw measure is assembled, the lever releases the plunger of switch S-902. This energizes the assembling elevator catch solenoid L-902 which prevents assembling elevator from rising. Switch S-902 is a normally closed switch, held open.

The Assembler Slide Brake Release

In order to assure that the last matrix which enters the Assembling Elevator is in front of the Assembling Elevator Pawls as the Assembling Elevator rises, the line of matrices is automatically tightened just before the matrices are elevated to the Delivery Slide.

Line tightening is accomplished by a rotary solenoid L-901 (Fig.13) (located on the front of the "swinging front") which is momentarily energized. The movement of the solenoid core results in the Assembler Slide Brake (49) being tripped immediately before the assembling elevator starts to rise. The Assembler Slide (57) pulls in against the line of matrices, tightening them just before they ascend.

Brake release solenoid L-901 is energized by the brake release solenoid switch S-803 (Figs.3 and 9) located in the Teletypesetter operating unit. This switch is actuated by cam action after the assembling elevator raising cam shaft has rotated approximately 10°. The switch is normally open and closes to energize the solenoid.

The Left-Hand Vise Jaw Electric Pot Pump Safety

The Left-Hand Vise Jaw Electric Pot Pump Safety prevents the pot pump plunger from descending if matrices are not held tightly between the vise jaws during casting. The electric safety is arranged to operate only when quadding or centering. For non-quadding composition the R.H. vise jaw mechanical safety is used.

When a line of matrices is pressed together by the vise jaws a protruding plunger in the left-hand vise jaw is pushed in. This closes contacts of a switch S-201 (Fig.4) located in the vise jaw, completing a circuit so that current is allowed to pass through the switch, the machine frame and a rotary solenoid L-201. The mechanical rotation of the solenoid clears the pot pump stop lever from under the catch block of the pot pump lever allowing the cast to be made.

The safety system operates on 18 volts direct current. Alternating current is supplied to the system from the power supply and is converted to direct current by a small rectifier unit. The minus DC terminal of the rectifier CR-301 is wired directly to an insulated contact on the left-hand vise jaw switch S-201. The other contact in the switch is grounded to the machine frame. The plus DC terminal of the rectifier, CR-301 is connected directly to, and through, the pot pump safety solenoid L-201 to ground on the column of the machine near the pump bracket. When the switch S-201 in the vise jaw is closed, current passes from the rectifier CR-301 through the switch to ground and then back through the rotary solenoid L-201 to the rectifier CR-301, completing the circuit.

A capacitor C-301 and resistor R-301 are in series with one another from the plus terminal of the rectifier to ground in the rectifier unit. These are used as an arc suppression circuit for prolonging the life of the tungsten contacts in the vise jaw switch.

The left-hand vise jaw safety circuit operates only when a quadding function occurs. The 24 volt AC power input to the rectifier CR-301 has one branch of the circuit wired to isolated contacts of relays K-102 and K-103 (Fig.5) of the memory relay unit F-8579. Since either or both

relays are energized for manual or teletypesetter quadding, current is allowed to pass through to the vise jaw safety circuit. However, when the "regular" button on the push button box (Fig.12) is pushed in or if the teletypesetter tape code does not call for a quadding function, these relays are not energized, the safety circuit is inoperative and the right-hand vise jaw mechanical safety is used to clear the pot pump safety.

Vise Jaw Switch

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 which snaps into a groove in the inner wall of the vise jaw.

Lead 201 from plug P-202 (Fig.4) connects to an insulated terminal on the end of the switch. This terminal is part of the 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 sliding connection between the switch plunger assembly and the vise jaw. This contact consists of a sub-assembly made up of the switch plunger, the contact, a small spring and a contact retaining collar. The small spring permits movement of the contact so that over-travel is allowed, to avoid damage to both contacts when they meet. This switch plunger--contact sub-assembly moves in the vise jaw to meet the insulated stationary contact when the plunger is depressed by the line of matrices. The plunger contact is normally held away from the stationary contact by a spring so that there is a .010" gap between contacts when no pressure is exerted on the plunger.

MAINTENANCE, TESTING AND ADJUSTMENTS

General Maintenance Information

It should be noted that on wiring diagrams shown, every conductor has a number which agrees with the number on the actual wire which is on the machine. All terminal strips and connectors are similarly marked so that reference between the diagrams and the wiring on the machine parts can be readily made.

Each electrical component such as switches, relays, terminal strips, solenoids, etc., has a symbol number in addition to a Mergenthaler Linotype Company part number. This is standard electrical coding practice for identifying electrical components which are alike and have the same part numbers but which are used to perform different functions in the circuit.

In doing the maintenance work which may be necessary to keep the quadder performing at top efficiency Service Instruction No. 11 should be used in conjunction with the Mergenthaler Linotype Company Service Instruction No. 8 entitled "Instructions for the Operation, Adjustment and Maintenance of the M.L. Quadder". Instruction No. 8 covers in detail the mechanical aspects of the outboard quadder and the maintenance of the quadder proper, whereas Service Instruction No. 11 deals more in detail with the electrical control of the quadder.

When difficulties in the electrical circuit occur they may usually be localized fairly quickly so that the point of trouble is isolated to a specific section of the entire circuit. These branch circuits consist of the wiring to, and component parts of, the (1) Operating Control Switch Box F-8602, (2) Control Unit Assembly E-5366, (3) First Elevator Cam Switch Assembly, (4) Teletypesetter Keyboard Safety Unit, (5) Power Supply Unit Assembly F-8608 and (6) Left-Hand Vise Jaw Safety.

Testing Equipment

In making the various electrical checks which should be performed on the circuit to determine where a possible difficulty might exist, it will be found most useful to have available any or all of the following testing equipment:

An Ohmmeter
A Voltmeter
A 6-volt battery--buzzer combination
A Lamp-Testing outfit
A Circuit Analyzer

A small circuit analyzer which is capable of measuring voltage, current or resistance for both A.C. and D.C. circuits is the handiest instrument to have for circuit trouble shooting. This instrument will more than pay for itself in usefulness for testing other electrical installations in a plant in addition to its use on the quadder circuit.

Testing Methods

Measuring Resistance--At the end of this chapter is a list of electrical components in the circuit and their electrical resistance. To check resistance, the ohmmeter or analyzer is used. With all other wire connections removed from the component being checked, the ohmmeter test leads are then held firmly across the terminals for the resistance reading.

Measuring Voltage--The voltmeter is used to measure voltage throughout the circuit. It should be remembered that the transformer has an input voltage of either 110 or 220 volts A.C. and an output voltage of 24 and 6 volts A.C. The 24 volts A.C. is converted to approximately 18-22 volts D.C. for operation of the quadder control and safeties. Refer to schematic wiring diagram (Fig.5) which shows electrical characteristics of various sections of the circuit. Voltage is measured by connecting the test leads in parallel with the component being tested.

Checking Continuity--To check continuity of conductors for breaks or shorts, any of the testing instruments listed may be used. However, the ohmmeter is probably the best suited for this test. With the ohmmeter test leads held at each end of the conductor, the resistance should be very low, in most cases less than one ohm, if there is no break in the conductor or if the conductor is not grounded. When checking continuity through other electrical components such as the fuses or relays, the resistances should be approximately those listed on the table at the end of this chapter.

When a buzzer is used for checking continuity, a clear sound will be heard. Absence of sound or a weak one indicates a break or short circuit. The buzzer cannot be relied on for checking continuity of transformer windings due to the high inductance of the windings.

Checking for Grounds--The highest resistance scale of the ohmmeter should be utilized to check for grounds. One ohmmeter test lead is connected to the component being tested and the other test lead is firmly contacted to the clean metallic surface of the machine frame, the box which houses the component, or whatever the component is fastened to. If no ground exists there should be no perceptible ohmmeter reading when the test leads are connected between ground and any terminal of the component being tested. In other words there is infinite resistance between ground and the unit being tested when no ground exists between them.

Checking Switches

(a) Snap Action and Toggle Switches--1. Disconnect all leads to the switch so that switch is isolated from the rest of the circuit. 2. Connect ohmmeter, analyzer or test lamp to the proper terminals. (For snap action switches, leads connected to "A" and "O" terminals indicate a normally open switch; leads connected to "A" and "C" a normally closed switch).

Switch action should be clean and quick.

When switch is in position to pass current, the resistance should be zero. When switch is in open position the resistance should be very high (infinity).

(b) Teletypesetter Operating Unit Transfer Switches and Bail Switches--(Figs. 9 and 10)--1. Connect ohmmeter, analyzer or test lamp across suspected defective switch. 2. Disconnect the 4, 6, and 8 prong plugs from the Teletypesetter Operating Unit. 3. Rotate the operating unit driving pulley manually and observe the opening and closing action of switch. Resistance across switch should be zero ohms when switch is in closed position and very high (infinity) when switch is in open position.

(c) Operating Control Switch Box Pushbutton Switches (Fig.12)--1. Disconnect harness plug P-603 from receptacle J-203. 2. Connect test leads across appropriate switch terminals (refer to wiring diagram) (Fig.3) and note switch action when pushbutton is depressed and then released by pushing in another button. Like the other switches, resistance of open switch should be very high (infinity) and of closed switch, zero ohms.

Checking Indicating Lamps

Indicating pilot lights XI-901, XI-201 and XI-202, lamps I-901, I-201, and I-202 should be checked as though they were resistances. Refer to table of cold resistances as shown at end of chapter.

General Check Points for Servicing

If the quadder fails to function properly the following general quick checks should be made:

1. Check action of 3 solenoids in Control Unit (Fig.7) to determine if they are functioning properly. A quad LEFT signal energizes solenoids L-401 and L-403. A quad RIGHT signal energizes solenoids L-401, L-402 and L-403. A CENTER signal energizes solenoids L-401 and L402. If they are operating correctly it can be assumed the electrical circuit is all right and trouble is of a mechanical nature.

2. If solenoids in Control Unit are functioning correctly, check mechanical linkage and cabling of quadder to be sure there are no misadjustments or wear, causing binding of quadder parts.

3. If an inspection of the solenoids reveals they are not functioning properly the following points pertaining to the electrical circuit should be checked:

(a) Make general inspection to be sure all connectors or plugs are properly assembled and making proper contact.

(b) Inspect visually for breaks or possible shorts in wires. Inspect closely in area where any mechanical work on machine has been done previously. Also check closely at points where clamps hold harness to machine frame and inside connectors where wires are soldered to pins. Make sure pins are not grounded to connector housing.

(c) Inspect terminal strips and terminal connections to electrical components to be sure they are tight.

(d) Look for any splattered type metal or chips which may be causing shorts.

(e) Check mechanical actuating of all switches by cams or levers to be sure a loose screw has not caused a misadjustment.

(f) Check for blown fuses - do not replace until cause of their blowing has been located and corrected.

(g) Be sure both the main motor switch and power supply box switch are in "on" position.

After examining the quadder and circuit rather quickly for any obvious reasons for malfunction without success, each individual component of the circuit should be more closely checked. There is always the possibility that grounds or breaks in conductors and connection points, defective electrical parts or mechanical misadjustments are the cause of the quadder not functioning correctly. The test instruments should be utilized to check conductors and electrical components, and mechanical adjustments should be gone over.

By observing the action of the quadder itself, it is sometimes possible to isolate trouble rather quickly to a specific location in the entire control circuit. When a definite pattern of action occurs it is possible to relate the trouble to a definite part of the cycle of operation. The determination of trouble is more easily made by observing related conditions rather than by hit and miss trouble shooting. For instance, to quickly determine whether quadder difficulty is mechanical or electrical, the action of the three solenoids in the Control Unit (Fig.7) should be observed. If these solenoids are functioning correctly, it is probable that a mechanical misadjustment of the quadder proper is the cause of the trouble.

Power Supply Unit F-8685

When difficulty in the Power Supply Box (Fig.2) occurs, the most evident symptoms are, (1) the failure of quadder to respond to any quad signal or (2) failure of the indicating lamps to light although they are not defective and conditions are such that they normally should light.

The power supply unit should be checked in the following manner:

1. Make sure the main machine power switch and power supply box switch S-301 are in "on" position.

2. Check fuses XF-301 and XF-302. If either or both are blown, turn power off by means of main power switch; disconnect connector plugs P-602, P-201, P-910 and P-301 so that the transformer T-301, rectifier CR-301, fuses XF-301 and XF-302, power supply box switch S-301, and associated wiring are isolated from the remainder of the electrical quadder circuit.

3. Replace fuse or fuses if they are blown and turn power on. If fuses do not blow, the power unit can be eliminated as a probable source of difficulty and other components of the circuit should be examined for shorts or grounds.

   If fuses blow when power is turned on (with all other components disconnected) the power supply circuit should be carefully checked for grounds or shorts.

4. To check voltages of power supply circuit proceed as follows:

   (a) Input voltage applied to primary side of transformer T-301 can be measured by holding voltmeter test leads on terminals to which leads 303 and 304 are connected on terminal strip E-302.

   (b) Output voltages of transformer T-301 can be checked on terminal strip E-301. 24 volts A.C. output should appear across terminals 3 and 5. 6.3 volts A.C. output should appear across terminals 1 and 2.

(c) 18-22 volts D.C. output of rectifier CR-301 should appear across terminals 6 and 7 of terminal strip E-301.

(d) To check D.C. output from the power supply unit to the Quadder Circuit, the minus lead of the direct current voltmeter should be connected to pin M of the receptacle J-302 on the power supply box. The plus D.C. voltmeter test lead should be connected successively to pins U, P, N and Z. If observed voltages are below 18 volts D.C. and the incoming line voltage to the transformer is at rated value, it is possible that rectifier CR-301 or transformer needs replacing.

(e) To check D.C. output from the power supply unit to the Teletypesetter Safety Circuit, the minus lead of the D.C. voltmeter should be connected to either pin A or B of receptacle J-309 on the power supply box and the plus lead connected to either pin C, D or E of the same receptacle. Output voltage should not be less than 18 volts D.C. in each case.

(f) To check A.C. output from the power supply unit to the Left-Hand Vise Jaw Safety Circuit it is necessary to include in the power unit circuit, relays K-102 and K-103 which are located in the Memory Relay Unit F-8579. This is because the electric Left-Hand Vise Jaw Safety only operates during quadding operations. Relays K-102 and K-103 are essential for both Manual and Teletypesetter quadding operations and are not utilized when no quadding occurs. Therefore one leg of the 24 volt A.C. circuit in the power supply passes through both relays. When either or both relays are energized, current is allowed to pass through to the vise jaw safety circuit. In checking the 24 volt A.C. output from terminals A and D of the power supply box connector J-308 to the electric left-hand vise jaw safety, it is necessary that a

quadding function be selected and the first elevator cam switch S-701 be closed in order that relays K-102 or K-103 close and complete the circuit.

For checking resistance of various components of the Power Supply Unit in order to determine if they are defective or not, refer to the table of Components at the end of this chapter.

