Bulletin No. 162
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Book 7

TELETYPE

PRINTING TELEGRAPH SYSTEMS

DESCRIPTION
OF THE
SINGLE MAGNET REPERFORATOR
(MODELS 14 AND 20)

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CORPORATION
SUBSIDIARY OF
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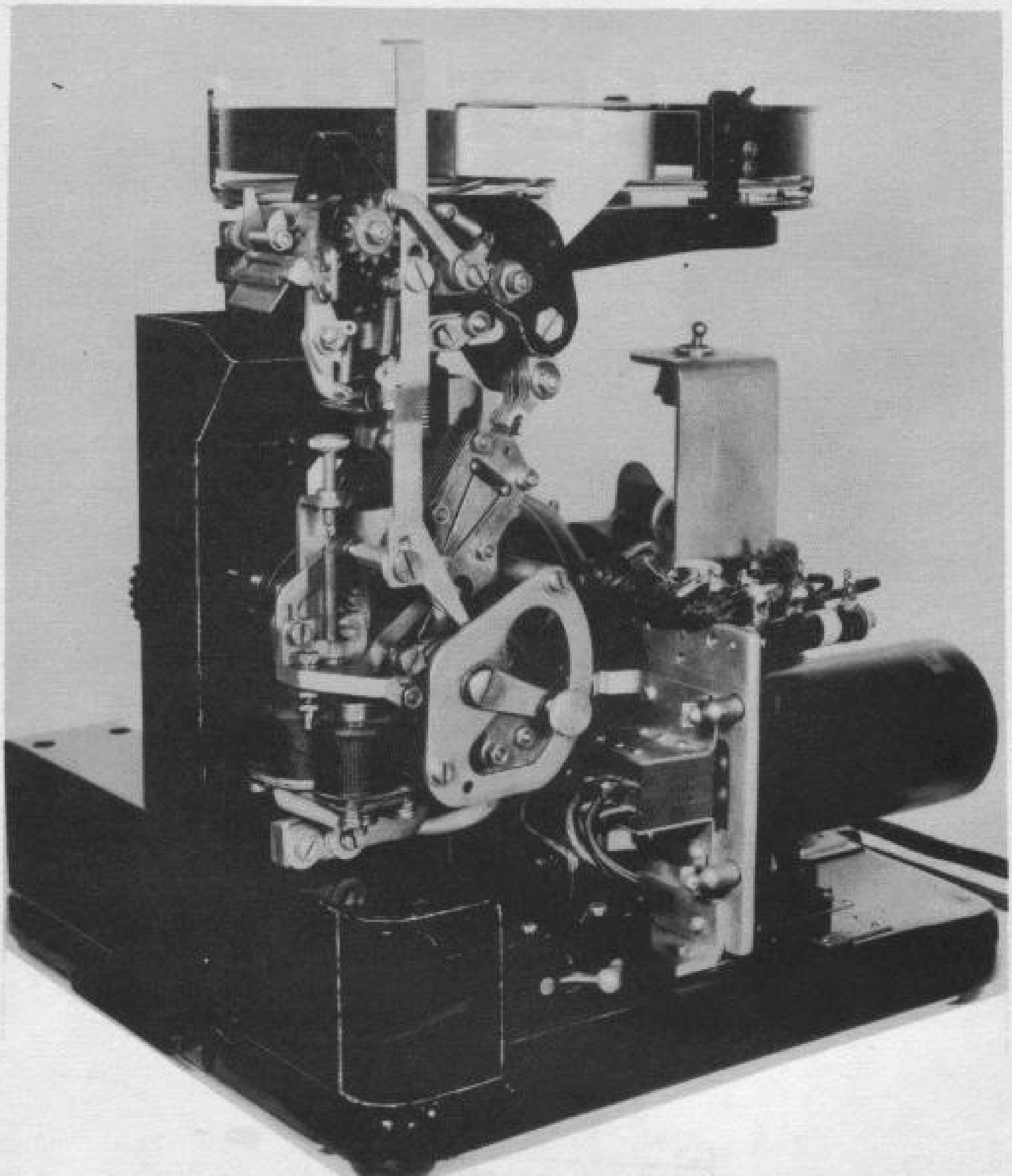


