ELECTROMATIC SAFETY for MODEL 33 LINOTYPE

SALES—SERVICE · MERGENTHALER LINOTYPE CO. · BROOKLYN 5, N. Y.
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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 Thyratron tube, Transformer, 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 one 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, an electronic switch and time delay circuit is employed. This consists of the Thyratron tube, 270 thousand ohm resistance R5 and the 2 micro-farad Condenser No. 2. The split-second 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 or less, thereby assuring complete safety. It should also be noted that the indicating light shows green when it is safe to proceed and also by use of the electronic switch circuit, the indicating light will be steady even though only a thin matrix is on the distributor bar. Also there is no sparking between the matrix and the distributor bar under any operating condition. The normal voltage present on the bar is less than 16 volts D.C.

Electronic Switch

The presence of matrices on the distributor bar or in the distributor box results in the grounding of the electronic tube circuit. This is a Thyratron tube circuit. The Thyratron tube controls the action of a small relay 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 Thyratron tube is conducting current causing the relay contacts to close. When the distributor bar is grounded by a matrix, the Thyratron tube stops conducting, the small relay opens, and the latch solenoid is de-energized, permitting the latch spring to pull the latch against the toothed wheel to prevent 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 Thyratron tube control grid, which controls the current flow from cathode to anode 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 bar, 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 bar must be clear of matrices

at the same time in order for the Thyratron tube to start conducting.

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 Thyratron tube to start conducting and the consequent releasing of the locking latch from the toothed wheel.

Channel Entrance

The channel entrance has 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.

The channel entrance is also designed with the partitions cut back to permit the upper and lower movable plates to be made with grooves, the same as an upper and lower magazine plate. The channel entrance partitions therefore position the matrices correctly as they pass to the grooved plates and the grooved plates guide the matrices into the magazine. The movement of the matrices from the lower end of the channel entrance to the magazine is similar to the movement of matrices from an upper split magazine to a lower split magazine.

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 AND SERVICING—MECHANICAL

Magazine Elevating Shaft Switch

The Magazine Elevating Shaft Switch which is actuated when the Automatic Matrix Guard Lever is depressed, causes the circuit to the solenoid to be completed, thus pulling the locking latch away from the toothed wheel. 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. The switch is normally open. A movement of the Matrix Guard Lever results in the pawl moving to release the magazines and the adjusting screw contacts the switch plunger, closing the switch and completing the circuit.

This screw should be adjusted as follows:

1. Depress matrix guard lever and move 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 screw on Stop Pawl until switch is just actuated and the channel entrance indicating light goes on and the solenoid pulls the latch off the toothed wheel. 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 light goes out as matrix guard lever returns to neutral position, and the latch engages the toothed wheel. This switch is normally open and is closed when the matrix guard lever is depressed.

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 33 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 pull latch into 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 diagrams. 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 lodged 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 and 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. Thyratron tube located in power and control box F-8706.
3. Action of Relay F-8384 which is located in power and control box F-8706.
4. Action of Distributor Shifter Switch D-6995, Magazine Elevating Shaft Switch F-8429 and Channel Entrance Movable Plate Switch D-6995.
5. Action of Locking Latch Solenoid F-8430.
6. Transformer F-8693 input and output voltages. Also D.C. output voltage of rectifier.
7. 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 F-8712 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 immediately 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. Refer to section under heading "The Power Supply and Control Box" for further details.

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

1. Check adjustments of Distributor Shifter Switch and Magazine Elevating Shaft Switch and Channel Entrance Movable Plate Switch to see that they are being properly actuated mechanically. (See section covering mechanical adjustment of switches.)
2. To check the distributor bar for accidental grounds it is necessary to isolate the bar from the circuit by disconnecting leads 602 and 622. Then touch one test lead of an ohmmeter or magneto to the distributor bar and the other lead to the machine frame.

   The ohmmeter reading should be infinite if there is no ground between the bar and frame. If a ground exists the ohmmeter should show either no resistance or some resistance reading between 0 ohms and infinity, depending on how heavy the ground condition is.

   The magneto bell will not ring if no ground exists between the bar and frame.
3. If, after checking the distributor bar and the power and control box, as described in sections 1 and 2 above, the source of trouble is not located, the next step would be to check the wiring of the main harness F-8712 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 three switches should be checked by means of a lamp testing outfit or ohmmeter to see that they are opening and closing properly.