Memory Relay Unit F-8579 Maintenance

In checking the action of the memory relay unit (Fig.2), which consists of eight switching relays, difficulties which are caused by the relay circuit may be revealed by related symptoms of the quadder.

Quadder action should be tested both by Manual Pushbutton Control and by Teletypesetter Control.

Since the circuit for Manual Control makes use of fewer components of the relay circuit, the quadder action, when operated manually, should be checked first in order to eliminate these components as possible sources of trouble. The relays K-104, K-105, K-106 and K-107 are by-passed for Manual Operation as are also the first and second transfer switches S-801 and S-802, the first elevator cam switch S-702, and the bail switches.

Symptoms which may point to the relay unit as a source of trouble when machine is set for "Manual Quadding" are:

1. No quadding action.
2. Same quadding action repeated, although another pushbutton is depressed.

Manual Quadding Circuit

To check the circuit for difficulties if incorrect quadder action results when machine is set for Manual Quadding, proceed as follows:

1. In order to check relay action, the memory relay unit should be removed from the Power Supply Box and the cover to which relays are fastened should be inverted so that relays can be observed.

2. Set toggle switch S-202 on Operating Control Switch Box (Fig.12), from "Teletype" position to "Manual" position. Relay K-108 (Fig.2) should deenergize. If it does not deenergize, the switch S-202 should be inspected to see that it is functioning correctly. (Refer to section dealing with checking of switches for further instructions). Also check wiring from switch terminals, through harness and plugs, to the Power Supply Unit and thence to the relay K-108 for possible shorts or grounding. Relay may also be defective and sticking in closed position.

3. Depress the "Quad Left" push button on the Operating Control Switch Box F-8602. Then with a thin pencil or screw-driver carefully push in the plunger of the first elevator cam switch S-701 (Fig.11). Relay K-103 should close and rotary solenoids L-401 and L-403 in the Control Unit Assembly E-5366 (Fig.7) should be actuated. Next, depress the plunger of first elevator cam switch S-703 (Fig.11). This deenergizes the circuit and completes the electrical sequence.

4. If at any point in the above sequence the reaction which should follow fails to occur, the previous section of the circuit should be carefully checked for breaks, grounds, mechanical misadjustments of the switches, relays and other electrical components, or electrical malfunction of these components. Refer to section dealing with how to check switches and table of electrical resistances for further details.

5. See sequence of Manual Operation for Quad Right and Centering in "Operation" section and go through them in same manner as described above for Left Quad.

Teletypesetter Quadding Circuit

When machine is being Teletypesetter operated and the following symptom groups occur, the appropriate procedure as outlined below for each symptom group should be followed in an effort to eliminate the difficulty. This difficulty may be located in the memory relay unit F-8579 (Fig.2) and will usually result in the symptoms listed below:

Symptom Group 1

(a) A "center" signal fails to move the jaws of the quadder.
(b) A "quad right" signal causes jaws to quad left.
(c) A "quad left" signal produces correct operation.

Symptom Group 2

(a) A "quad right" signal produces centering motion of jaws.
(b) A "quad left" signal fails to produce jaw motion.
(c) A "center" signal produces correct jaw motion.

The occurrence of either of the two symptom groups eliminates from consideration transfer switches either in the Teletypesetter operating unit, S-801 and S-802 (Fig.9), or the first elevator cam switches S-701, S-702 and S-703 (Fig.11). The fact that correct action results in one case in each of the two groups is proof that the switches are functioning correctly.

Trouble Shooting for Symptom Group 1

1. Prepare Teletypesetter tape having the following perforations in sequence:

(a) Tape advance signals (a convenient number).
(b) "Center" signal.
(c) "Elevate" signal.
(d) Tape advance signals (a convenient number).

2. Disconnect operating unit belt drive and push in starting and stopping handle of Linotype to "off" position.

3. Turn power supply off and open memory relay unit box. Invert cover to which relays are fastened so that their action may be observed.

4. Turn power "on" and note that relays K-101 and K-108 pull in. (Note: Relay closing action may be observed by holding a small screw-driver close to the relay clapper. Energizing the relay will result in a magnetic field which tugs on the screw-driver blade. Do not press against clapper as this may cause relay to lock in on its self-locking circuit.)

5. Remove cover plate from Control Unit Assembly, E-5366 (Fig.7).

6. Feed tape through operating unit by turning pulley manually. Observe closing action of No. 4 bail switch used for centering, followed immediately by the pulling in of relay K-107. Failure to obtain relay action requires continuity and voltage checks of all leads from power supply to center bail switch No. 4 and then to the relay itself.

7. Cause line to be elevated by rotating pulley until "elevate" signal takes effect. As first transfer switch (S-801) is closed, relay K-105 should pull in. Continue rotating; relay K-107 should drop out as second transfer switch (S-802) is opened. (See Figs. 2 and 9).

8. Complete the elevating cycle.

9. Manually depress the first elevator cam switches S-701, S-702 and S-703 (Fig.11) in sequence and observe the resulting actions as tabulated. Do not hold the switches closed but rather try to simulate the momentary closing action provided by the first elevator cam.

	Switch Actuated		Resulting Action
1.	S-701	1.a.	Relay K-102 closes.
		b.	Rotary solenoids L-401 and L-402 in Control Unit Assembly, E-5366 are energized and rotated.
2.	S-702	2.a.	Relay K-105 drops out (is de-energized).
3.	S-703	3.a.	K-102 drops out.
		b.	Solenoids L-401 and L-402 return to normal.

If the tabulated actions do not take place properly check the Control Unit, F-5366 (Fig.7) or replace the Memory Relay Unit F-8579 (Fig.2).

Trouble Shooting for Symptom Group 2

1. Prepare Teletypesetter tape as in tests for Symptom Group 1, but substitute "quad left" for "center" signal.

2, 3, 4 and 5. Proceed as in Group 1.

6. Insert tape into Teletypesetter Operating Unit, turning drive pulley manually. Note closing action of quad left bail switch No. 5 (Fig.10) resulting in energizing of relay K-106. Failure to obtain relay action requires voltage and continuity tests of circuit associated with quad left bail switch.

7. Elevate line as in "7" of Symptom Group 1. Action of first transfer switch S-801 (Fig.9) should cause relay K-104 to pull in. Continue rotation; relay K-106 should drop out due to opening of second transfer switch S-802.

8. Complete elevating cycle.

9. Depress first elevator cam switches S-701, S-702 and S-703 as for Symptom Group 1. Note following required actions:

	Switch Actuated		Resulting Action
1.	S-701	1.a.	Relay K-103 pulls in.
		b.	Rotary solenoids L-401 and L-403 in Control Unit Assembly, E-5366 are energized and rotated.
2.	S-702	2.a.	Relay K-104 drops out.
3.	S-703	3.a.	Relay K-103 drops out.
		b.	Solenoids L-401 and L-403 return to normal.

Failure to obtain the above actions requires a check of either the Control Unit E-5366 (Fig.7) or replacement of the Memory Relay Unit F-8579 (Fig.2).

Operating Control Switch Box F-8602 Maintenance

The Operating Control Switch Box F-8602 (Fig. 12) has the "Manual" and "Teletypesetter" control switch S-202 located in it. Other components are (1) the power supply indicator light XI-201 which goes on when the power supply switch in the power unit is in the "on" position and (2) the control indicator light XI-202 which is lighted for Teletypesetter operation and out for manual operation.

The push-button switches S-201 which condition the relay circuit for the various quadding functions are also in this unit. A snap cover on the left side of the box permits easy access to the wiring of the electrical components and their terminals, for the purpose of checking.

To remove the push-button switch assembly from the box for close inspection of the switch action, it is only necessary to loosen the two screws which hold the bracket on which these switches are mounted in the box. The bracket and switches may then be pulled out of the box since there is enough slack in the wiring harness to permit doing this without removing any wires from their terminals.

The lead 205 (Fig. 3) which comes from terminal pin E of receptacle J-203 carries current from a 6-volt A.C. source to the indicating lights XI-201 and XI-202. This 6-volt circuit to the indicating lights is completed by grounding through the machine frame. The ground connection is made by lead 210 which is fastened to the toggle switch S-202. Since the circuit is completed through ground it is necessary that all connections be clean and tight and that the Keyboard Control Unit F-8602 (Fig.3) be firmly fastened to its mounting bracket and this in turn to the Linotype machine frame.

The wires going to the push-button switches and terminals B and D of control switch S-202 carry 18 to 22 volts D.C.

First Elevator Cam Switch Maintenance

The two snap action switches S-701 and S-702 are mounted by brackets to the Cam Shaft Bracket and the third snap action switch S-703 is held by a bracket fastened to the Mold Gear Arm (see Fig.11). All three switches are positioned so that their plungers are contacted by a switch actuating screw or projection located on the hub periphery of the first elevator cam, as the cam revolves.

Elongated holes in the switch mounting brackets permit adjustment of position of the switches so that the roller which actuates the switch plunger will contact the switch actuating screw or projection properly.

Switch S-701 is normally open.

Switch S-702 is normally closed.

Switch S-703 is normally closed.

When cams are in normal position the first elevator cam switch S-701 must be open. It closes immediately when cams start to rotate.

If switch S-701 is closed at normal position however, a change in quad or center signals will not register until the cams rotate a second time. Also, if there is a misadjustment so that the closing of switch S-701 is late, pressure exerted by the control rod rotating lever roll 2, Fig.6 contacting the cam on the first elevator slide will cause the control rod selecting solenoid stop levers 19, (Fig.7) to bind and prevent them from operating.

If switch S-702 does not open at the time the actuating screw depresses the plunger, quad signals sent through the Teletypesetter Unit will continue to repeat.

Bail Switch and Assembling Elevator Cam Switch Maintenance

These switches (Figs. 9 and 10), which are located in the Teletypesetter Unit, are of the leaf type.

The Assembling Elevator Raising Cam Shaft Switch Assembly (Fig.9) consists of (1) Brake Trip Solenoid Switch S-803 (Normally Open), (2) First Transfer Switch S-801 (Normally Open) and (3) Second Transfer Switch S-802 (Normally Closed). The 3 switches are actuated by fibre pins which ride on small cams assembled on the Assembling Elevator Raising Cam Shaft.

The Bail Switch Assembly, (Fig.10) consists of the 5 leaf-type switches which are actuated from the keyboard bails. Four of the 5 switches are used. Switch 3 to which the gray lead is connected is a spare and has no connection out of terminal 3 of the 8 prong Jones plug on the Teletypesetter Unit.

To check Assembling Elevator Raising Cam Shaft Switches (Fig.9):

1. Make certain that the cams on the operating unit Assembling Elevator Cam Shaft are positioned on the shaft properly. Viewing the Teletypesetter Unit from the front of the Linotype machine, the approximate relation of the cams on the shaft should be as follows:

   (a) The dropping-off point of the center cam should be aligned with the left-hand edge of the fibre pin bracket and the center of the cam shaft. Check this cam to see that it will actuate the switch any time after the brake trip solenoid switch is actuated, but before the assembling elevator starts to rise.

   (b) The edge of the dropping-off point on the front cam should be approximately 1/8" to the left of the dropping-off point of the center cam. Check this brake trip solenoid switch cam to assure switch closing before the assembling elevator starts to rise.

   (c) The right-hand edge of the projection on the rear cam should be approximately 15/32" to the left of the dropping-off point of the center cam. This cam should actuate the 2nd transfer switch immediately after the first transfer switch cam has opened its switch.

2. Be sure that fibre pins are not binding and are not broken or worn to the extent that switch is not being actuated.

3. See that conductors are firmly wired to switch terminals and the contacts are free of oil or corrosion and are making good contact. Check switch make and break for proper operation.

To check Bail Switches (Fig.10):

1. Be sure tape code for desired quadding or centering function is correct:

   L.Q. -- 0134
   Center -- 02345
   R.Q. -- 01234

2. Check Bails to see that they are not binding, and are operating respective bail switches according to the code signal.

   Left Quad Code operates bail #5 closing bail switch #5 which in turn energizes memory relay K-106. Center Code operates bail #4 closing bail switch #4 which in turn energizes memory relay K-107. Right Quad Code operates bails #1 and #2 which in turn energize memory relays K-106 and K-107.

3. See that switch contacts are free of oil or corrosion and are closing firmly. Make and break should be checked for proper operation.

4. Make certain switch terminal connections are secure.

In general the quickest way to check on whether these two switch assemblies may be causing difficulty is to eliminate them from the circuit entirely by switching to "Manual Control". When quadder is being operated by push-button control these switches are not used. Therefore, if quadder operates satisfactorily when manually controlled, there is a good chance that the difficulty lies in these switch assemblies or their associated wiring.

Control Unit Maintenance

The Control Unit (Figs. 6 and 7) houses the three solenoids L-401, L-402 and L-403, to each of which are fastened the slide link stop levers (19). These levers are normally held in slots in the side face of the link (20) by spring (21) so that any one lever can stop the movement of the link at a different vertical position. At one end of the link is fastened the cable (8) which passes out of the top of the box over pulleys and winds around the double grooved pulley on the quadder control rod and thence to a spring fastened to the quadder housing. At the other end of the link the cable (9) goes out of the bottom of the box and is fastened to a small adjustment lever which is pivoted in the end of lever mechanism (4). This lever mechanism is rotated by cam (3) action each time the first elevator lowers to casting position. The slide link (20) in the control box is then pulled down to the position allowed by the stop levers (19) and the control rod rotates to permit the quadding or centering function desired.

Adjusting Movement of Slide Link

After the quadding cycle has been completed and the solenoid stop levers return to normal position, a spring pulls on the cable (8), returning the control rod to its normal non-quad position. The amount the slide link (20) will allow the cable (8) to move is determined by the stop screw (10). Stop screw (10) is set so as to locate the upper edge of the top slot in slide link (20) about 1/32" above the top stop lever (19). It is important that this clearance exist so that the top stop lever can pivot in or out of the slot without binding. After stop screw (10) has been properly adjusted, lock nut (11) should be tightened.

At this point cable (8) should be adjusted by means of its turnbuckle so that the slot in the control rod head, used for centering position, lines up with the locating key. To make this adjustment set Quadder for manual operation "center" function and allow first elevator to rest on vise cap. At this position centering slot control head should align with key.

Next, using adjusting screw (14), adjust cable (9), until it is tight. Then tighten lock nut (15).

When the machine is set to quad right all three stop levers (19), are withdrawn from the slide link (20), and the link will be drawn down until it strikes stop screw (16). Since the slide link should now be set to its proper relation with the top stop lever by the upper stop screw (10), it is only necessary to adjust the lower stop screw (16) so that R.H. Quad Slot in control rod head will align with the locating key.

Adjusting Lever Mechanism

An overtravel lever mechanism is used to allow for the strain put on the slide link and cable when no quadding occurs or when the stop levers prevent the slide link from moving all the way down during regular, left quad or centering.