<u>C O N T E N T S</u>

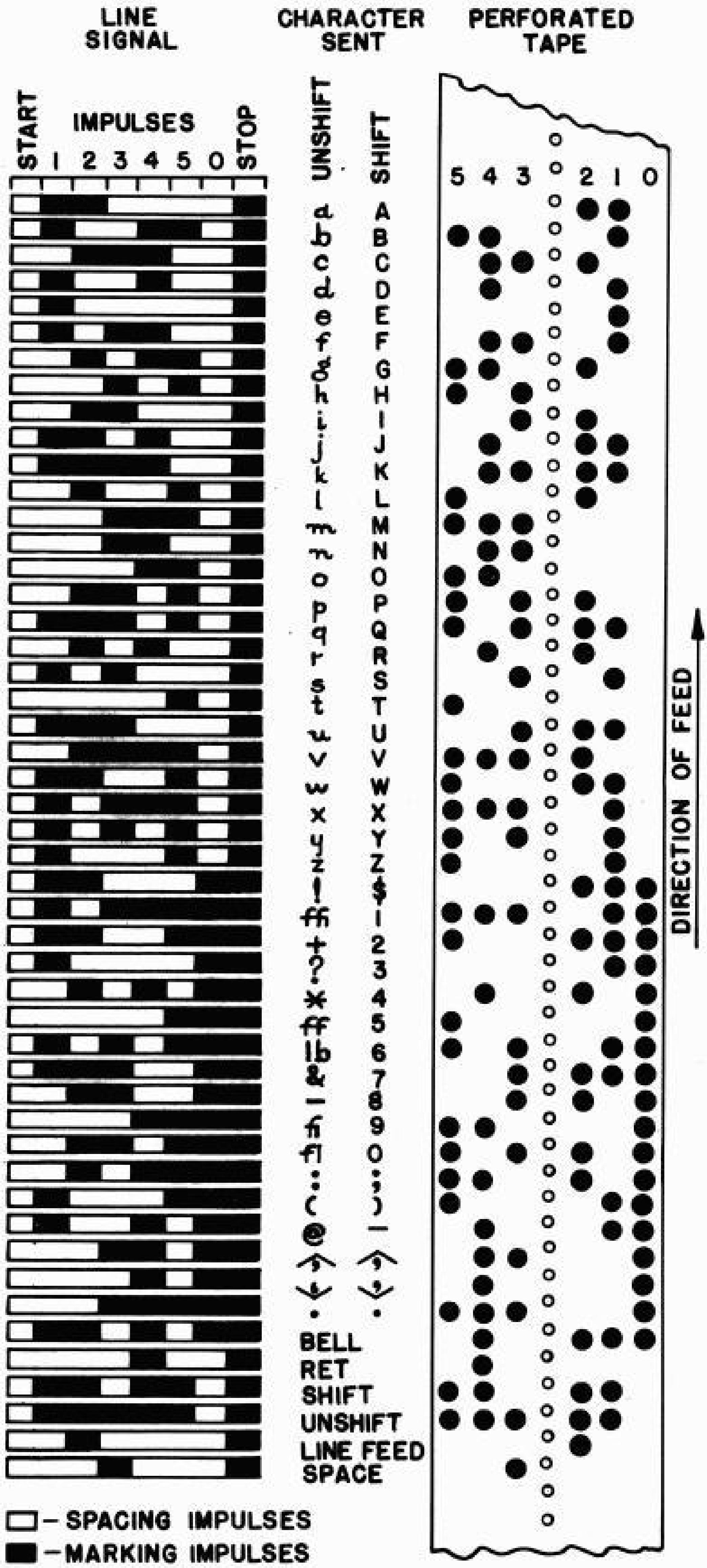

LINE SIGNAL
CHARACTER SENT
PERFORATED TAPE
START
IMPULSES
1 2 3 4 5 0
STOP
UNSHIFT
SHIFT
5 4 3 2 1 0
a b c d e f g h i j k l m n o p q r s t u v w x y z ! ff + ? * ff lb & - fi fl : (@ .
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z $ 1 2 3 4 5 6 7 8 9 0 ;) — .
BELL
RET
SHIFT
UNSHIFT
LINE FEED
SPACE
DIRECTION OF FEED
– SPACING IMPULSES
– MARKING IMPULSES

FIGURE 1.