The Thyratron tube which is located in the power and control box F-8706 is rated by the manufacturer at over a year's service under normal operating conditions. This is a standard tube, which is carried by most radio supply dealers, but it is suggested that they be ordered from the Mergenthaler Linotype Company as they are pretested to assure correct operating characteristics. It is suggested that spare tubes be kept on hand.

The distributor bar is insulated from the distributor bracket by a nylon insulating strip. Screws and nuts which hold the bar in position are also insulated and dowels are made of nylon so that the bar is completely insulated.

No metal chips or other conducting material should be allowed to lodge between the distributor bar and the distributor bracket. 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.

Over a long period of time, the rectifier may age so that the D.C. output will not be the required minimum necessary to cause the Thyratron tube to stop conducting. Rectifier D.C. 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. D.C. voltage should be approximately 10 volts D.C. plus or minus 5% when power supply is 110 or 220 volts A.C.

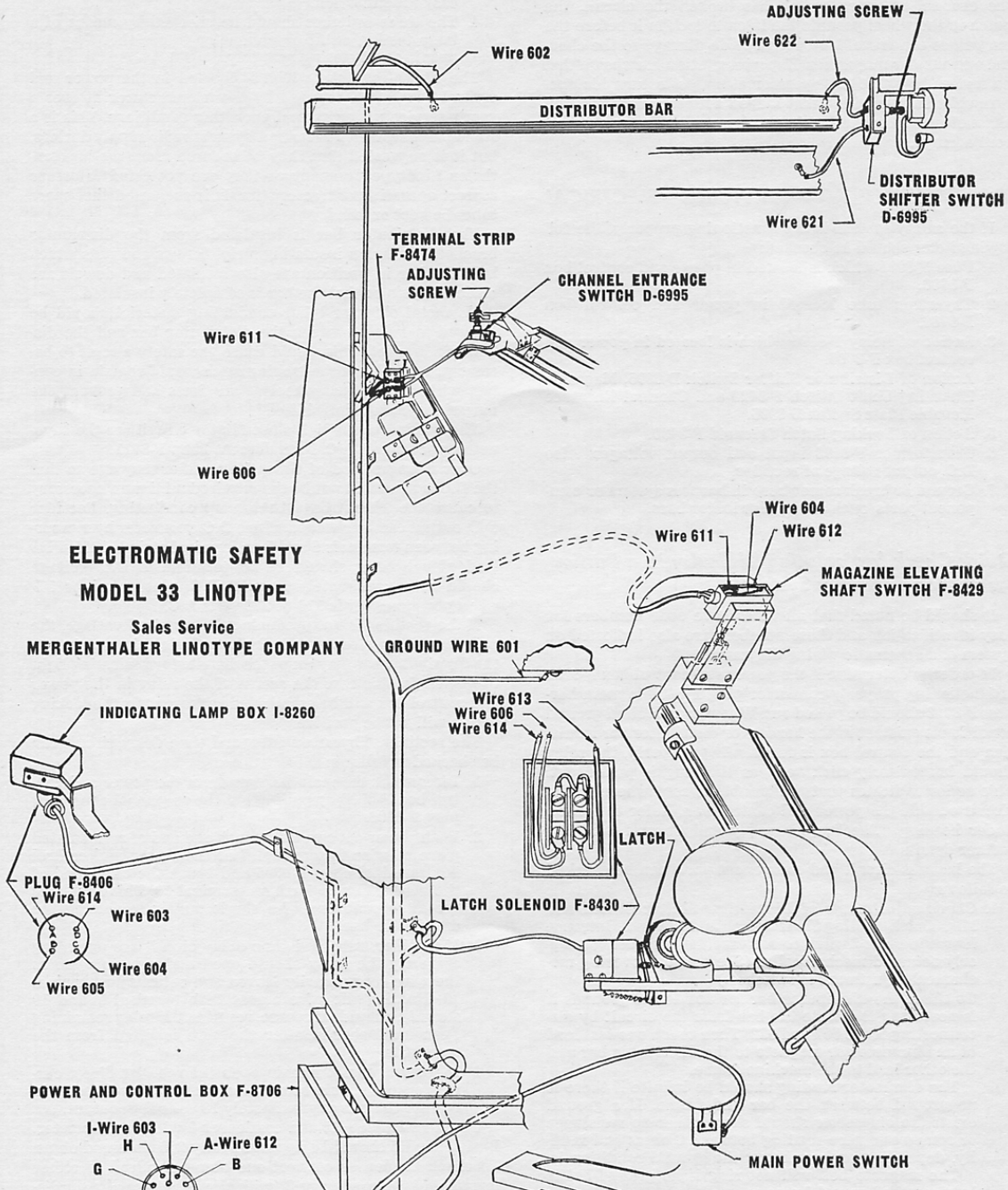
If the rectifier is not producing the required voltage, the presence of matrices (particularly a single thin matrix) on the distributor bar may cause the distributor indicating light to flicker. In this case the action of the relay in the power and control box will be erratic and consequently the locking action will not be positive.