The lever mechanism consists of (see Figs. 6 and 7): (a) lever and roller (2) pinned to shaft (42) which is held by the bracket (6); (b) coupler (41), which is held in position by a pin through shaft 42, has notches cut in it so that the tension on torsion spring (40) can be adjusted; (c) the spring (40) which has one end anchored in the coupler (41) and the other end looped around lever (4); (d) pin in shaft (42) operates in a slot in the side face of lever (4) allowing a limited amount of relative movement between levers 2 and 4. This spring-loaded lever mechanism provides the means for transmitting movement from lever (2) to lever (4) and at the same time allows for overtravel.

To adjust the lever mechanism proceed as follows:

1. Withdraw all three stop levers (19) manually.
2. Lower first elevator to casting position. This causes cam (3) to move the lever mechanism through its full stroke so that link (20) is resting on stop screw (16).

3. Return elevator to normal position so that lever (4) is horizontal.

4. Adjust stop screw (12) so that there is 1/32" space between it and the boss it contacts on lever (4). After adjusting, tighten lock nut (13).

5. Check cabling (8, 9) to be sure it is not slack when lever mechanism is in normal position. If necessary adjust turnbuckle to take up any excessive slackness.

Adjusting Lockout Lever Linkage

When quadding or centering, lockout lever (27) (Fig.8) is held in position by a spring to prevent justification. The lockout lever is normally held out of locking position when non-quadding occurs by means of linkage (7, 25, 26) to the lever mechanism (4) which does not move appreciably during non-quadding due to the stop levers (19) (Fig.7) preventing movement of the link (20).

Spring (32) (Fig.8) connected to lever (25) and the bracket (6) provides the necessary force to pull the linkage and lockout lever (27) into locking position whenever lever (4) swings down during a quadding or centering operation.

To adjust the linkage movement for correct positioning of lockout lever, proceed as follows:

1. Operate machine "regular". Adjust rod (7) (Fig.8) so that the lockout lever (27) just clears the vise justification rod collar. Justification should occur as usual. Rod (7) may be lengthened or shortened by unloosening lock nut (29) and turning the rod for the proper adjustment.

2. Set machine for quad "Left" and check to see that lockout lever (27) engages the vise justification rod collar, so that no justification occurs.

3. With machine set for quad "Left" stop machine when the first elevator is down on vise cap and adjust stop nut (30) so that it banks on the bracket (6). Tighten lock nut (31) down on stop nut (30).

Teletypesetter Keyboard Safeties Circuit Maintenance

The Teletypesetter Keyboard Safeties Circuit (Fig.13) is a separate electrical system which may be used on Teletypesetter operated Linotype Comets whether they are equipped with the Electrical Quadder or

not. The power to operate this safety circuit is taken from the Electrical Quadder Power Supply Box. The connection is made by plug P-910 at the five prong connector J-309 located at the rear of the Power Supply Box. This circuit operates on 18 volts D.C.

In general, symptoms which point to the improper functioning of some component of this safety circuit will make themselves immediately evident by that particular safety failing to perform the function it was designed to perform. Thus, a distributor stop might result in the Teletypesetter continuing to feed tape, or pushing in the assembler driving belt shifter knob will not stop the Teletypesetter Unit, as it is supposed to do.

When safeties fail to function properly, make a quick check of the following points:

1. Check mechanical adjustments of the cams and levers which actuate the snap-action switches.

2. Check connections of wire leads at terminal points throughout the circuit for secureness of fastening, shorts, or grounds. Make continuity test of conductors.

3. Check electrical closing and opening of switches, as described at beginning of chapter, to be sure they are making and breaking properly.

4. Check voltage at various points in circuit to be sure power is going to electrical components. Voltage should not be less than 18 volts D.C.

5. Since the distributor stop safety switch S-903, the assembler belt safety switch S-901, and the elevator handle yield safety switch (located in Teletypesetter Operating Unit) are all connected in parallel with each other and with the Operating Unit stop magnets and the indicating light, the failure of one to function will not necessarily prevent the other two safeties from functioning. However, if all three switches are actuated without results, the power supply, or Teletypesetter stop magnets may be the cause of the difficulty, and should be checked.

Distributor Stop Safety

The distributor stop safety switch S-903 (Fig.13) is actuated by the "throw out" movement of the distributor clutch flange (54) contacting the switch roller, which causes the switch plunger to be depressed.

Switch S-903 is a normally open switch, and is closed when a distributor stop causes the "throw out" movement of the clutch flange. It is mounted adjacent to the distributor clutch by means of bracket (55).

The adjustment of switch S-903 is accomplished as follows:

1. Turn in switch adjusting screw, until switch just closes. Then back off screw until switch is just barely opened. This limits switch plunger movement so that only the slightest movement is necessary to cause switch action.

2. Adjust switch by loosening switch mounting screws and moving the switch in until the roller just clears the clutch flange. Clutch flange must be rotating with clutch engaged, when this adjustment is made.

If Distributor Stop Safety is not functioning correctly, the following points should be checked:

1. See that switch S-903 is being properly actuated by the clutch flange.

2. Check switch S-903 make and break, to be sure it is operating properly.

3. Check terminal connections for tightness, and wiring for possible shorts or grounds. Run continuity test for breaks in wiring.

4. Check action of stop magnets located in Teletypesetter Unit to be sure they are disengaging the clutch properly.

Assembler Belt Safety

The Assembler Belt Safety Switch S-901 (Fig.13) located on the back of the "Swinging Front" is a normally-closed switch which is held open by a pawl (53) fastened to the belt shifter (52). When the belt shifter knob is pushed in to stop the assembler belt, the pawl moves to allow the switch to return to its normally-closed position and the circuit is completed, thereby energizing the stop magnets and indicating lamp I-901.

The adjustment of the switch S-901 is as follows:

1. Switch mounting plate has elongated holes so that the switch and plate assembled can be moved in relation to the actuating pawl. Loosen the 2 screws and nuts which hold switch and mounting plate to back of swinging front.

2. With assembler shifter knob pushed in, adjust switch so that the switch closes.

3. Tighten switch mounting plate nuts and screws and check adjustment by pulling out Assembler Shifter Knob. Switch plunger should be depressed by actuating pawl so that switch is opened and indicating light goes out.

Long Line Safety

The Long Line Safety Switch S-902 (Fig.13) which is mounted on the back of the "Swinging Front" is a normally-closed switch. It is held open by a lever (45) extending from the assembler slide stop, through the front plate, to the switch. When a line of matrices, longer than the present jaw measure is assembled, the lever (45) releases the plunger of switch S-902. This energizes solenoid L-902 which prevents assembling elevator from rising.

The Long Line Safety Switch(Fig.13) is adjusted as follows:

1. Loosen lock nut and adjust screw (46) located at top of lever (45) until switch S-902 is just actuated. This switch is normally closed and is held open by the adjusting screw (46) until an overset line causes movement of the lever (45) to release the switch plunger.

2. For Teletypesetter Operation the assembler slide clamp adjusting screw (48), which contacts the switch actuating lever, should be set so that switch S-902 is energized when the assembler slide is approximately .015" to .020" beyond the vise jaw setting.

If the Long Line Safety is not functioning properly, the following points should be checked:

1. See that switch S-902 is being properly actuated mechanically.

2. Check make and break of switch to be sure it is operating properly.

3. Check terminal connections for tightness and be sure there are no grounds or shorts. Run continuity test on connecting wires involved in circuit.

4. See that assembling elevator catch solenoid L-902 is not defective. Check resistance as indicated on table at end of chapter.

5. Check locking action of latch (50) to be sure it is catching yield handle mechanism.

The Assembler Slide Brake Release

The Assembler Brake Release Solenoid L-901 (Fig.13) which is located on the front of the swinging front is energized momentarily, immediately before the assembler elevator starts to rise. The movement of the solenoid core results in the assembler slide brake (49) being tripped and the assembler slide (57) pulls the line of matrices together so that the last matrix being assembled will be in front of the Assembling Elevator Pawls.

The Brake Release Solenoid L-901, is energized by the Brake Release Solenoid Switch S-803. This switch is actuated by a cam located on the Assembling Elevator Raising Cam Shaft (Fig.9) in the Teletypesetter Unit. It is part of the 3 switch assembly of which the other 2 switches are the 1st and 2nd transfer switches.

The Brake Release Solenoid Switch S-803 is held open by a fibre pin and closes after approximately 10° rotation of the Assembling Elevator Raising Cam Shaft.

If difficulty is encountered in the operation of the Assembler Slide Brake Release the following points should be checked:

1. Fibre pin which rides on cam (Fig.9) to actuate switch S-803 may be worn or broken so that switch is not operating properly.

2. Keep switch contact points clean of oil or corrosion.

3. See that wire connections at terminal points are tight and that there is no grounding or shorting. Check continuity.

4. Check switch closing and opening to see that make and break is properly made.

5. Be sure cam is positioned properly to give switch action at correct place in machine cycle.

6. Check electrical resistance (as shown in tables at end of this chapter) of solenoid L-901, to determine if it is defective or not.

The Indicating Light XI-901

The indicating light XI-901 (Fig.13) operates on 18 volts direct current. It should light each time the Assembler Belt, Long Line or Distributor Clutch Safety switches are actuated to stop the Teletypesetter Unit.

If light does not go on when it should, check resistance of the lamp I-901. It should be between 14 and 36 ohms for a lamp which is not defective.

Also check all terminal connections for tightness and shorts or grounds. Run continuity test on wire leads for possible breaks. Measure voltage across lamp socket XI-901 terminals when one of the above safeties is actuated, to be sure power is getting to lamp. If no power appears across the lamp socket terminals check voltage across terminals A and C of connector J-309 in Power Supply Box F-8608 to be sure power is going to the safety circuit. A voltage reading of 18 volts D.C. minimum across the connector J-309 terminals would indicate that the difficulty was somewhere in the safety circuit and this should be carefully checked as outlined previously.

Left-Hand Vise Jaw Electric Safety

The basic action of the Left-Hand Vise Jaw Electric Safety (Fig.4) is the closing of the switch S-201 (which is built into the left-hand vise jaw) to complete an electrical circuit, energizing rotary solenoid L-201. The solenoid, L-201, pulls back the stop lever from under the catch block of the pot pump lever, allowing the cast to be made.

The Left-Hand Vise Jaw Electric Safety Circuit is a separate electrical circuit which is supplied 24 volts alternating current from Power Supply Unit F-8608 and then converts to 18 volts direct current by means of a small rectifier unit. Relays K-102 and K-103, in the Memory Relay Unit, control flow of current to the safety circuit by having one leg of the 24 volt A.C. power supply pass through them.

Improper operation of this safety may possibly be due to one of the following reasons (Fig.4):

1. Poor Switch (S-201) Action—This may be due to mechanical or electrical reasons. Check switch action after disconnecting the two prong plug P-202. Terminal 1 of plug P-202 (which has the wire 201 connected to it) should be connected to an ohmmeter. When the switch S-201 is closed by pressing on the plunger, the resistance should be less than one ohm. If switch is allowed to open by relieving pressure on the plunger, the resistance should be infinite.

   If switch is sticking, disassemble and inspect closely for cause of bind.

2. Defective Solenoid, L-201—To check this solenoid remove both leads from terminal strip E-202 and measure resistance from either lead to machine frame. Resistance should be infinite. Then measure resistance between leads. Resistance should be between 17 ohms and 21 ohms.

3. Defective Capacitor C-301 or Resistor R-301--
If the contact points of the left-hand vise jaw safety switch are being burned or pitted by excessive arcing, this may be due to a defective condenser or resistor since these parts comprise the arc suppression circuit which is designed to suppress excessive arcing between switch contact points.

4. No Voltage--If fuse F-302 (Fig.2) which protects the circuit, is not blown, depress Keyboard Control Unit push-button marked "center". Then proceed as follows:

(a) Start Linotype and allow machine cycle to continue until vise jaws are closed. Measure D.C. voltage at terminal strip, E-202 (Fig.4). It should be between 18 and 24 volts.

(b) If no voltage can be measured at terminal strip E-202, check voltage at terminal strip E-301 of the Rectifier Box Assembly F-8480. If 18 to 24 volt D.C. voltage is not present at terminals 3 and 4 of E-301, measure the A.C. voltage on the same terminal strip between terminals 1 and 2. This should be about 24 volts A.C.

(c) If there is no voltage present on terminal strip E-301, check across pins A and D of receptacle J-308 in power supply unit (Fig.2). Disconnect plug P-201 from receptacle J-308 in order to do this.

(d) Failure to observe voltage at receptacle J-308 requires a check further back, across terminals 5 and 9 of long terminal strip E-301 in Power Supply Unit. Voltage should be 24 volts A.C.

(e) Absence of voltage across terminals 5 and 9 requires a check further back in the circuit. This is the other side of the fuse F-302 and can be checked across terminals 5 and 3 of long terminal strip E-301. 24 A.C. voltage must appear across terminals 5 and 3, otherwise the balance of the quadder circuit necessary for bringing the vise jaws to the center position would not have worked.

(f) Since 24 volt alternating current would have to appear across terminals 5 and 3 under the conditions outlined above, it will then be necessary to check continuity of the circuit from these terminals to points successively further out in the circuit. In view of the fact that the fuse was not blown it will be found that an open lead must exist some place between terminals 5 and 3 and possibly terminal 9. A ground condition being present before the fuse is unlikely since the transformer lead insulation would most likely smoke and be immediately evident.

If voltage does not appear across terminals A and D of receptacle J-308 (Fig.2) but does appear between terminal D of J-308 and terminal 9 of terminal board E-301 there is a likelihood that relay K-102 (Fig.2) is defective.

Possibly contact has not been made between terminals G and H of the relay or there is an open circuit between pins 18 and 19 of J-101 receptacle. There is the further possibility that wire connections at either plug P-301 or receptacle J-101 are not secure. Continue to check continuity successively in the circuit until the open conductor or defective terminal connection is located.

If the Left-Hand Vise Jaw Safety Circuit failed to function when the quadder control was set to quad "Left", a similar series of checks would have to be made bearing in mind that relay K-103 in the Memory Relay Unit F-8579 (Fig.2) is the relay which supplies the alternating current for left-hand quadding.

For right-hand quadding both relays K-102 and K-103 are energized and therefore there is the possibility that even though one relay is not functioning correctly the other one will complete the circuit so that the safety operates.

Since this safety circuit is completed by grounding through the machine frame it is important that ground (GND-203) (Fig.4) connection of lead 301 from solenoid L-201 to the inside of column be securely fastened and kept clean of oil or corrosion. Also the wires which ground the various machine castings to one another to assure a complete circuit through the machine frame, should be securely fastened at terminal points.

Pot Pump Solenoid L-201 Hums or Energizes Prematurely

A humming or prematurely energized pot pump solenoid L-201 (Fig.4) may be caused by (1) a faulty or grounded vise jaw switch S-201, (2) a defective solenoid or, (3) a D.C. leakage caused by a ground condition in the Teletypesetter Keyboard Safety Circuit, or a ground on the "live" side of the Quadder Circuit, such as in a Control Unit Solenoid.