DESCRIPTION OF THE SINGLE MAGNET REPERFORATOR

14 AND 20 TYPE

General

There are two types of Teletype single magnet reperforators; the 20 type, which operates on the six unit code and the 14 type which operates on the five unit code. This bulletin mainly covers the 20 type six unit reperforator. However, the mechanical parts of the 14 type reperforator are the same as the 20 type except the parts associated with the "zero" pulse are not used, such as the zero selector lever, sword, "T" lever, transfer lever, and punch lever. Also, different range scales, punch blocks, selector cams, feed rolls and guides are used on the five unit reperforators.

The Teletype reperforators are motor driven tape reperforating machines which receive electrically transmitted signals and translate these signals, through the medium of selecting and perforating mechanism into code combinations of holes in a paper tape. This tape may then be used for retransmitting these code combinations on other similar printing telegraph circuits; thus eliminating manual preparation of tape with a perforator at the relaying station.

Signaling Code

The signaling code used for the 20 type single magnet reperforator is a six unit start-stop code which consists of six selecting impulses used in various combinations of current and no-current intervals. Each group of six selecting impulses is preceded by a start impulse and followed by a stop impulse to maintain unison between the sending and receiving apparatus. Impulses which operate the selector magnets are known as marking and those which do not operate the selector magnets are known as spacing. Figure 1 shows graphically the six unit code.

The signaling code used for the 14 type single magnet reperforator is the same as the six unit code except that the zero impulse is omitted.

Main Shaft Assembly

The main shaft (Figure 2) is driven by the motor through the medium of the motor pinion and worm gear. A hub, mounted approximately in the middle of the main shaft, a felt friction washer, a steel disc and a compression spring, comprise the main shaft friction clutch. Projections on the steel disc fit into notches of the punch arm cam hub. On the opposite side of the punch arm cam are projections which engage notches in the driven member of the main shaft clutch. The main shaft clutch spring moves the driven clutch member so as to engage the driving clutch member when permitted to do so by the clutch throwout lever.

The selector cam sleeve is driven through the medium of the friction clutch formed by the selector cam clutch spring, four steel discs and two felt friction washers. (Figure 2).

Selecting Mechanism

The purpose of the selecting mechanism (Figure 3) is to receive signals from the transmitting station, distributing them mechanically thereby setting up various combinations with the transfer levers. The combinations set up with the transfer levers will cause the punch levers to be positioned so as to select certain punches in the punch block. (See Figures 7 and 8). When the punch hammer moves upward, the selected punch pins will be forced through the tape causing a combination of holes to be perforated.

The selecting mechanism is controlled by a selector magnet which receives the code impulses from the line. Normally the armature of this magnet is pulled up and the stop arm (Figure 4) is against the stop lever which in turn is held by the trip latch. The cam sleeve is prevented from revolving because the stop arm, which is a part of the selector cam sleeve, is engaged with the stop lever.

