

# Electromatic Safety for Model 36 Linotype

SALES—SERVICE

MERGENTHALER LINOTYPE COMPANY

BROOKLYN 5, N. Y.

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Service Instruction No. 6 for Type PE-4

## DESCRIPTION

The Electromatic Safety System is designed to prevent shifting magazines if matrices are in the distributor box, on the distributor bar, or caught between the channel entrance and the magazine.

It consists of:

- a. A snap-action switch operated by the distributor shifter to act as a distributor box safety.
- b. Insulated distributor bar or bars so that when matrices are on the bar, an electrical circuit is completed.
- c. Channel entrance with movable upper and lower front plates which actuate a snap-action switch when forced out of normal position.
- d. Solenoid latch to lock magazine elevating mechanism.
- e. Safety circuit switch operated by automatic matrix guard lever.
- f. Indicator lights at right of operator.
- g. Power supply box, including Thyatron tube, Amperite delay relay tube, Transformer, Small Relay, Rectifier, Fuse, Terminal strips, etc.
- h. Wiring harness.

## OPERATION

When matrices are in the distributor box, on the distributor bar or lodged between the channel entrance and magazine, a locking latch which locks against a toothed wheel on the magazine elevating shaft crank shaft, prevents the operator from shifting magazines. The latch is held against the wheel by spring action.

There are two green indicating lights located to the right of the operator. The left-hand light is for the distributor box and distributor bar safety and lights whenever these parts are clear of matrices. The right-hand light lights when the operator depresses the automatic matrix guard handle preparatory to shifting.

When the operator is ready to shift magazines, he waits for the left-hand light to show green which means that matrices have cleared the distributor box and bar. He then presses the automatic matrix guard handle and starts turning the one-turn shift handle. If the right-hand light remains green he can complete the shift. If it does not remain lighted, however, the operator cannot shift because the locking latch contacts a projection on the toothed wheel and prevents shifting. Failure of the right-hand light to show green in this case means that a matrix or matrices are caught between the channel entrance and the magazine. It should be pointed out, that even if the operator attempts to shift when the channel entrance light is off, he cannot do so because the solenoid latch remains in position to prevent shifting.

The channel entrance is arranged with movable upper and lower front plates and with a snap-action switch located between the plates. If a matrix is lodged between the channel entrance and magazine, turning the one-turn shift handle forces the upper or lower plate to move which opens the

snap-action switch breaking the circuit and preventing the latch solenoid from being energized. The latch will then remain against the toothed wheel to prevent shifting.

To keep the distributor signal light from flickering when a single matrix is on the distributor bar, a time delay circuit is employed. This consists of a 270 thousand ohm resistance R5 and the 2 micro-farad Condenser No. 2 in the Thyatron tube control grid circuit. The delay in the control grid circuit allows for the momentary breaking of the circuit to ground, as the single matrix may not be making full contact with the distributor bar at times as it travels the length of the bar.

## Distributor Bar Safety

Both distributor bars on mixer models and single bars on other models are insulated from the rest of the machine. With this arrangement a matrix on the distributor bar will complete a circuit to ground and by means of an electronic switch, the safety circuit will remain open and the solenoid latch will remain in locked position until all the matrices are back in the magazine.

It should be noted that the electromatic safety switches, solenoids, etc., are operated on 24 volts A.C. or less, thereby assuring complete safety. The normal voltage present on the distributor bar is less than 5 volts D.C., and there is no sparking between the matrices and the bar under any operating conditions.

## Electronic Switch

The presence of matrices on the distributor bar or in the distributor box results in the grounding of the Thyatron tube grid circuit. The Thyatron tube controls the action of a small relay F-8384, which in turn performs the switching action and subsequent energizing or de-energizing of the latch solenoid. When the distribution system is clear of matrices, the Thyatron tube is conducting current causing the relay contacts to close. When the distributor bar is grounded by a matrix, the Thyatron tube stops conducting, the small relay opens, and the latch solenoid cannot be energized. The latch spring continues to hold the latch against the toothed wheel and prevents shifting of magazines.

In the case of matrices being on the distributor bar, the matrices themselves cause completion of the circuit to ground by connecting the insulated distributor bar to the distributor screws which in turn are fastened to the machine frame.

The Thyatron tube control grid, which controls the current flow from cathode to plate of the tube, is biased negatively when the distributor bar circuit is grounded to the machine frame and this results in the tube not conducting. As soon as the matrices clear the bar, the bias is removed from the control grid and the tube will again conduct, closing the relay.

Since the distributor shifter switch is connected in series with the distributor bars, the opening of this switch by the shifter coming into the distributor box also results in the circuit to ground being broken. Therefore, the switch must

be opened and the distributor bars must be clear of matrices at the same time in order for the Thyatron tube to start conducting.