To determine which of the three items it might be, proceed as follows:

1. Check vise jaw switch S-201 as outlined previously.

2. Check resistance of solenoid (as given in table at end of this chapter) to see if it is defective.

3. Disconnect 5 prong plug P-910 which connects the Teletypesetter Keyboard Safety Circuit to the Power Supply Unit (see Fig.13). If leakage from this circuit by a short or ground is causing the solenoid to flutter and hum, or energize prematurely, disconnecting power to the circuit should stop the trouble. Locating a ground or short in the Quadder Circuit requires a check of all components and wiring.

It is possible that over a period of several years the rectifier CR-301 (Fig.4) located in the Rectifier Box F-8480 will age to the extent that it may not have the minimum 18 volt D.C. out-put to operate the electrical components of the circuit. In this case either the 26 volt tap of the transformer T-301 (Fig.2) in the Power Supply Unit is used, or the rectifier CR-301 can be replaced.

Care should be exercised to keep the small cover over terminal strip E-202 (Fig.4) as its location in the area of the metal pot might expose the terminals to type metal splashes which would cause short circuits or undesired grounding.

Adjustments

Vise Jaw Switch

Tip should protrude .027" from face of vise jaw. If it does not, the entire switch must be removed from vise jaw for readjusting. This is done by removing four screws and retaining plate from end of left-hand vise jaw, and removing snap ring from around base of switch. Special pliers are available for removal of this snap ring.

It will be noted that the movable tip in the plunger is held in place by a pin. There are four slots cut in the tip into which this pin fits. These slots represent a quarter turn and each quarter turn moves tip .008". To decrease tip extension from face of vise jaw, remove pin, turn tip clockwise 1/4 turn and replace pin. Turn counter-clockwise to increase extension.

MLCo. ELECTRIC QUADDER

ELECTRICAL COMPONENTS

POWER SUPPLY UNIT
ASSEMBLY NO. F-8685

SYMBOL	PART NO.	DESCRIPTION	RESISTANCE
CR-301	F-8599	Rectifier	Resistance (Ohms) Forward Min. 19, Max. 21; Backward Min. 9000, Max. 16000
E-301	F-8603	Terminal Strip	
E-302	F-8410	Terminal Strip	
J-302	F-8591	Receptacle	
J-308	F-8402	Receptacle	
J-309	F-8635	Receptacle	
P-301	F-8592	Plug	
S-301	F-8597	Switch	
T-301	F-8600	Transformer	Resistance (Ohms) Primary - Wired for 110V: 2.5; 220V: 10; Secondary 24V: 0.2; 6.3V: 0.2
XF-301	F-8630	Fuse Socket	
XF-302	F-8630	Fuse Socket	
F-301	F-8631	Fuse	0.1 ohms
F-302	F-8631	Fuse	0.1 ohms

MEMORY RELAY UNIT
ASSEMBLY NO. F-8579

J-101	F-8573	Receptacle	
K-101	F-8542	Relay	300 ohms
K-102	F-8575	Relay	300 ohms
K-103	F-8575	Relay	300 ohms
K-104	F-8576	Relay	300 ohms
K-105	F-8577	Relay	300 ohms
K-106	F-8577	Relay	300 ohms
K-107	F-8577	Relay	300 ohms
K-108	F-8541	Relay	300 ohms
R-101	F-8772	Resistor	2200 ohms
R-102	F-8772	Resistor	2200 ohms

MACHINE WIRING
ASSEMBLY NO. F-8587

P-602	F-8580	Plug
P-603	F-8581	Plug
P-604	F-8406	Plug
P-605	F-8583	Plug
P-606	F-8584	Plug

MLCo. ELECTRIC QUADDER

LEFT-HAND VISE JAW SAFETY CIRCUIT
PART OF ATTACHMENT LIST E-5466

SYMBOL	PART NO.	DESCRIPTION	RESISTANCE
S-201	E-5106	Switch	
J-202	F-8504	Plug	

POT PUMP SOLENOID ASSEMBLY
ASSEMBLY NO. F-8508

E-202	F-8474	Terminal Strip	
L-201	E-5374	Solenoid	between 17 ohms and 21 ohms

RECTIFIER BOX
ASSEMBLY NO. F-8480

E-301	F-8410	Terminal Strip	
CR-301	F-8476	Rectifier	Resistance (Ohms) Forward Min. 20 Max. 33 Backward Min. 8000 Max. 120,000
R-301	F-8478	Resistor	5 ohms
C-301	F-8477	Capacitor	Infinity

WIRING COMPONENTS

P-202	F-8503	Plug
J-202	F-8505	Receptacle

MLCo. ELECTRIC QUADDER

KEYBOARD CONTROL UNIT ASSEMBLY NO. F-8602

SYMBOL	PART NO.	DESCRIPTION	RESISTANCE
J-203	F-8588	Receptacle	
S-201	F-8595	Switch	
S-202	F-8597	Switch	
XI-201	F-8601	Pilot Light Socket & Jewel	
XI-202	F-8601	Pilot Light Socket & Jewel	
I-201	F-8590	Lamp	Between 3 ohms and 10 ohms
I-202	F-8590	Lamp	" " " " " "

CONTROL UNIT ASSEMBLY ASSEMBLY NO. E-5366

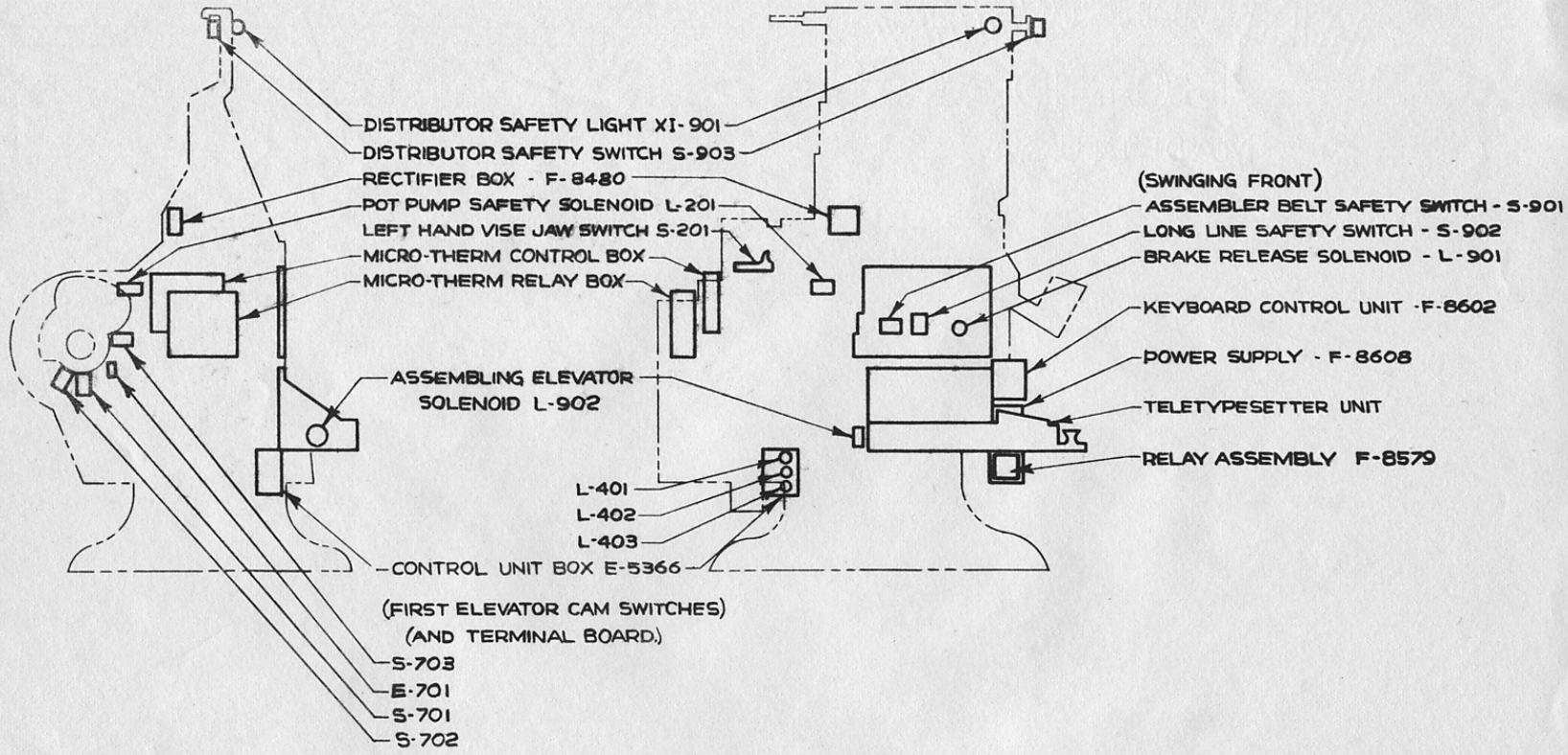
J-404	I-8263	Receptacle	
L-401	F-8649	Solenoid	Between 42 ohms and 51 ohms
L-402	F-8649	Solenoid	" " " " " "
L-403	F-8649	Solenoid	" " " " " "

FIRST ELEVATOR CAM SWITCH ASSEMBLY PART OF ATTACHMENT LIST E-5466

E-701	F-8410	Terminal Strip
S-701	F-8614	Switch
S-702	F-8614	Switch
S-703	F-8614	Switch

TELETYPE SAFETY UNIT PART OF ATTACHMENT LIST E-5466

E-901	D-6954	Terminal Strip	
E-903	F-8474	Terminal Strip	
E-904	F-8474	Terminal Strip	
XI-901	F-8709	Pilot Light Socket & Jewel	
I-901	F-8711	Lamp	Between 14 ohms and 36 ohms
J-907	F-8593	Receptacle	
L-901	D-6958	Solenoid	Between 17 ohms and 21 ohms
L-902	F-8649	Solenoid	Between 42 ohms and 51 ohms
P-907	F-8505	Plug	
P-909	F-8679	Plug	
P-910	F-8678	Plug	
S-901	D-6995	Switch	
S-902	D-6995	Switch	
S-903	F-8614	Switch	



Finding Diagram

Electrical Components for Teletypesetter Operated Quadder and Associated Safety Systems