The rectifier, Thyratron tube, and time delay circuit can be checked as follows:

1. Disconnect the main harness from the power and control box F-8706 by pulling out the amphenol connector plug F-8408.
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, of course, 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 direct current output should be checked with a D.C. voltmeter to be sure there is approximately 10 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 ground. The resistance as measured from either terminal to ground should be infinite. If values of voltage and resistance as given above are not approximately close, the offending part should be replaced.

Continued on Page 8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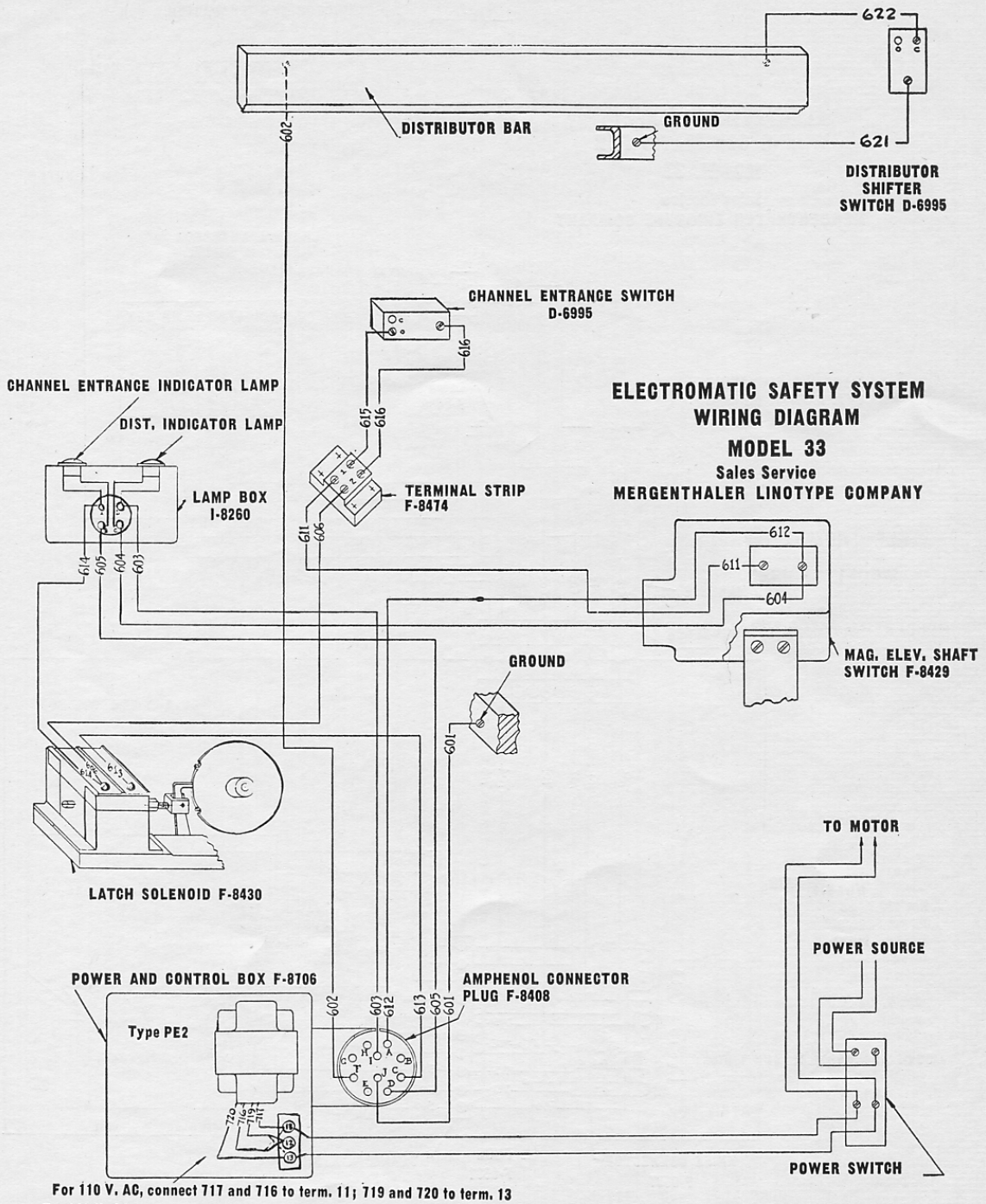
Wire 622
Wire 602
DISTRIBUTOR BAR
DISTRIBUTOR SHIFTER SWITCH D-6995
Wire 621
TERMINAL STRIP F-8474
ADJUSTING SCREW
CHANNEL ENTRANCE SWITCH D-6995
Wire 611
Wire 606
ELECTROMATIC SAFETY
MODEL 33 LINOTYPE
Sales Service
MERGENTHALER LINOTYPE COMPANY
Wire 604
Wire 612
Wire 611
MAGAZINE ELEVATING SHAFT SWITCH F-8429
GROUND WIRE 601
Wire 613
Wire 606
Wire 614
INDICATING LAMP BOX I-8260
LATCH
PLUG F-8406
Wire 614
Wire 603
Wire 604
Wire 605
LATCH SOLENOID F-8430
POWER AND CONTROL BOX F-8706
I-Wire 603
H
A-Wire 612
G
B
Wire 602-F
C-Wire 613
E
CONNECTOR PLUG F-8408
D 605
J-Wire 601
MAIN POWER SWITCH