To protect the cathode and therefore increase the life of the Thyatron tube, an Amperite delay relay tube, part number F-9081, is used. The only function of the delay relay tube is to allow the filament of the Thyatron tube sufficient time to heat before applying the plate voltage. This delay action is accomplished by a set of contacts within the relay tube which close only after being actuated by the heater wire of that tube. It should be noted that the plate voltage is applied to the Thyatron tube only when the contacts within the relay tube are touching.

### **Distributor Box Safety**

The snap-action switch used for this safety was chosen for its small size and long life expectancy since it operates each time a line of matrices passes through the distributor box. It is so adjusted that it will not open until the distributor shifter is in fully closed position with no matrices in the distributor box. When the switch is open it breaks the electronic circuit to ground, which causes the Thyatron tube to start conducting and the consequent releasing of the locking latch from the toothed wheel.

### **Channel Entrance**

The channel entrances have a lower movable plate at the magazine end in addition to the matrix guard. A snap-action switch is mounted on the lower movable plate so that any movement of either movable plate will open the switch and break the circuit. If, while attempting to shift magazines downward, a matrix is caught between the channel entrance and the magazine, the lower plate will be moved downward by the matrix. Before any damage can occur, however, the switch opens and the solenoid latch prevents further movement of the magazine elevating shaft. If the shifting of magazines is upward, the upper plate or matrix guard will be forced upward by the matrix and the same action takes place, with further shifting prevented.

### **Fail-Safe Operation**

The Electromatic safety works on a fail-safe principle. That is, in the event of power failure, the safety operates so that the magazines cannot be shifted, thereby making the presence of the failure evident and preventing damage. However, it is possible where necessity makes it imperative to shift magazines to simply hold the latch back off the toothed wheel so that the magazines can be shifted until difficulty is eliminated.

## **MAINTENANCE & SERVICING—MECHANICAL**

### **Main Magazine Elevating Shaft Switch and Auxiliary Magazine Safety Switch**

The circuit is arranged so that the Main Latch Solenoid and Auxiliary Latch Solenoid are energized simultaneously when the Automatic Matrix Guard Lever is moved to release either the main or auxiliary magazines for shifting.

Locking latches will be disengaged from the toothed wheels on both the main side and auxiliary side magazine elevating shafts when the Matrix Guard Lever is moved. However, the magazine locating pawls which lock the magazines in operating position will only release the magazines for whichever side the Matrix Guard Lever is turned.

The Main Magazine Elevating Shaft Switch will be actuated to complete the circuit through the solenoids when the Matrix Guard Lever is moved to the "Main" position. An adjustable screw and lock nut, which is in the Magazine Elevating Shaft Stop Pawl on the elevating "cannon" permits adjustment for opening or closing this switch. A movement of the Matrix Guard Lever to the "Main" position results in the pawl moving to release the magazines and the adjusting screw contacts the switch plunger, closing the switch.

The Auxiliary Magazine Safety Switch will be actuated to complete the circuit through the solenoids when the Matrix Guard Lever is moved to the "Aux." position. An adjustable screw and lock nut which is on a small bracket fastened to the Auxiliary Magazine Locating Sliding Block permits adjustment for operation of this switch.

The adjusting of the switch actuating screws for either the Main Magazine Elevating Shaft Switch or the Auxiliary Magazine Safety Switch is made in the same manner. To adjust the actuating screw for either switch proceed as follows:

1. Move the Matrix Guard Lever to either "Main" or "Aux." position and shift magazines to a position somewhere between regular operating positions.
2. Let go of Matrix Guard Lever so that it assumes its natural position with magazines out of operating position.
3. Adjust the switch plunger actuating screw until the switch is just actuated and simultaneously the channel entrance indicating light goes on and the solenoids pull the latches off the toothed wheels. Care should be taken to have the screw out just far enough to depress the switch plunger without damaging the switch by over-travel of the plunger.
4. Raise or lower magazines to regular operating position and check to see that the light goes out as the Matrix Guard Lever returns to neutral position and the latches engage the toothed wheels. These switches are both normally open and depending on whether the Matrix Guard Lever is moved to "Main" or "Aux." position, each is closed individually.

### **Channel Entrance Movable Plate Switch**

The channel entrance movable plate switch is activated by the movement of either upper or lower movable plate of the channel entrance. It is fastened to the lower plate. The movement of either upper or lower plate allows the plunger of the switch to release, thus breaking the circuit. A threaded stud and lock nut on a small bracket mounted on the upper plate permits adjustment of the stud against the switch plunger. The threaded stud is screwed down so that it will just make the plunger close the switch when the plates are in normal operating position, i.e. together.