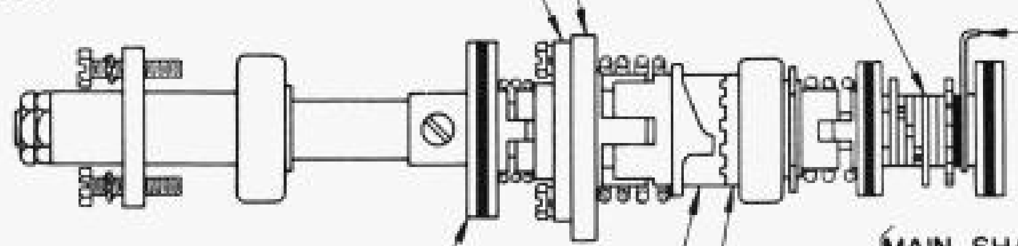


FIGURE 2

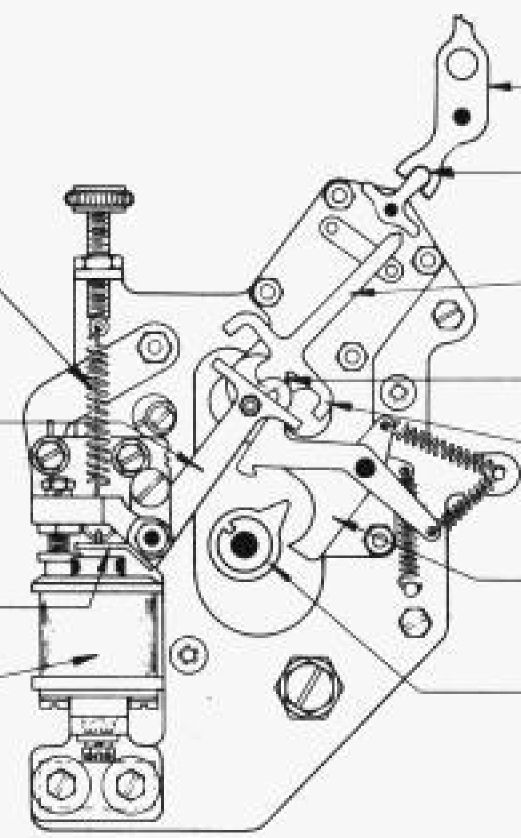


FIGURE 3.

When the start impulse, which is spacing (no current), is received, the armature is released and pulled away from the magnet pole pieces by the armature spring. This moves the trip latch out of engagement with the stop lever, releasing the stop arm and allows the cam sleeve to revolve with the main shaft.

Each transfer lever is operated by a selector cam through the medium of a selector lever, a sword, and a "T" lever (Figures 3 and 4). For instance, suppose that the code for the letter "E" is received. Upon the reception of the start impulse (no current), the armature moves away from the magnet, imparting motion first to the trip latch plunger, which in turn causes the bell crank to move the trip latch out of engagement with the stop lever, releasing the stop arm as explained previously.

The selector cams start to revolve and the number 1 selector cam engages the number 1 selector lever when the first impulse of the letter "E" (marking or current impulse) has been received by the magnets from the line. The magnet is energized, operating the armature, causing the upper end of the armature extension to be in the path of the upper sword arm. When the peak of the number 1 cam passes the number 1 selector lever, the number 1 selector lever is rotated counterclockwise, carrying with it the sword, which strikes the upper end of the armature extension and is in turn rotated clockwise about its pivot "A". This positions the sword so that when the number 1 cam clears the selector lever, the selector lever spring will cause the sword to be moved against the lower end of the "T" lever which in turn causes the number 1 transfer lever to be rotated clockwise, bringing the number 1 punch lever in a position to operate the number 1 punch. As no current is received while the numbers 2, 3, 4, 5 and 0 cams are passing their selector levers, the magnet armature is released and pulled away from the magnet by a spring. The lower end of the armature extension will then be in the path of the lower sword arms. As the numbers 2, 3, 4, 5 and 0 cams pass the numbers 2, 3, 4, 5 and 0 selector levers, the numbers 2, 3, 4, 5 and 0 transfer levers will be moved counterclockwise. The transfer levers will be held in this position until the perforation in the tape of the letter "E" combination has been completed.