622
DISTRIBUTOR BAR
GROUND
621
DISTRIBUTOR SHIFTER SWITCH D-6995
602
CHANNEL ENTRANCE SWITCH D-6995
616
CHANNEL ENTRANCE INDICATOR LAMP
DIST. INDICATOR LAMP
615
616
LAMP BOX I-8260
TERMINAL STRIP F-8474
611
609
614
605
604
603
ELECTROMATIC SAFETY SYSTEM
WIRING DIAGRAM
MODEL 33
Sales Service
MERGENTHALER LINOTYPE COMPANY
612
611
604
MAG. ELEV. SHAFT SWITCH F-8429
GROUND
609
LATCH SOLENOID F-8430
TO MOTOR
POWER SOURCE
POWER AND CONTROL BOX F-8706
Type PE2
602
603
612
613
605
601
AMPHENOL CONNECTOR PLUG F-8408
POWER SWITCH
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

ELECTROMATIC SAFETY WIRING SCHEMATIC FOR MODEL 33

Sales Service
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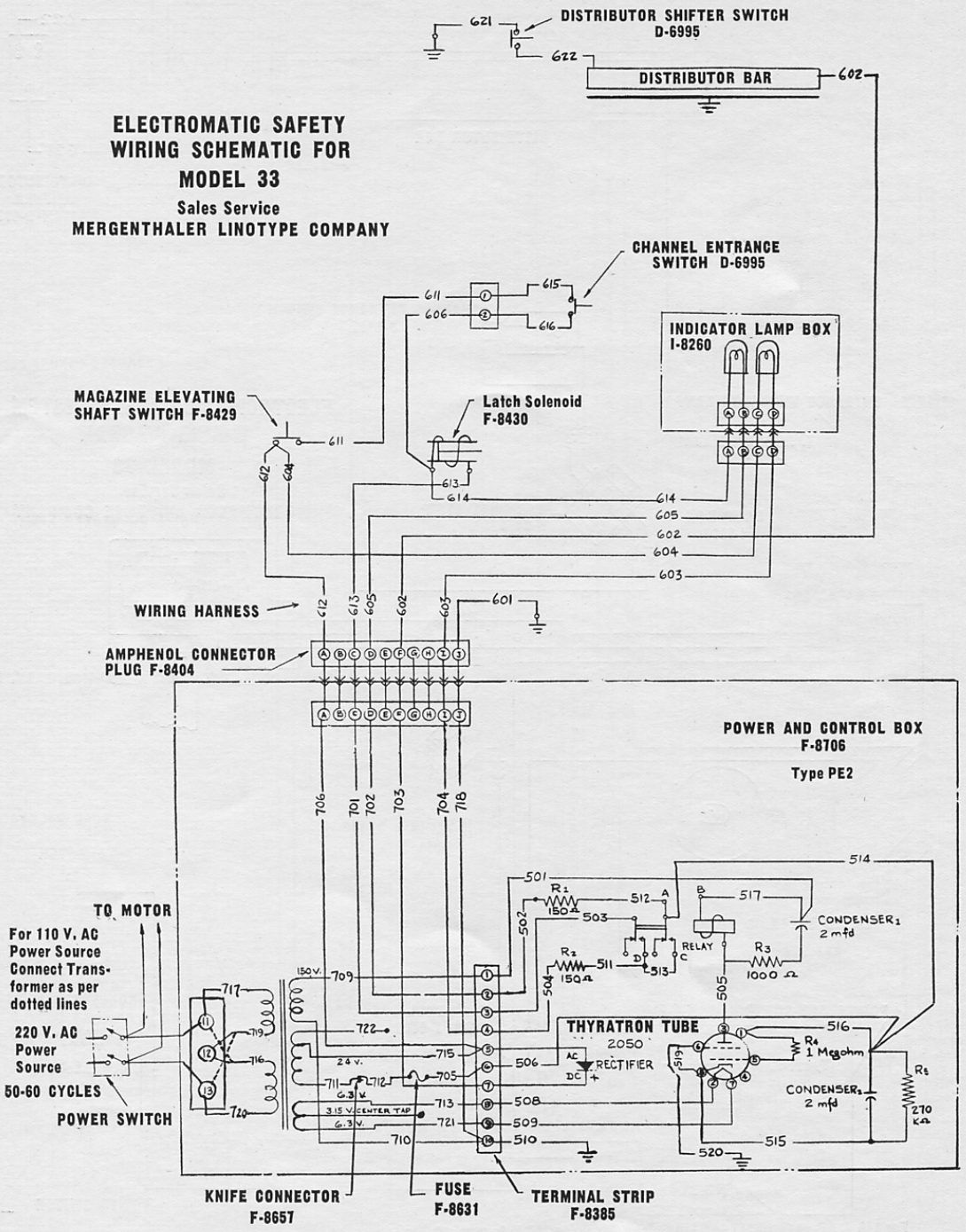