FIG. 1

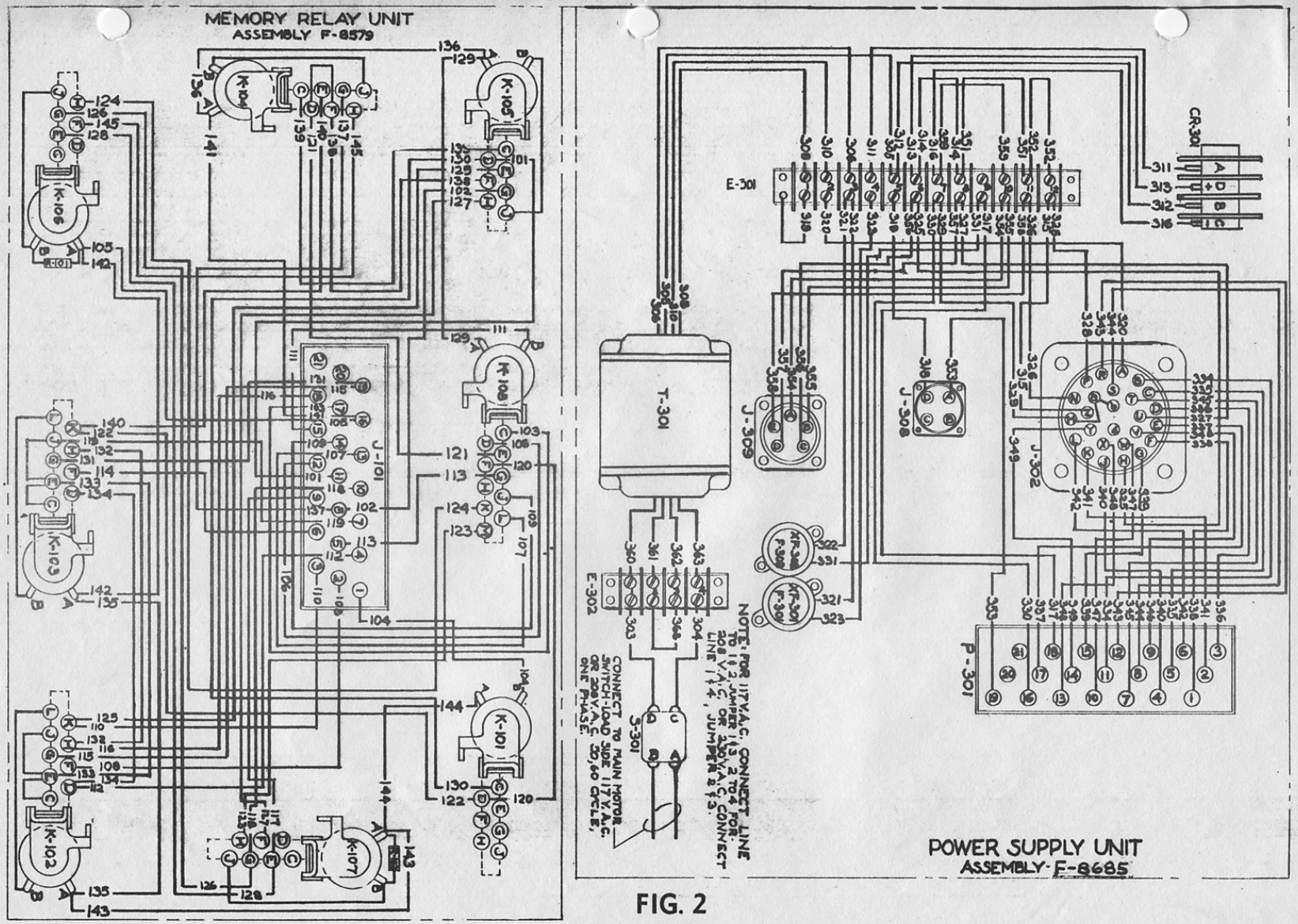


FIG. 2

Wiring Diagram of
Power Supply and Memory Relay Unit

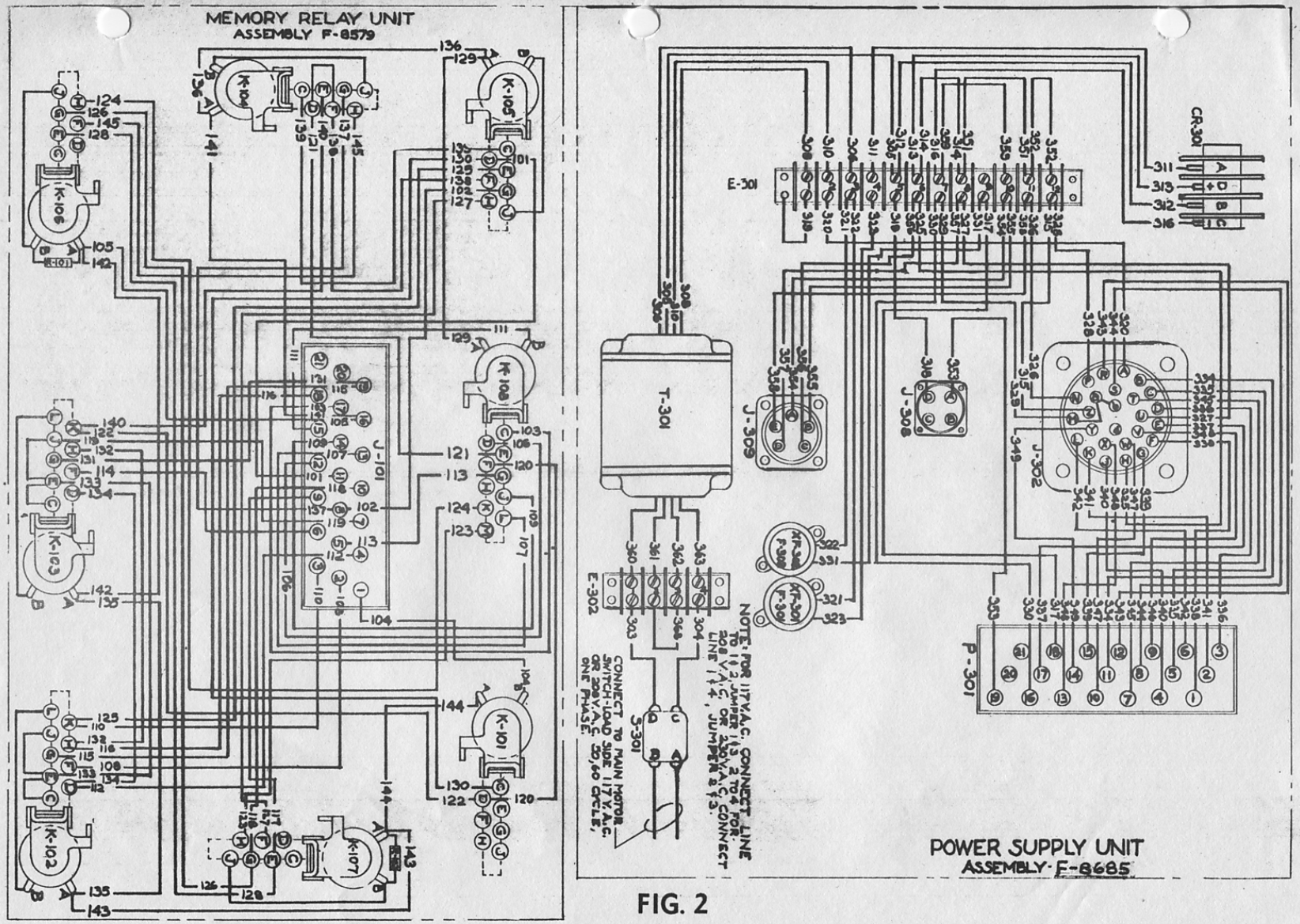
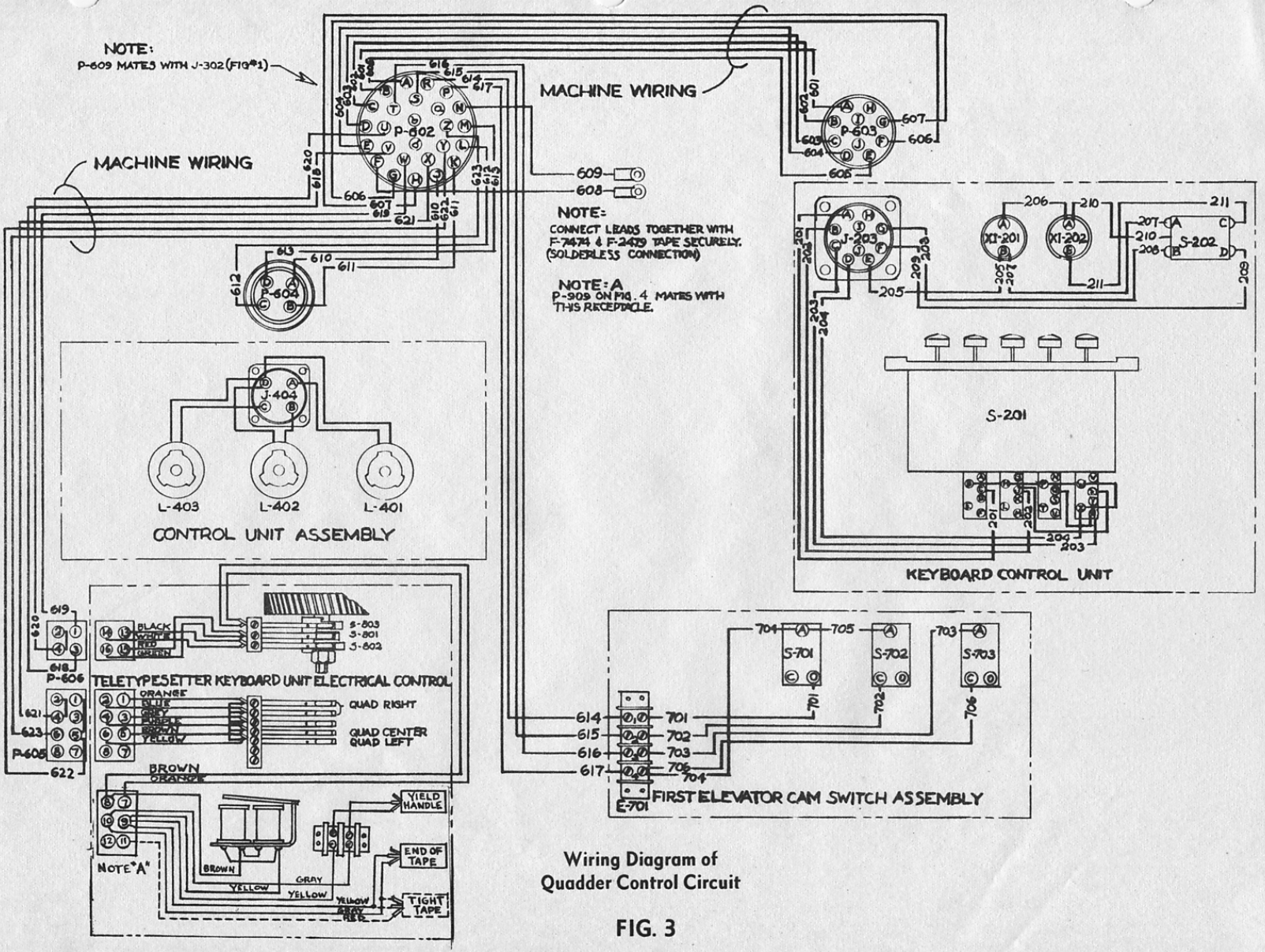


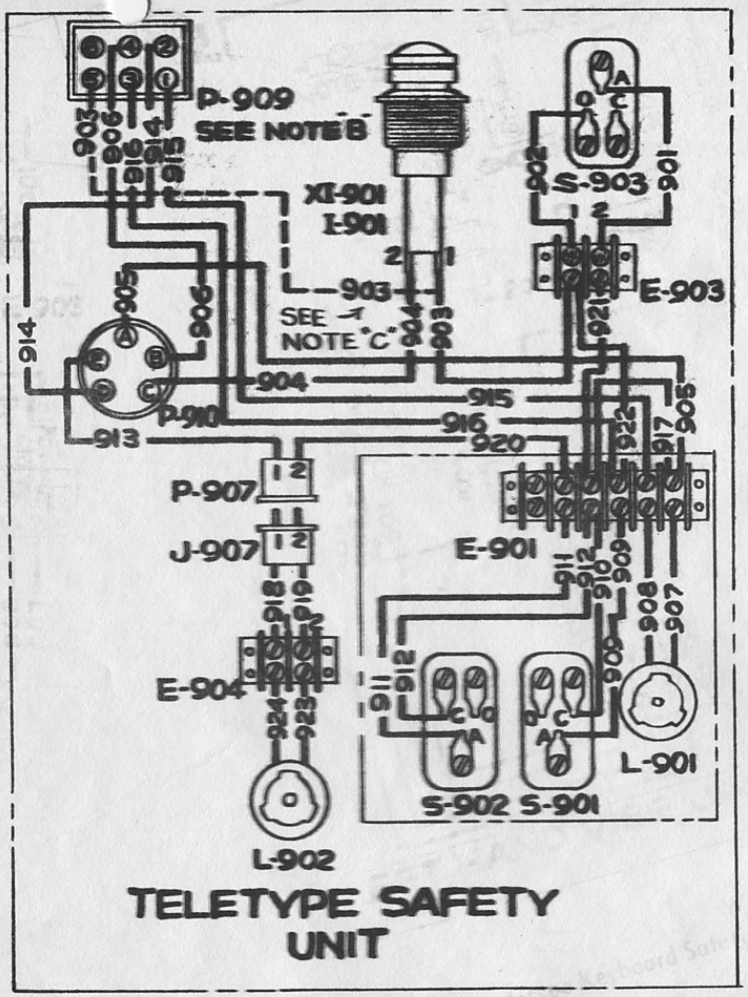
FIG. 2

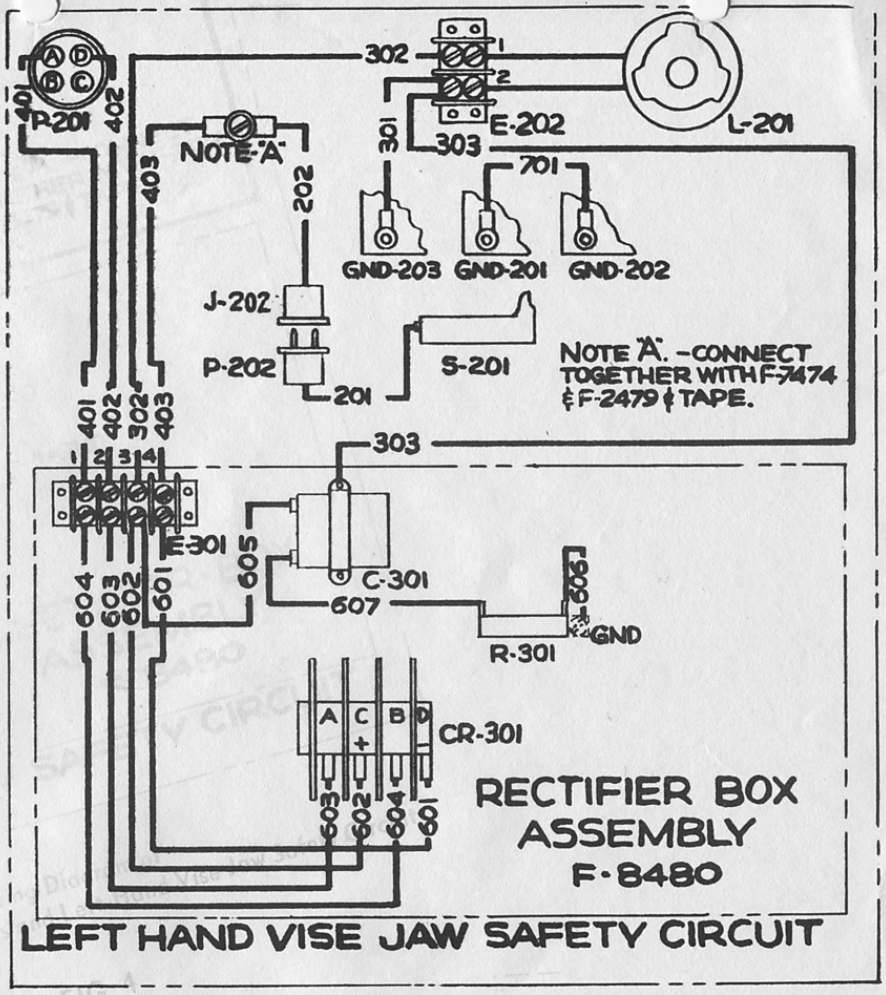
Wiring Diagram of
Power Supply and Memory Relay Unit



Wiring Diagram of
Quadder Control Circuit

FIG. 3





NOTE "B"-
CONNECT P-909 TO TELETYPESETTER KEYBOARD UNIT.—(FIG. 3)

NOTE "C"-
IF TELETYPESETTER UNIT HAS TIGHT-TAPE SAFETY, CONNECT WIRE 903 AS SHOWN IN DOTTED LINE. OTHERWISE CONNECT 903 AS SHOWN IN SOLID LINE.

Wiring Diagram of
Teletype Keyboard Safeties and Left-Hand Vise Jaw Safety Circuit