The switch is normally in open position and the plunger must be depressed to close it. After adjusting the screw so that the switch will be actuated at the slightest movement of either plate, the lock nut is tightened to keep the adjusting screw in position.

### **Distributor Shifter Switch**

On Model 36 there is a banking screw in back of shifter switch bracket which stops travel of distributor shifter.

An adjusting screw and lock nut on shifter provides the means of actuating the distributor shifter switch plunger.

Adjustment is accomplished when shifter is on banking screw. Adjustment should be such that switch is just "ticked on," to prevent damage to switch by over-travel. This switch is normally closed and is opened when the shifter slider is all the way in the distributor box.

### **Latch Solenoid and Latch**

The adjustment of the latch with respect to the toothed wheel can be easily made by a threaded link which screws into the solenoid core. A lock nut on the threaded link is tightened after proper adjustment is made so that the latch clears the toothed wheel when the solenoid is activated. The threaded link should not be twisted so that a bind occurs between the link and latch.

The spring under the solenoid mounting bracket should have enough tension to hold latch in contact with the toothed wheel when the solenoid is deactivated. It should not be too strong, however, or the solenoid will not be able to pull the latch back.

Latch pivot screw should allow free movement of the latch. A drop or two of non-running oil or graphite at this pivot will save wear on the solenoid and spring.

When magazines are in operating position the latch should be located approximately halfway between the ends of the cut-out portion of the wheel, as shown in the diagram. The notch at either end of the cut-out portion of the wheel is there in case the operator turns his shift handle extremely fast with a matrix lodge between channel entrance and the magazine. The magazines will of course start to move slightly before the movable channel entrance plate switch breaks the circuit to cause the latch solenoid to be deactivated an allow the latch to lock against the toothed wheel. When the operator is shifting so fast that the latch has cleared the end of the large cut-out portion of the toothed wheel before the channel entrance switch has broken the circuit, the notch in the wheel permits the latch to lock in it before the magazines can travel far enough to do damage to the channel entrance or magazines. Experimentation has shown that no matter how fast the operator attempts to turn his one-turn shift handle with a mat lodged between magazine and channel entrance, the locking action occurs in time to prevent damage.

## **MAINTENANCE AND SERVICING—ELECTRICAL**

If the safety system is not functioning properly, the following items should be checked:

1. Fuse F-8631 which is located in power and control box F-8706.
2. Thyatron tub located in power and control box F-8706.
3. Amperite delay relay tube, part F-9081. If the internal contacts of this tube do not close, the Thyatron tube plate voltage is cut off and the safety system will not function properly. The solenoid cannot be energized to pull the latch from the locked position even after all the matrices have returned to the magazine.
4. Action of Relay F-8384 which is located in power and control box F-8706. With the distributor system clear of matrices, this relay should be closed.
5. Action of Distributor Shifter Switch F-8412, Magazine Elevating Shaft Switch F-8429 and Channel Entrance Movable Plate Switch D-6995.
6. Action of Locking Latch Solenoid F-8430. The energy to disengage the locking latch, is supplied to the sole-

noid only when both of the following conditions (a and b) are satisfied.

- a. When all matrices have returned to the magazines, and the distributor bar is not grounded.
  - b. When the magazine switch, F-8429, is closed.
7. Transformer F-8693 input and output voltages.
  8. D.C. output voltage of rectifier. If the output of the rectifier is below the minimum value, the safety system will not function properly. The distributor safety indicating light will remain lighted even when matrices are in the distributor box or on the distributor bar. This will then give a false indication that it is safe to shift magazines.
  9. Ground or break somewhere in harness system or component parts, such as the distributor bars.