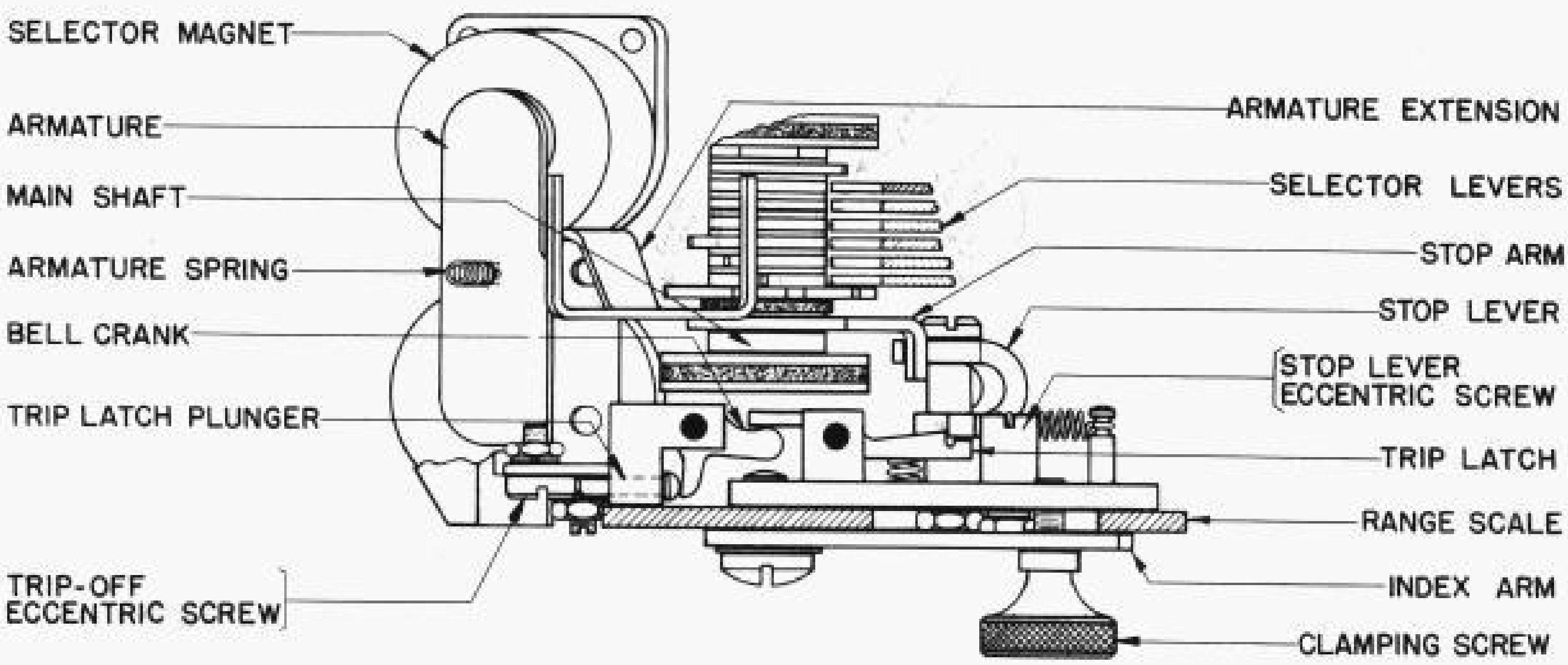


FIGURE 4.

The sixth cam releases the main shaft clutch allowing the punch arm cam to start revolving. As the punch arm roller rides up on the high part of its cam the punch arm link will force the punch hammer upward, carrying with it the punch levers. The selected number 1 punch lever will force the number 1 punch pin upward, through the tape, thus perforating a hole in the number 1 position in the tape.

Locking Cam

The locking cam on the selector cam sleeve assembly against which the locking lever is held by a spring, has six low and six high portions (for the six unit) and five low and five high portions (for the five unit) on its periphery (Figure 5). During that part of each impulse, when the swords are set by striking against the armature extension (at the time the peak of any selector cam is operating the corresponding selector lever) a low portion of the locking cam is opposite the locking lever. The armature will now be held firmly in position by the "U" shaped extension of the locking lever engaging the locking wedge on the armature extension. When the locking lever is riding on a high portion of the locking cam, the locking lever extension will be held away from the locking wedge, and the armature will be free to move in response to the next impulse.