FIG. 4

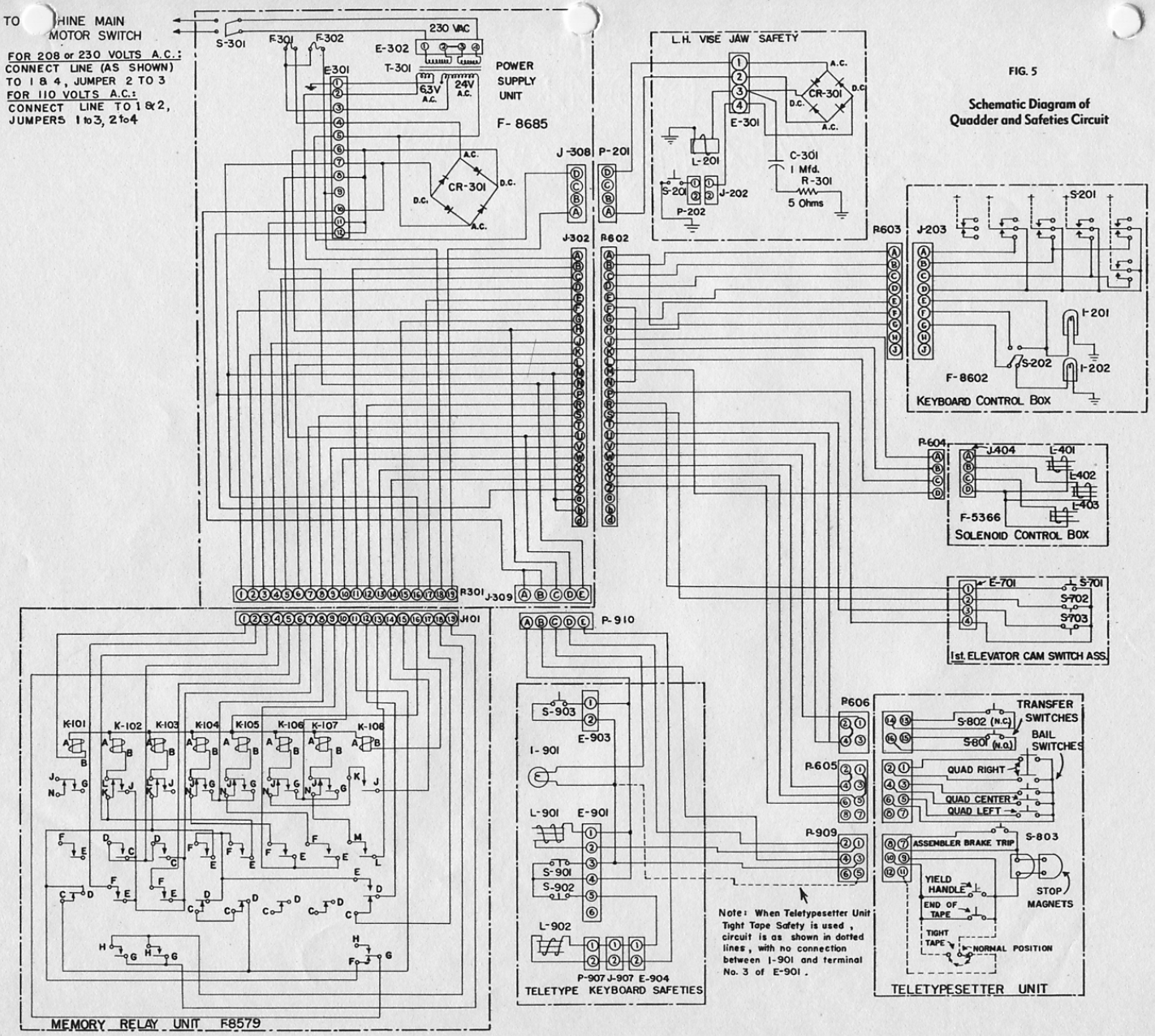
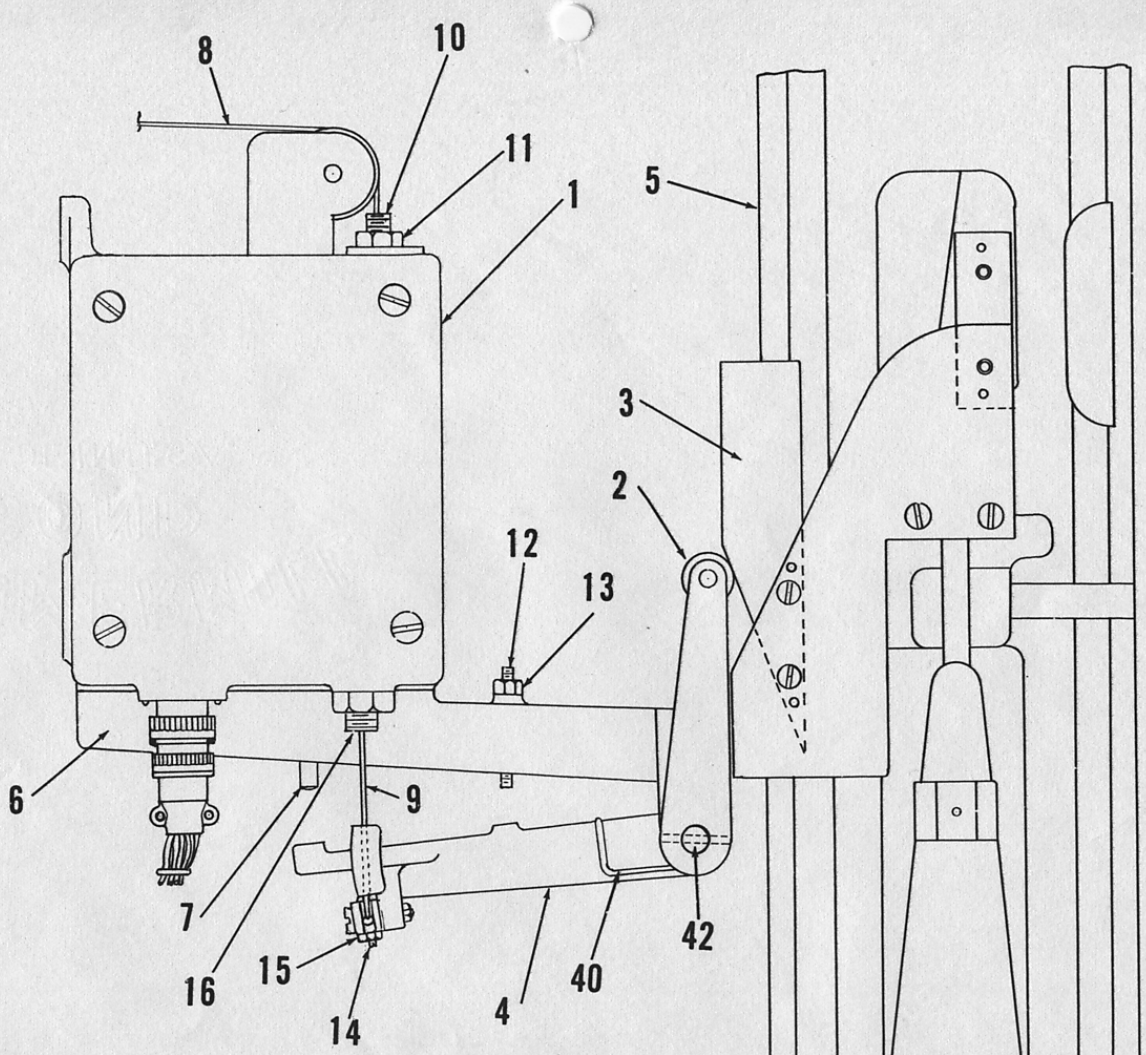


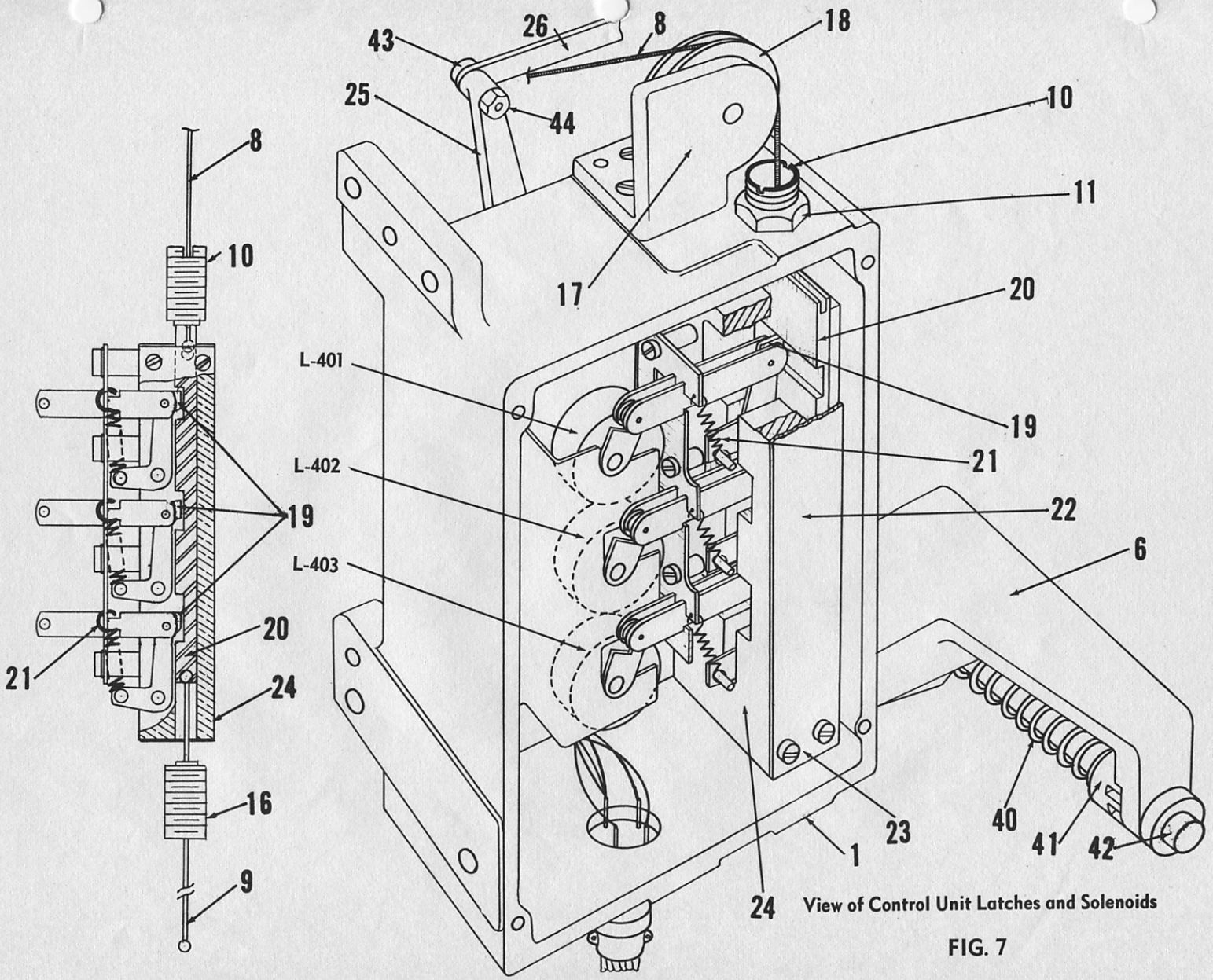
FIG. 5

Schematic Diagram of Quadder and Safeties Circuit



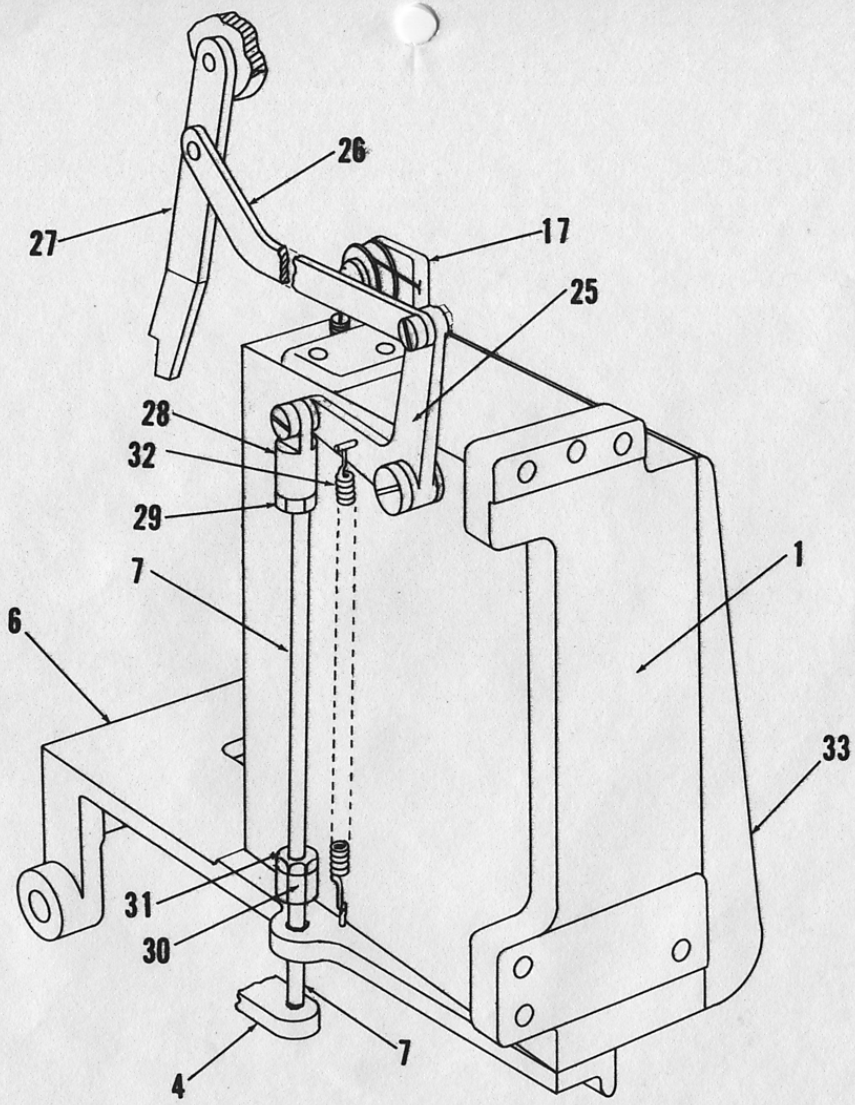
View of Control Unit Cable Mechanism

FIG. 6



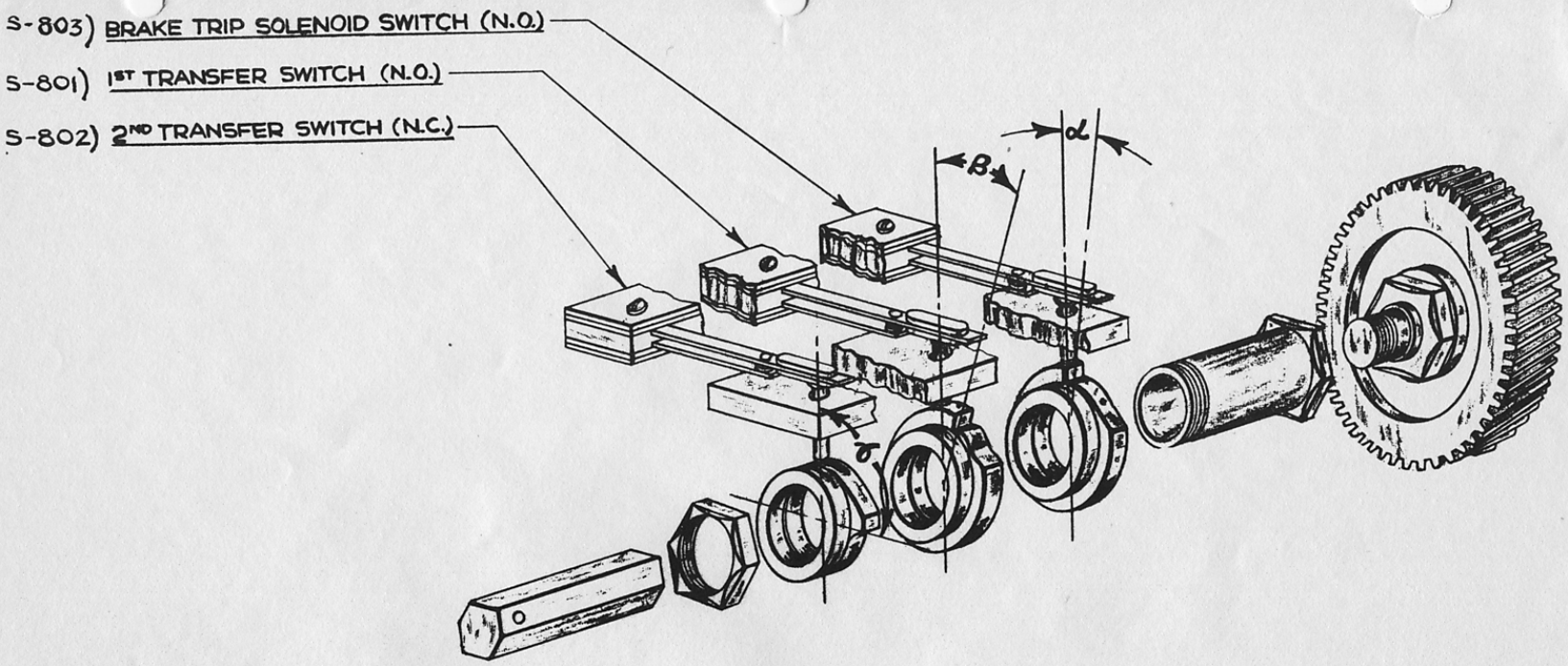
View of Control Unit Latches and Solenoids