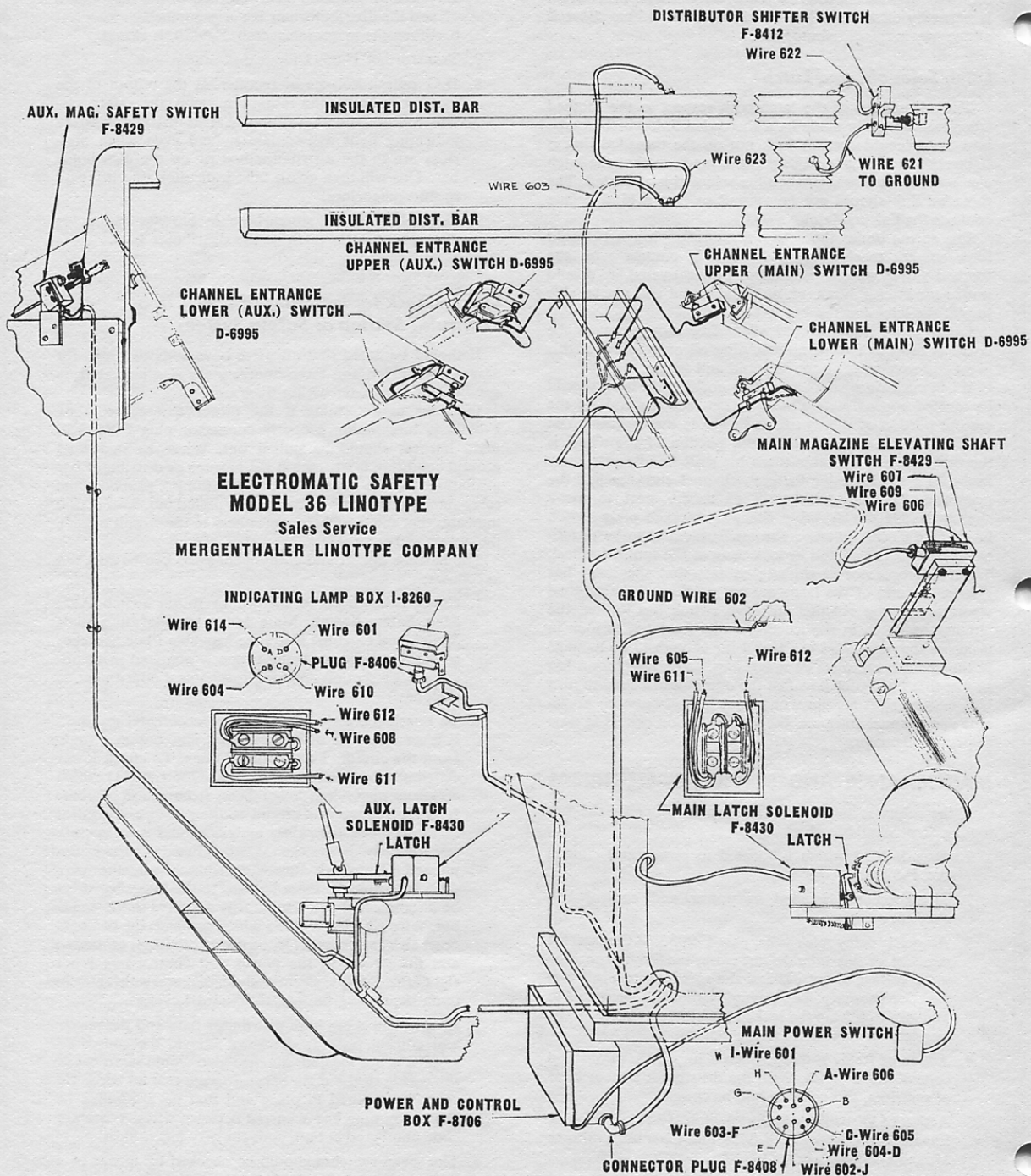
### **Quick Check for Isolating Difficulty in a Particular Section of Safety System**