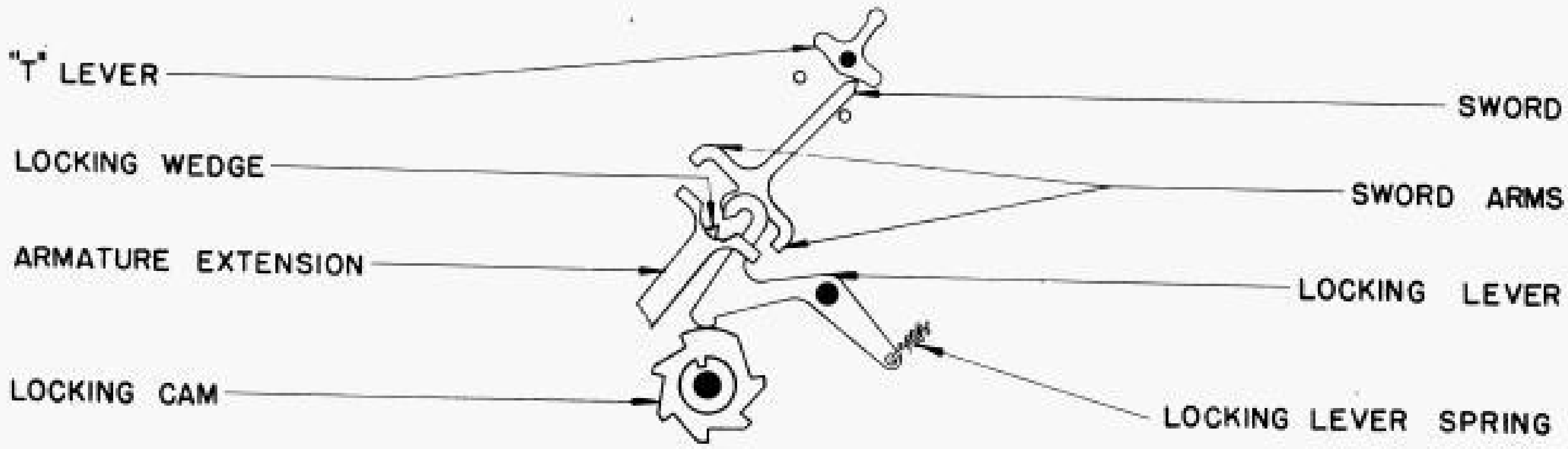


FIGURE 5

Main Shaft Clutch Throwout Lever

As previously described, the sixth cam on the selector cam sleeve, releases the main shaft clutch, allowing the punch arm cam to make one complete revolution. At the end of each revolution of the punch arm cam the clutch stop arm engages with the projection on the driven clutch member and cams it out of mesh with the driving clutch member (Figure 6).

Immediately after the zero impulse has been received, the peak of the sixth cam strikes the clutch throwout lever arm, moving the clutch stop arm out of engagement with the projection on the driven clutch member. This will permit the clutch spring to move the driven clutch member into mesh with the driving clutch member. Thus, it may be seen that immediately after the completion of the selection of the punch levers, the punch arm cam will be permitted to revolve one revolution which will effect the perforation of a combination of holes in the tape.