FIG. 7



View of Lockout Lever Linkage

FIG. 8



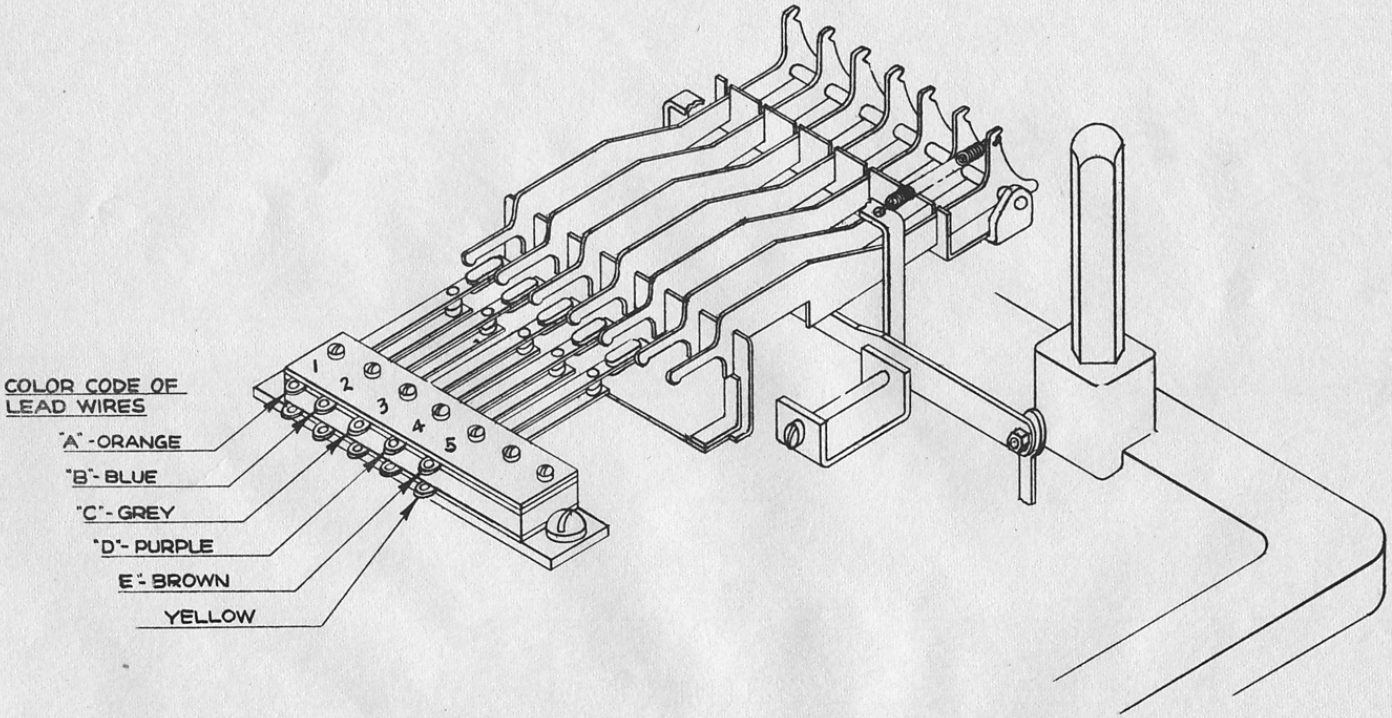
α = 10°
β = 50°
δ = 70°

ALL ANGLES MEASURED FROM NEUTRAL POSITION.

View of Assembling Elevator Raising Cam Shaft Switches Located in Teletypesetter Operating Unit

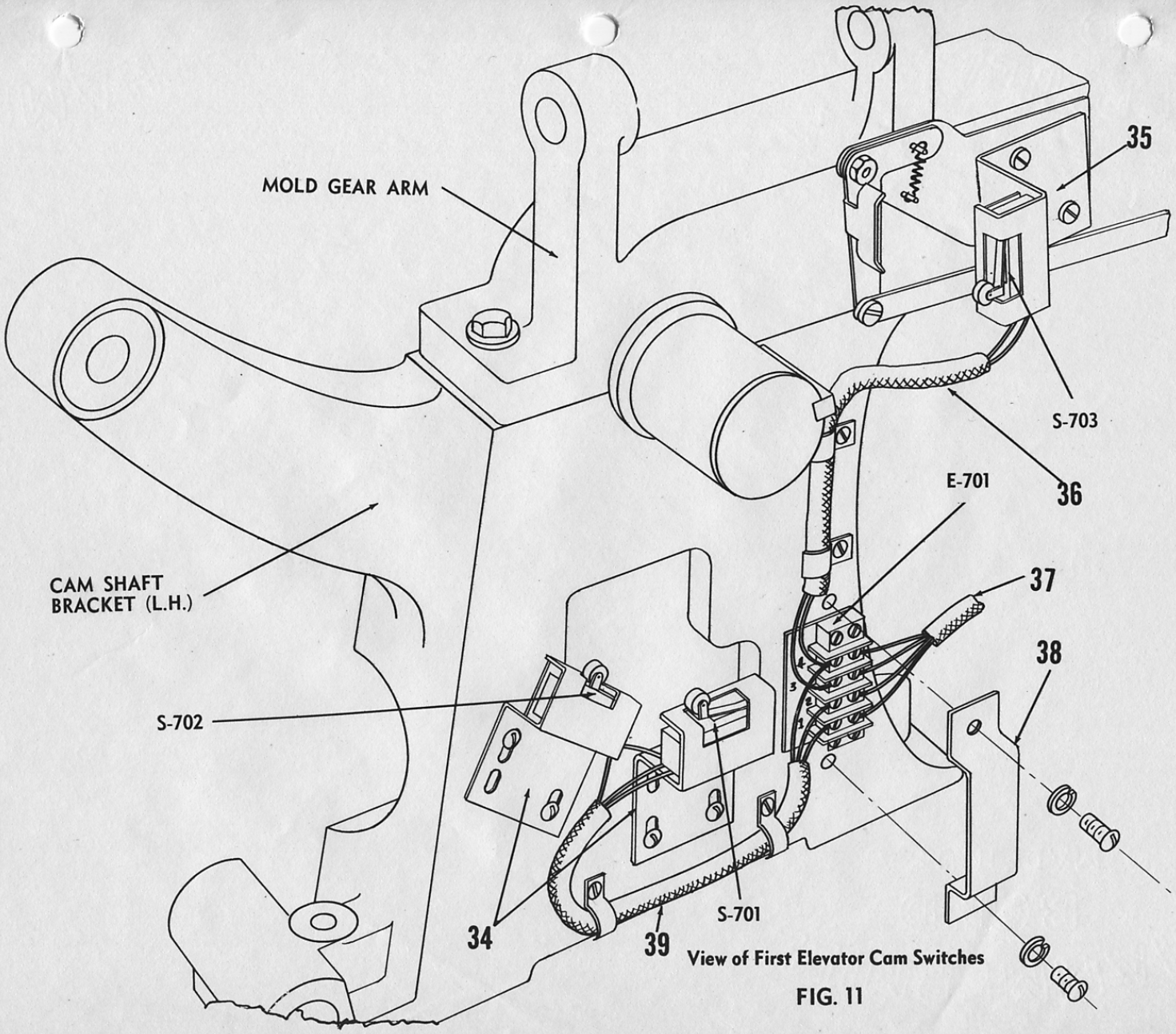
FIG. 9

NOTE:
"A" & "B" - QUAD RIGHT BAIL SWITCHES. (N.O.)
"D" - CENTER BAIL SWITCH. (N.O.)
"E" - QUAD LEFT BAIL SWITCH. (N.O.)
"C" - NOT USED



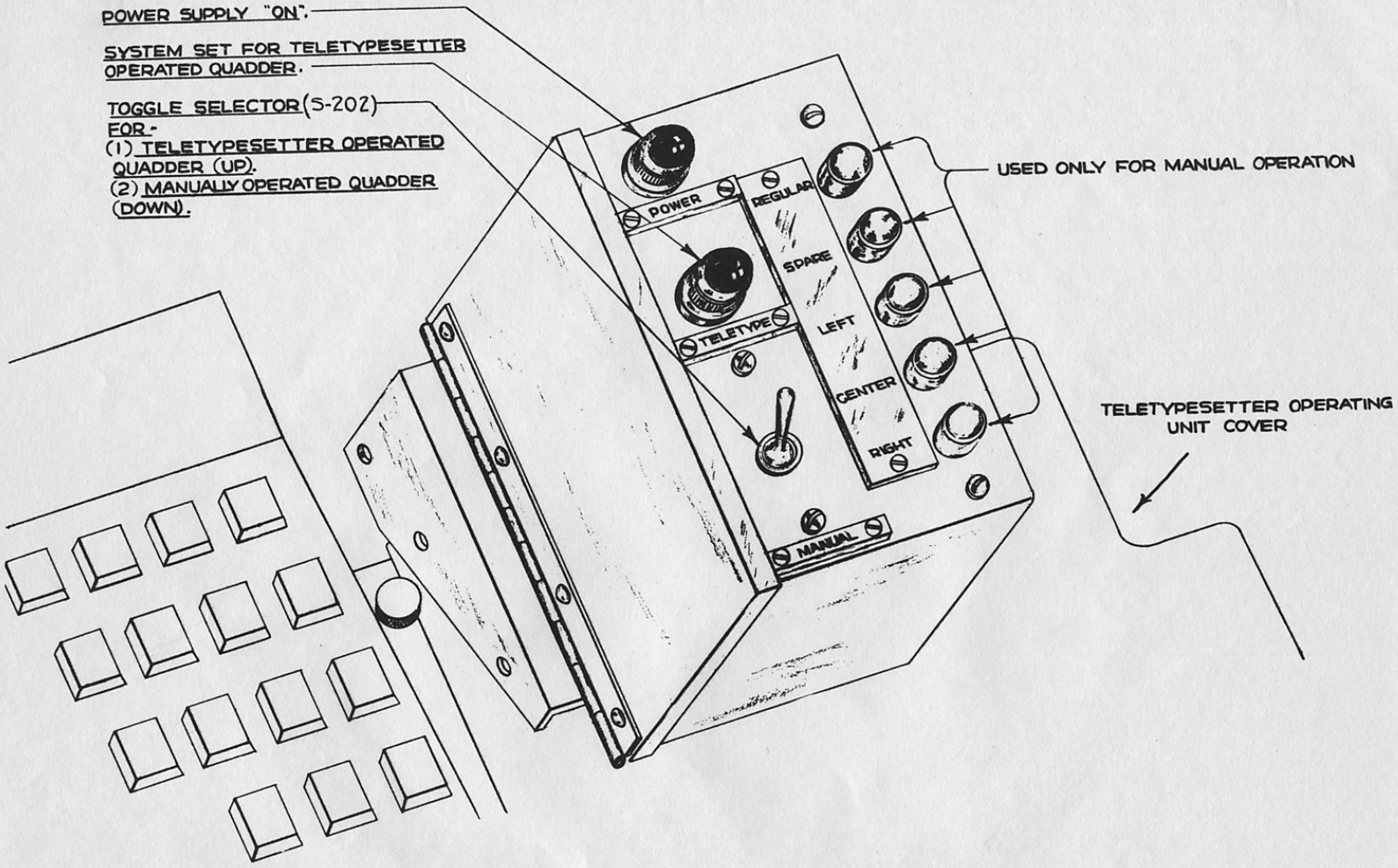
View of Bail Switches
Located in Teletypesetter Operating Unit