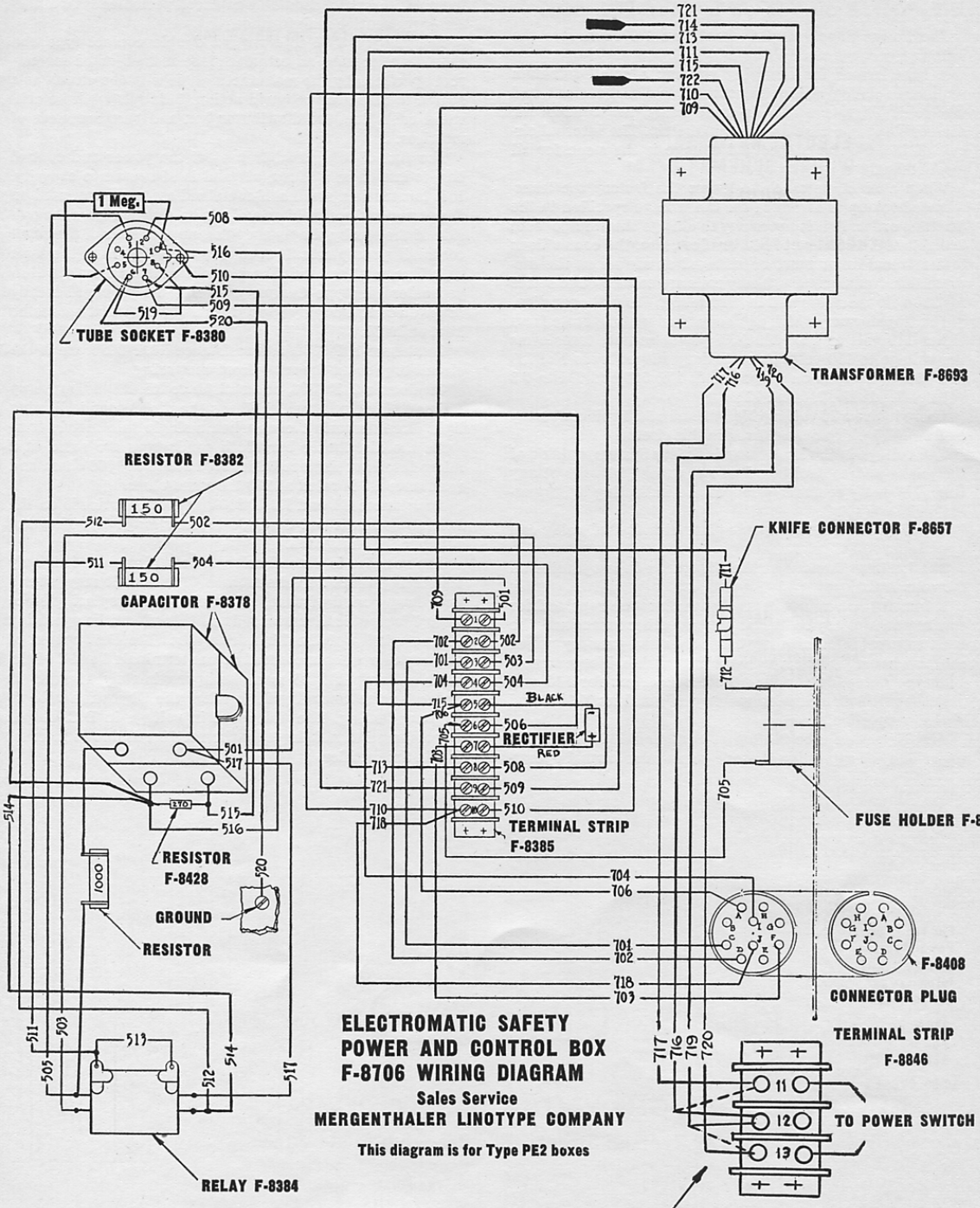

ELECTROMATIC SAFETY POWER AND CONTROL BOX F-8706 WIRING DIAGRAM

Sales Service

MERGENTHALER LINOTYPE COMPANY

This diagram is for Type PE2 boxes

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 POWER SUPPLY AND CONTROL BOX

The Power Supply and Control Box F-8706 houses the following:

A transformer for changing voltage; a small selenium rectifier to change alternating current to direct current, and electronic Thyratron tube, a small relay, two condensers, five resistances, a fuse and terminal strip. The internal circuit of this box for a specified voltage is the same for all model machines.

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 operation and in parallel for 110 volt operation.

The transformer, which can be hooked up to operate from either 110 volt or 220 volt A.C. power source, transforms the voltage to 150 volts on secondary output leads No. 709 and 710, to 24 volts on output leads No. 715 and 711 to 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 lead No. 714 which are not used in this circuit.

The voltage in the Electromatic Safety System, outside of the power and control box does not exceed 24 volts at any time. The relay contacts, solenoid and indicating light operate on 24 volts A.C.

The Thyratron tube cathode-plate circuit, and relay coil operate on 150 volts, A.C.

The heating filament of the Thyratron tube operates on 6.3 volts A.C.

A transformer cannot be used with direct current, and for this reason a rotary converter or some other means must be used to provide alternating current as the primary power source when only direct current is available. Mergenthaler Linotype Company supplies these converters for 110 volt and 220 volt D.C. operation under part numbers X-1845 and X-1846 respectively.

The Thyratron tube 2050, part number F-8355, has a life expectancy of approximately one year under normal operating conditions and should be replaced periodically as a matter of preventive maintenance.

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. This relay will be 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. It is located in a small self-contained assembly mounted on the power and control box and can be checked from the outside of the box by simply snapping up the cover of the small containing receptacle. 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 micro-farads, resistance R3 is rated at 820 or 1000 ohms, and resistance R5 is rated at 270 thousand ohms.

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.

The rectifier is a small selenium rectifier since it is only converting about 24 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 Thyratron tube. The D.C. output of this rectifier when measured across terminals 6 and 7 of the terminal strip F-8385 must be approximately 10 volts in order for the control grid to allow the Thyratron tube to stop conducting. The difference in voltage in D.C. output as compared to A.C. input to the rectifier is due to internal loss in the rectifier.

• LINOTYPE •

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