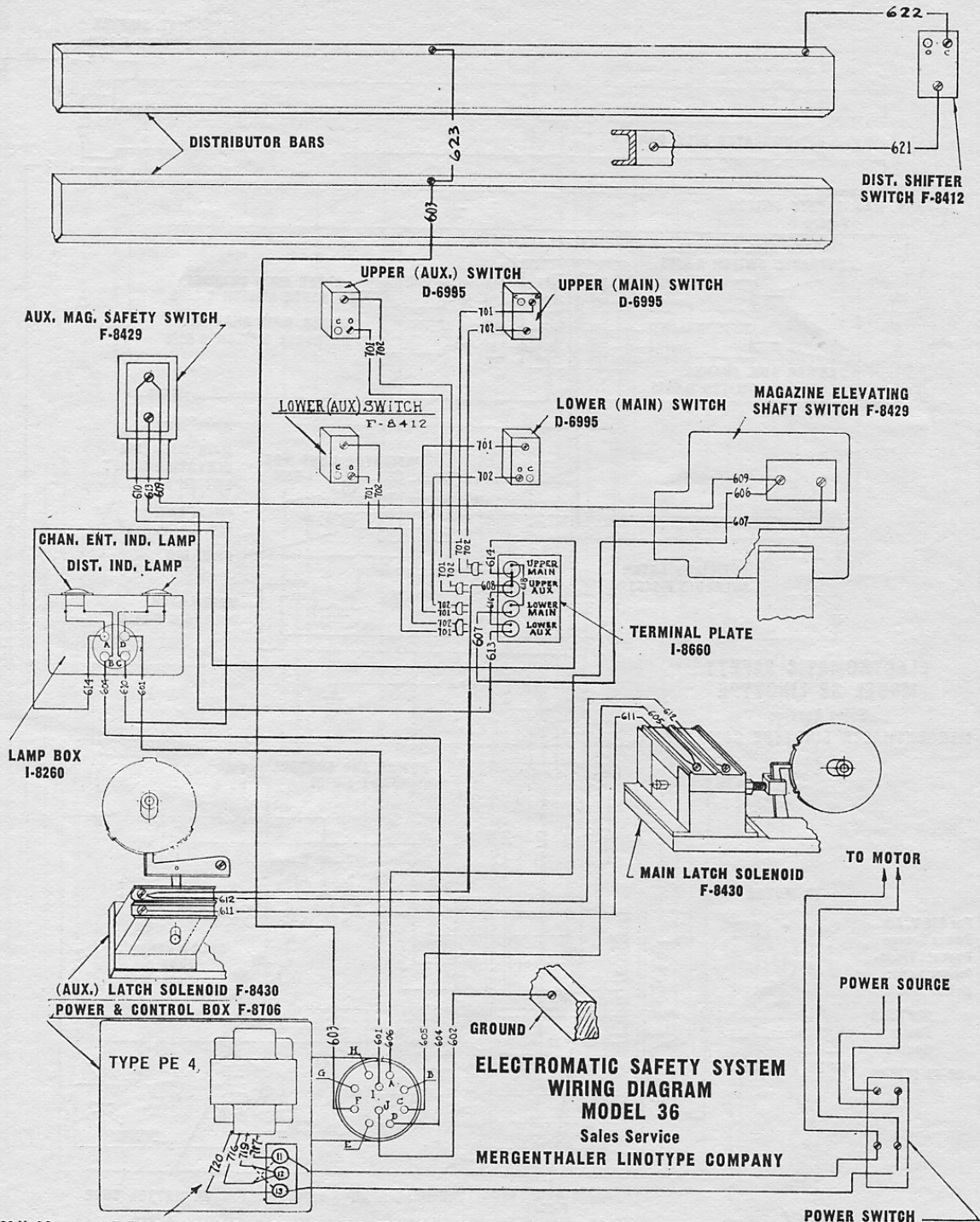
It should be noted that all wires have code numbers for easy identification and these numbers are also indicated on system and schematic wiring diagrams.

In order to determine if the power and control box F-8706 is functioning properly connector plug F-8408 to main harness should be pulled out. When an undesired ground condition is existent in the harness or distributor bar insulation and the control box is functioning properly, the relay should click "on" as the plug is pulled out. This action indicates that the trouble is somewhere in the circuit outside the power and control box.

The harness circuit and component parts can be checked as follows:

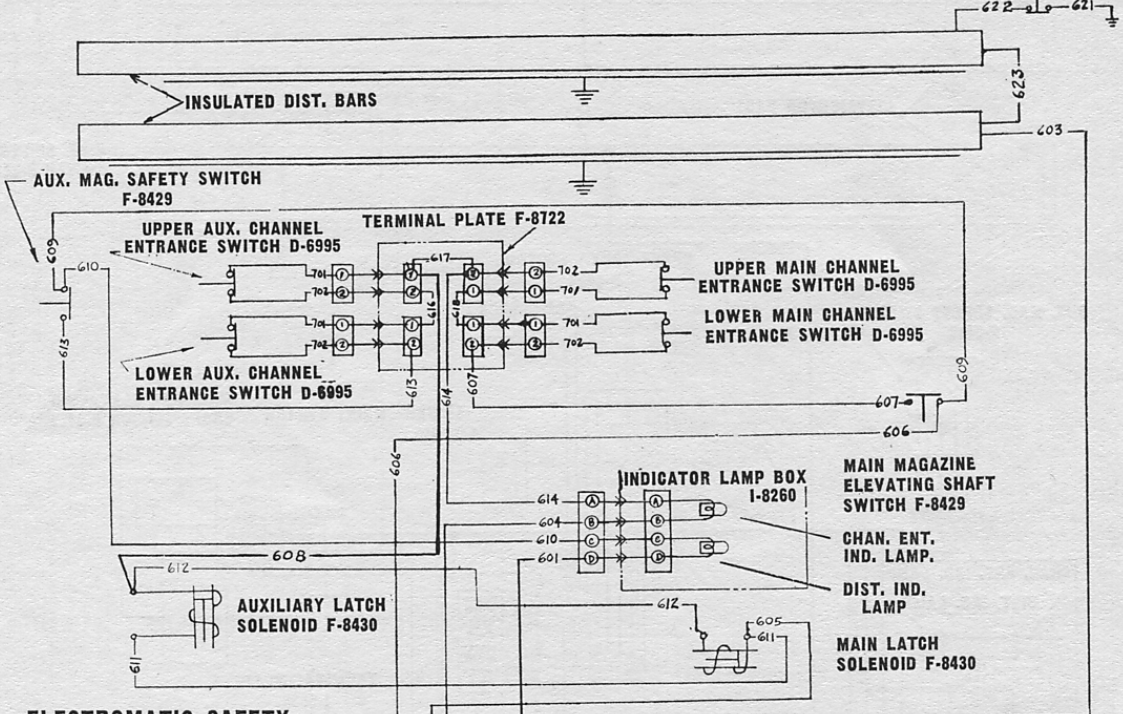
1. Check adjustments of Distributor Shifter Switch, Aux. Mag. Safety Switch, Main Magazine Elevating Shaft Switch and Channel Entrance Movable Plate Switches to see that they are being properly actuated mechanically. (See section covering mechanical adjustment of switches.)
2. To check the distributor bars for accidental grounds, it is necessary to disconnect each bar, one at a time, from the circuit. This is simply done. To check lower distributor bar, disconnect wire F-8735 (#623) which connects upper and lower bars, from the upper bar. If the lower bar and circuit to the power and control box is correct, the safety system should now operate satisfactorily when the Matrix Guard Lever is depressed. To check upper distributor bar, the wire (#603) from the main harness to the lower bar must be disconnected and temporarily attached to the upper bar. Wire (#623) F-8735 which connects the two bars must also be removed. If the upper bar is not grounded and the circuit to the power and control box is all right, the safety system should operate satisfactorily upon depressing the Matrix Guard Lever.
3. If, after checking both distributor bars and the power and control box, as described above, the source of trouble is not located, the next step would be to check the wiring of the main harness to see that all wires are securely fastened in place and that no grounding or short circuiting has occurred between wires. Wires are code numbered at both ends for easy identification.
4. The seven switches should be checked by means of a lamp testing outfit or ohmmeter to see that they are opening and closing properly.





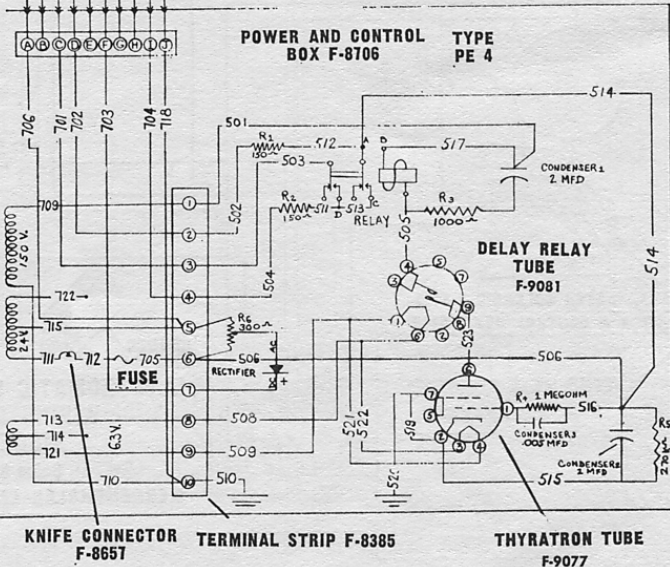
For 220 V. AC, connect 717 to term. 11; 716 and 719 to term. 12; 720 to term. 13  
 For 110 V. AC, connect 717 and 716 to term. 11; 719 and 720 to term. 13