FIG. 10



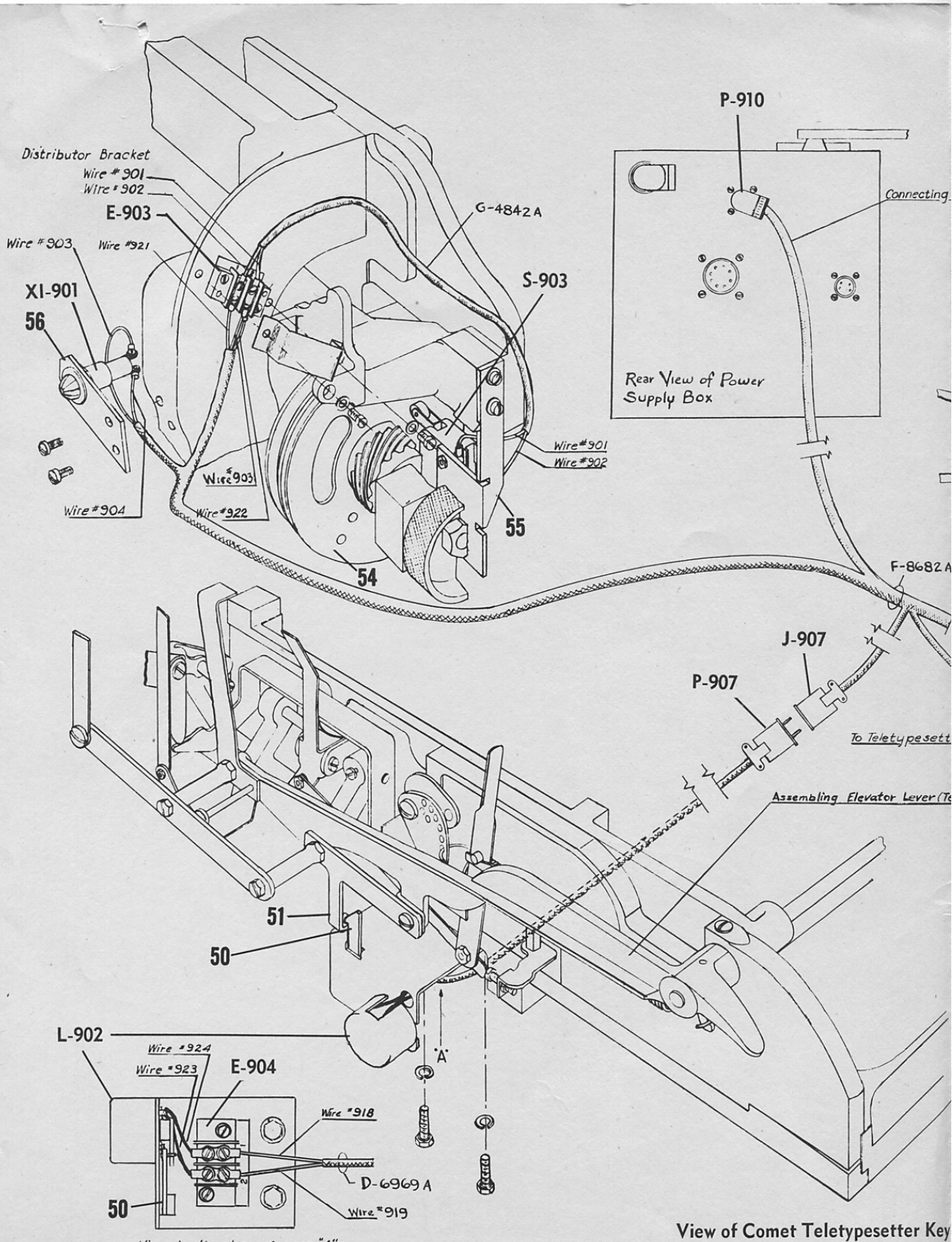
View of First Elevator Cam Switches

FIG. 11



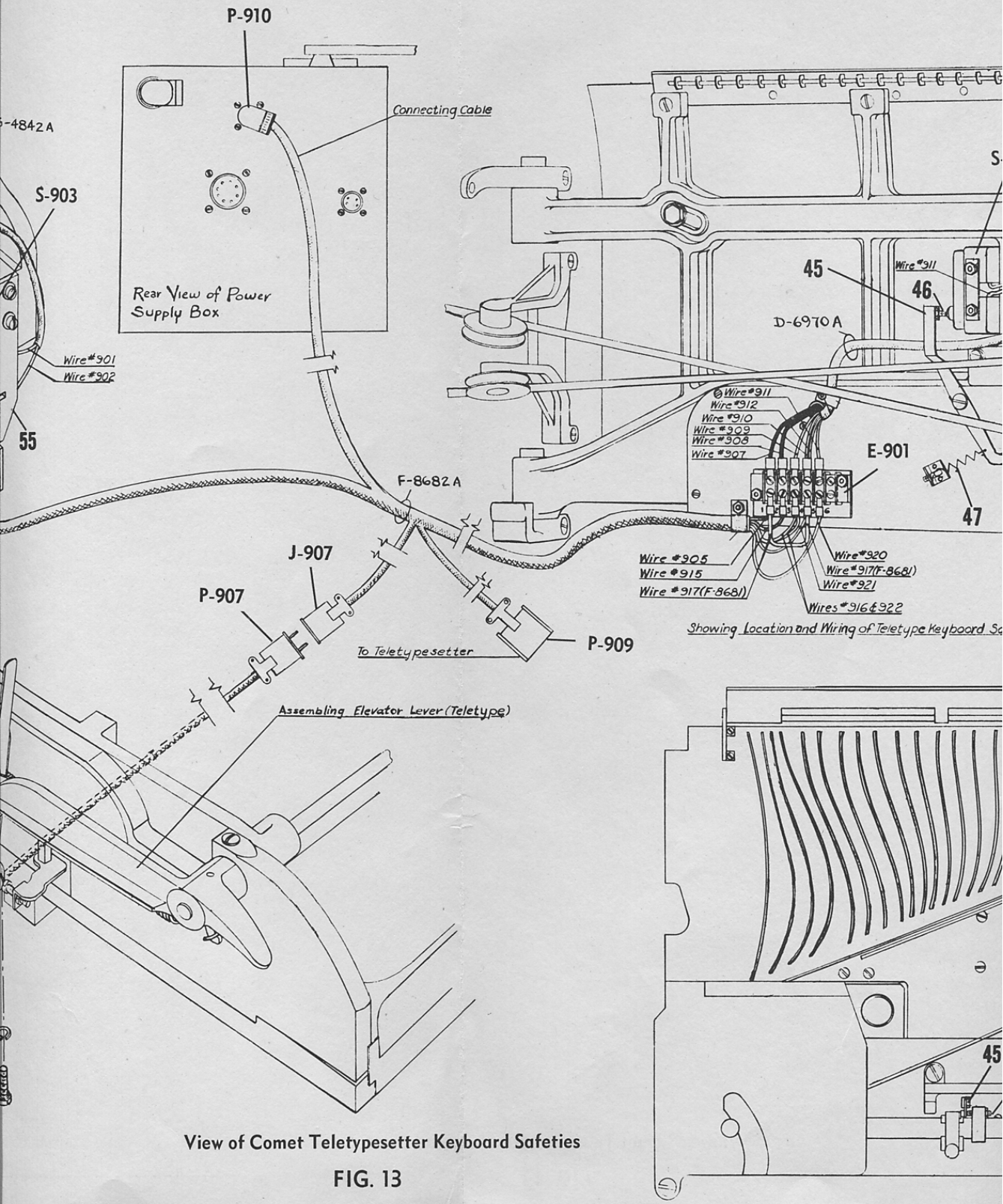
View of Operating Control Switch Box

FIG. 12



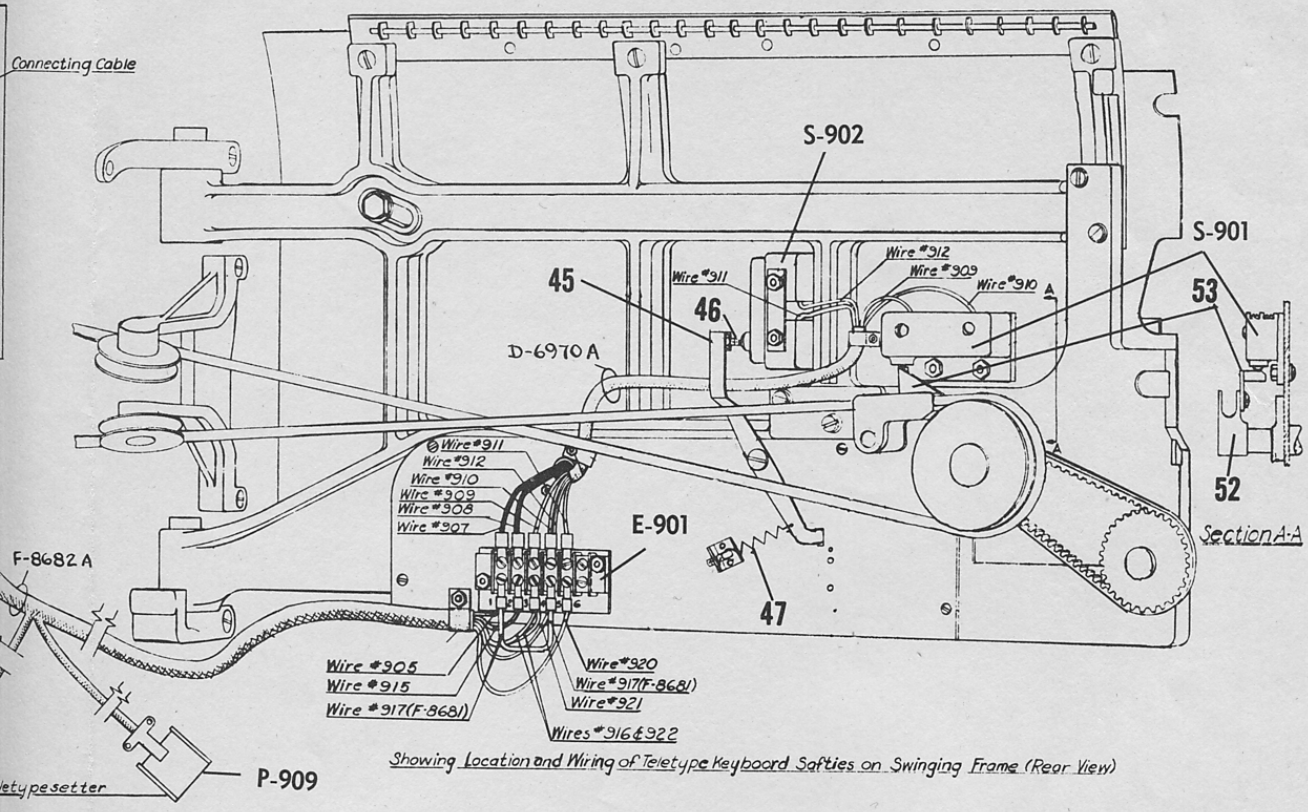
View of Comet Teletypesetter Key

FIG. 13



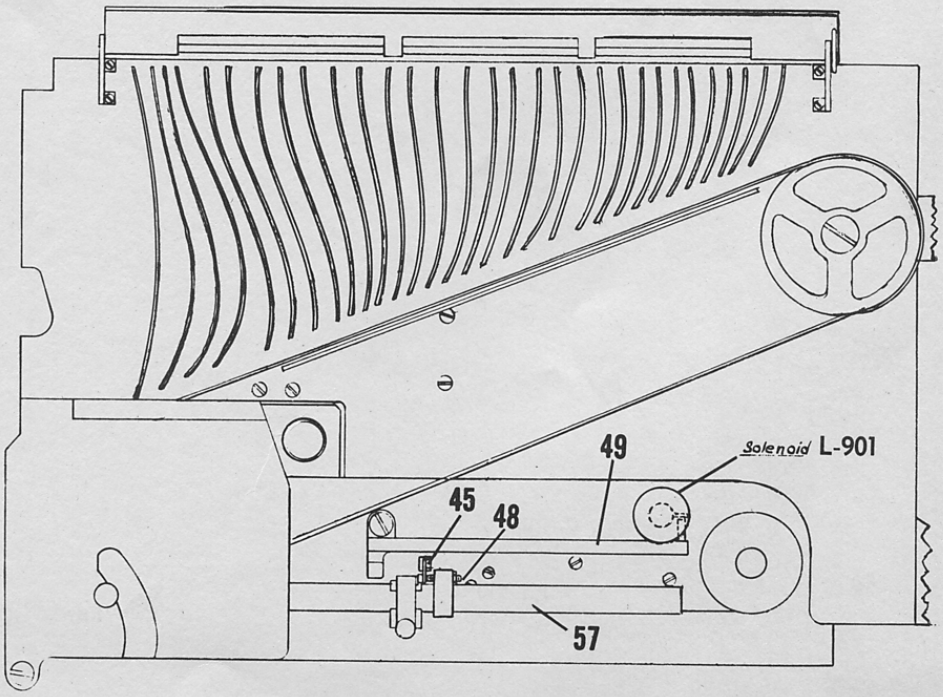
View of Comet Teletypesetter Keyboard Safeties

FIG. 13



Showing Location and Wiring of Teletype Keyboard Safties on Swinging Frame (Rear View)

or Lever (Teletype)



etter Keyboard Safeties

3

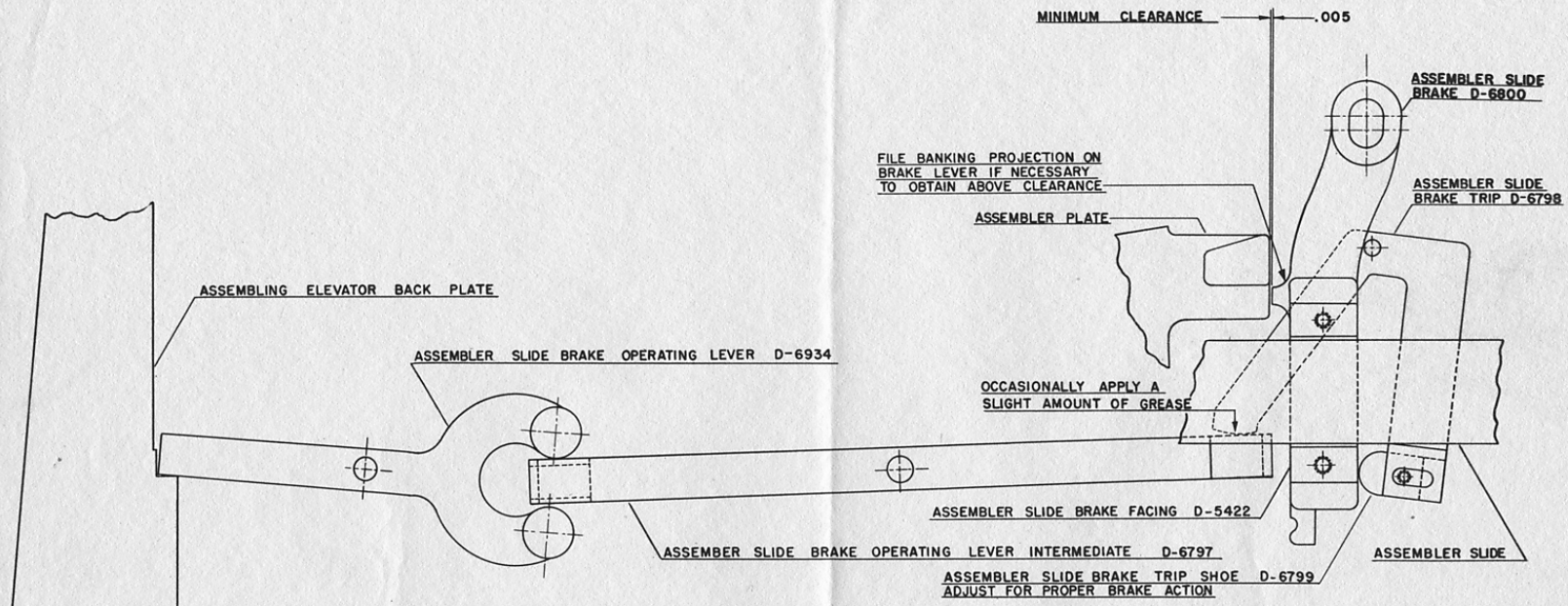


DIAGRAM OF ASSEMBLER SLIDE BRAKE RELEASE MECHANISM SHOWING POSITION OF PARTS WHEN ASSEMBLER BRAKE IS RELEASED. (ASSEMBLING ELEVATOR IS FULLY RAISED).

FIG. 6

The originals from which this digital version were created were collected in a three-ring binder with other service documents. Sometimes, therefore, the precise association and order of the source material was not clear.

In the original binder, the single sheet
"Diagram of Assembler Slide Brake Release Mechanism"
["Fig. 6"]
appeared in close proximity to both

"Operation of Comet Teletypesetter Safeties (Distributor Stop, Tight Line, Assembler Belt Stop and Last Mat Kicker) Using a Standard Teletypesetter Operating Unit"
[Service Instruction No. 10 (1951-12-12)]

and to

"Instructions for the Operation, Adjustment and Maintenance of the M. L. Co. Electric Quadder (Teletypesetter Operated)."
[Service Instruction No. 11 (1951-02-01)]

It doesn't appear to be a part of either,
but it is not irrelevant to them and probably was inserted by a previous owner of the binders.

I have, in any case, included it here.

Figure 13 was larger than the scanner bed, and is presented here in three overlapping sections. Admittedly, this is inconvenient; it is at least complete, though.