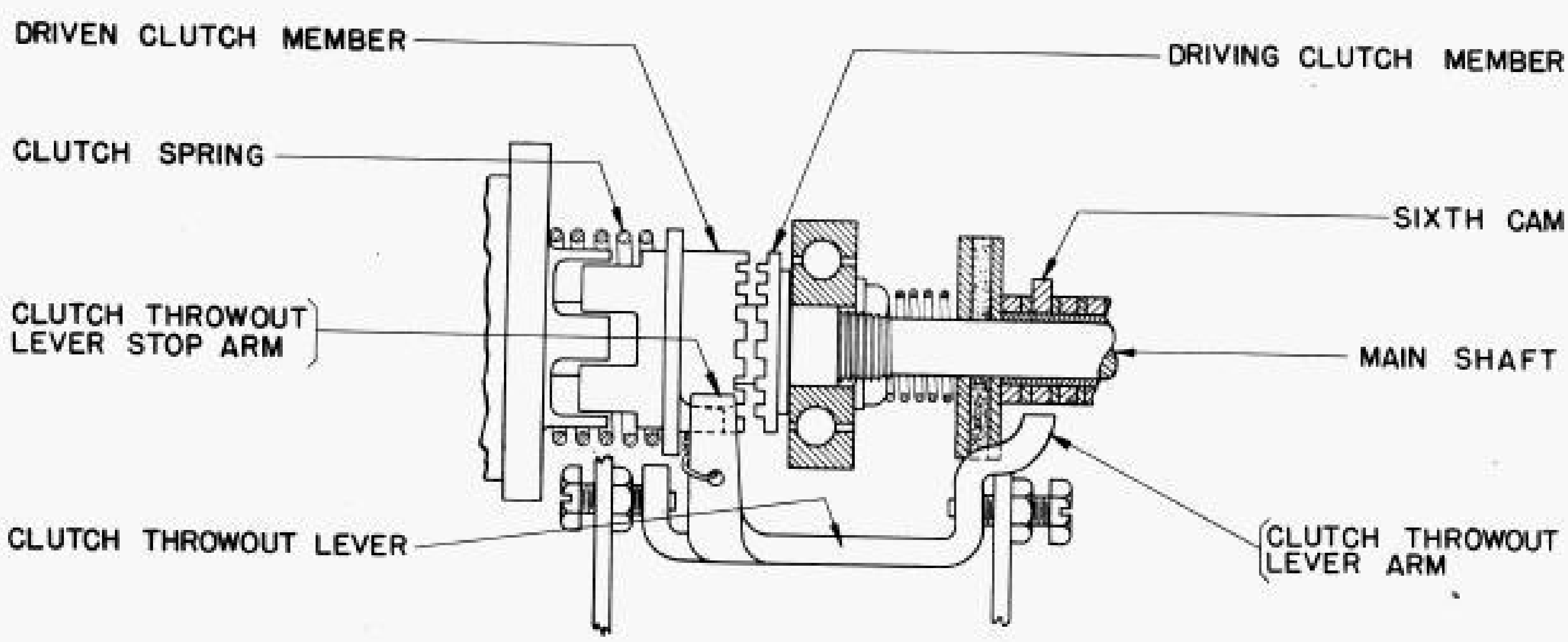


FIGURE 6.

Perforator Mechanism

Above the selecting mechanism is the perforator mechanism which consists essentially of a punch block with a set of punches for perforating the tape, a punch hammer, a set of punch levers and a tape feed mechanism (Figures 7 and 8).

The punch levers rest horizontally in guide slots in the punch hammer, just below and in line with the punches. The rear end of each punch lever is attached to a transfer lever (Figure 7) which in turn is connected to a "T" lever of the selecting mechanism.

At the rear of the punch hammer and extending over the tops of the transfer levers is a lock bail (Figure 8). When the punch hammer moves upward, the lock bail will move downward and hold the operated or selected transfer levers in position until the perforating operation has been completed and the punch hammer is returned down to its normal unoperated position. The lock bail will then be moved upward, releasing the selected transfer levers. The part of the punch hammer that is used as a guide for the punch levers has a raised portion in the center, directly under the middle punch on the 20 type reperforator or the third punch from the inside on the 14 type reperforator. This raised portion, on the punch hammer, will operate its corresponding punch pin, the feed hole punch pin, every time the punch hammer is operated. The feed hole punch pin perforates small holes in the tape that are used for feeding the tape forward.

Tape Feeding Mechanism

Spaced at equal intervals around the periphery of a tape feed roll, located in front of the punch block, is a series of projecting tape feed pins which mesh with the feed holes punched in the tape. A tape tension lever (Figure 8) holds the tape against the tape feed roll, keeping the feed holes, in the tape, in constant mesh with the tape feed pins.