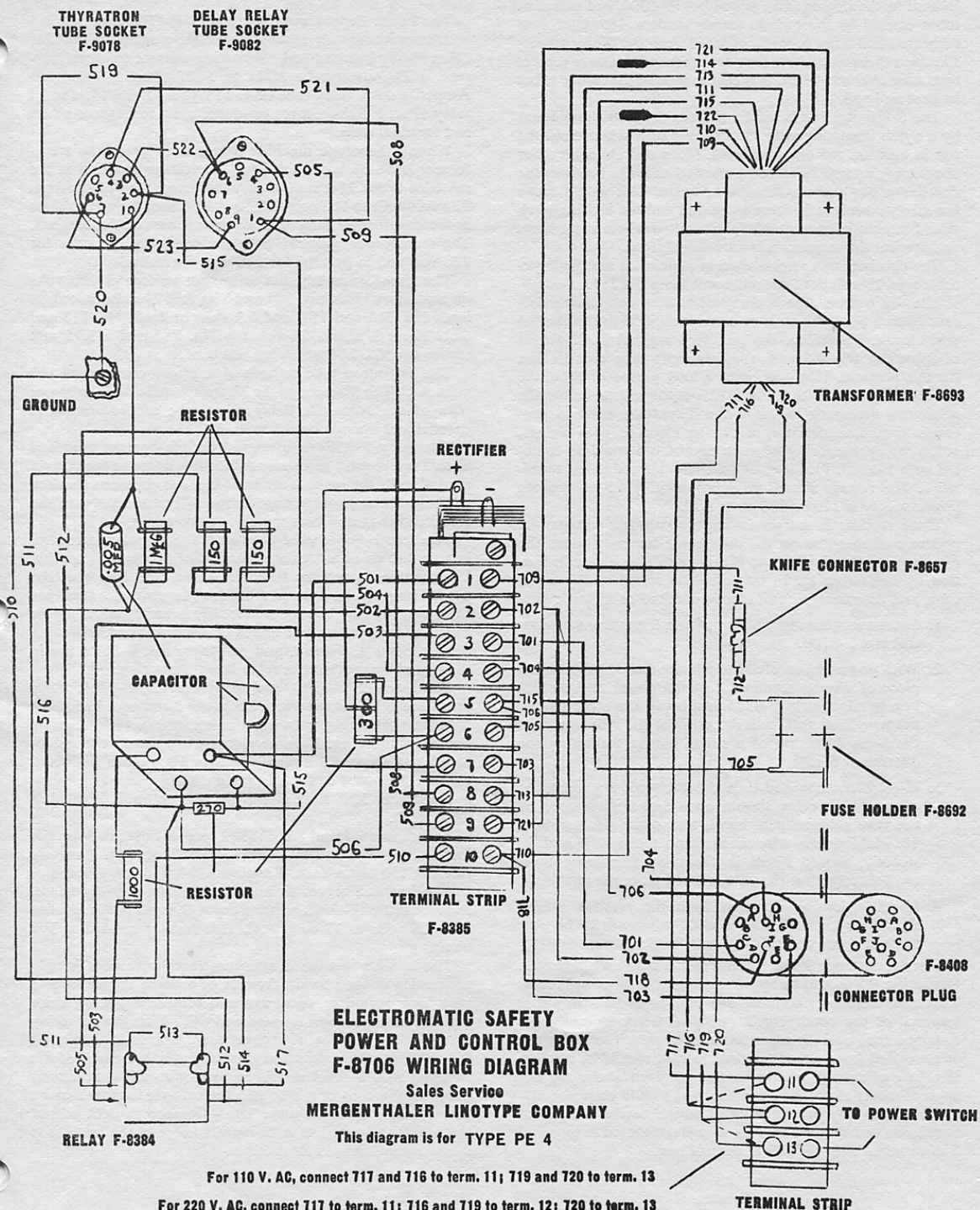
DIST. SHIFTER SWITCH F-8412



**ELECTROMATIC SAFETY  
MODEL 36 LINOTYPE**

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**ELECTROMATIC SAFETY  
POWER AND CONTROL BOX  
F-8706 WIRING DIAGRAM**

Sales Service  
**MERGENTHALER LINOTYPE COMPANY**

This diagram is for TYPE PE 4

For 110 V. AC, connect 717 and 716 to term. 11; 719 and 720 to term. 13

For 220 V. AC, connect 717 to term. 11; 716 and 719 to term. 12; 720 to term. 13

The Thyatron tube and the Amperite delay relay tube located in the power and control box F-8706, are standard tubes carried by most radio supply dealers. However, it is suggested that these tubes be ordered from the Mergenthaler Linotype Company where they are pretested to assure correct operating characteristics. It is also suggested that spare tubes be kept on hand.

The distributor bar is insulated from the distributor beam by a nylon insulating strip. Screws and nuts which hold the bar in position are also insulated. No metal chips or other conducting material should be allowed to lodge between the distributor bar and the distributor beam. This would cause the safety circuit to become grounded and the locking latch would remain in contact with the toothed wheel at all times and prevent the magazines from being shifted.

The two indicating lights used in the circuit are the bayonette type 28 volt A.C. incandescent lamp F-8711.

The Thyatron tube is designed to stop conducting current when a bias of 2 volts or more is applied to the control grid circuit. Therefore, the rectifier's normal D.C. output of approximately 4.5 volts supplies more than enough bias for this purpose. However, over a long period of time, the rectifier may age so that the D.C. output will be below the minimum necessary to cause the Thyatron tube to stop conducting. Rectifier output can be checked with a D.C. voltmeter by measuring between terminals 6 and 7 on terminal strip F-8385. Plus lead of voltmeter should be on terminal 7. The voltage should be approximately 4.5 volts when power supply is 110 or 220 volts A.C.

If the rectifier is not producing the required voltage, the presence of matrices on the distributor bar may cause the distributor indicating light to flicker or to give a false indication by remaining lit. In this case the rectifier, Thyatron tube, and time delay circuit can be checked as follows:

1. Disconnect the main harness from the power and control box F-8706.
2. With power on, carefully touch one end of an insulated piece of wire to terminal 7 of the power and control box terminal strip F-8385 and brush the other end of the wire back and forth on terminal 10. This simulates the same condition of a single matrix traversing the distributor bar.
3. If rectifier, tube and time delay circuit are operating correctly the relay should open and remain open as the wire momentarily leaves and returns to terminal 10. Holding the wire across both terminal 7 and 10 steadily, should result in the relay remaining open until shortly after the wire is lifted from the terminals.
4. If relay does not remain open the rectifier output should be checked with a D.C. voltmeter to be sure there is approximately 4.5 volts D.C. output.

Check resistance R5 and condenser 2 with an ohmmeter. Resistance R5 should be approximately 270 thousand ohms. To check condenser connect one ohmmeter lead to either terminal of the condenser 2 (with all wires to condenser disconnected) and the other test lead to case. The resistance as measured from either terminal to case should be infinite. If values of voltage and resistance as given above are not approximately close, the offending part should be replaced.

Check for any breaks in wire which carries output of rectifier to distributor bar. This wire is connected to terminal 7 of terminal strip F-8385 in control box.

## THE POWER SUPPLY AND CONTROL BOX

The Power Supply and Control Box F-8706 contains:

A transformer for changing voltage, a selenium rectifier (Part F-8911 to convert alternating current to direct current, a Thyatron tube 2D21 or 5727 (Part F-9077), an Amperite delay relay tube 6NO 15T (Part F-9081), a small relay (Part F-8384), three condensers, six resistances a fuse and terminal strip.

When a Linotype machine leaves the factory the transformer hook-up is arranged for the voltage specified in the machine order. If it is necessary to change the voltage from 220 volt A.C. to 110 volt A.C., or vice-versa, the connections to the transformer must be changed as shown on the diagram. The transformer primary coils are connected in series for 220 volt and in parallel for 110 volt operation.

The transformer supplies an output voltage of 150 volts on secondary leads No. 709 and 710, and 24 volts on output leads No. 715 and 711, and 6.3 volts on leads No. 713 and 721. There is also a 26 volt tap No. 722 and a 3.15 volt center tap No. 714 which are not used.

The Thyatron tube cathode-plate circuit operates on 150 volts A.C. The filament of the Thyatron tube and the heater wire of the Amperite delay relay tube are connected in parallel and operate on 6.3 volts A.C.

The relay F-8384 is a rugged double contact type and should not require adjustment since it is adjusted for correct operation by the manufacturer. It is in the circuit as a switch to cause the solenoid action, and is activated each time the distributor box and bars are clear of matrices.

The fuse F-8631, used to protect the power and control box, is known as a "fusestat" and is of two amps capacity. If necessary to replace fuse, the same type fuse must be used. These can be ordered from the Mergenthaler Linotype Company, or may be procured locally in an electrical supply shop. It is suggested that spares be kept on hand.

Condenser 1, F-8378, and resistance R3, F-8690, are in the circuit to prevent the relay from chattering.

Condenser 2, F-8378, and resistance R5, F-8428, make up a time delay circuit which keeps the distributor indicating light from flickering, even when a single thin matrix traverses the distributor bar. Both condensers are rated at 2 microfarads, resistance R3 is rated at 820 or 1000 ohms, and resistance R5 is rated at 270 thousand ohms.

Condenser 3, F-8912 eliminates relay hum. It is rated at .005 MFD.

Resistances R1 and R2, F-8382, prevent overloads on the indicating lamps and thus add to their longevity. They are rated at 150 ohms each. Resistance R4, F-8427, is rated at 1 megohm and serves to prevent Thyatron grid current. Resistance R6, F-9047, reduces the A.C. input to the rectifier from 24 volts to 12 volts A.C. This resistor is rated at 300 ohms.

The rectifier is a small selenium rectifier since it is only converting about 12 volts from A.C. to D.C. It may, over a very long period of time, age and require replacing since its D.C. output is then lowered and this affects the operating characteristics of the Thyatron tube. The D.C. output of this rectifier when measured across terminals 6 and 7 of the terminal strip F-8385 should be approximately 4.5 volts in order for the control grid to stop the cathode to plate current flow of the Thyatron tube. The difference in D.C. output voltage as compared to A.C. input voltage of the rectifier is due to internal loss in the rectifier.