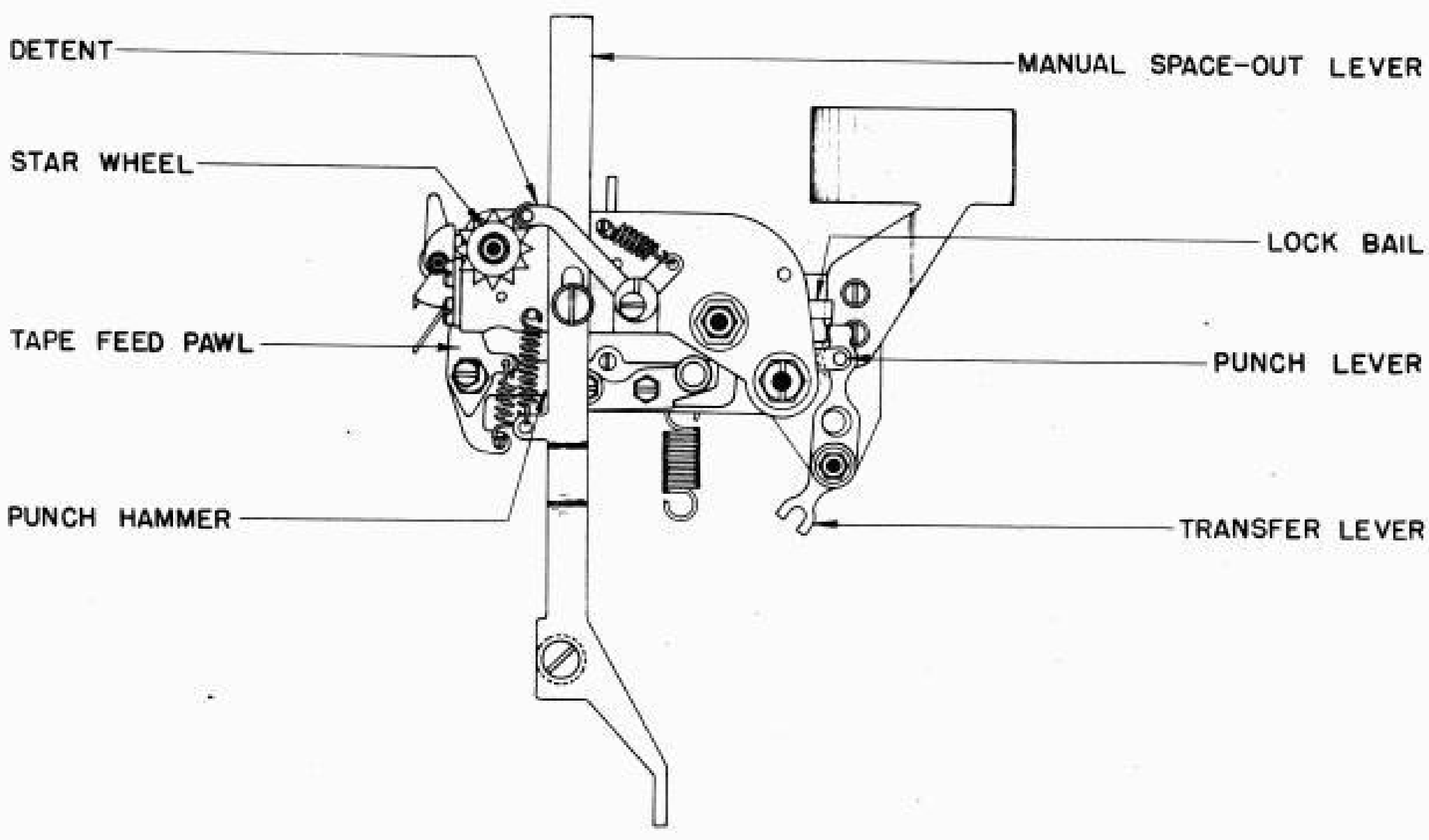


FIGURE 7.

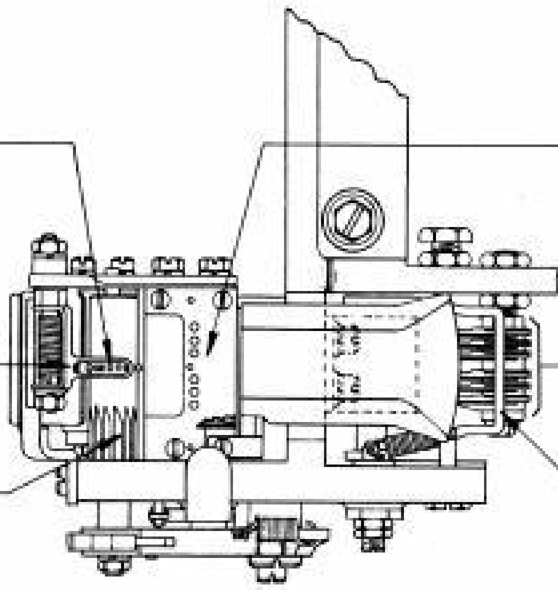


FIGURE 8.

During the upward movement of the punch hammer, the tape feed pawl (Figure 7), which is attached to the punch hammer, engages the next tooth on the tape feed roll. When the punch hammer moves downward, the tape feed roll will revolve, advancing the tape one code combination space. A star wheel and detent are provided to insure equal spacing of the tape (Figure 7).

Space-out Lever

The reperforator is equipped with a manual space-out lever (Figure 7) so that the tape may be spaced out when necessary, independently of the line signals. This lever may be used when starting a new roll of tape or to cause additional tape to be perforated at the end of a message so that the end of the message will be beyond the tearing edge.

If a transmitter distributor is used in connection with the reperforator, the space-out lever may be used to space out enough tape to permit the last message to be transmitted, thus avoiding the necessity of tearing the tape.

The lower end of the space-out lever, when depressed, will cam the range finder assembly bell crank out of engagement with the trip latch plunger and the trip latch will be held away from the stop lever, thus allowing the selector cam sleeve to revolve. The letters or rub-out combination will continue to be selected and perforated until the space-out lever is released.

Motor Speed Control

In order to maintain the transmitting and receiving stations at the proper speed, each motor (excepting synchronous motors) is equipped with a governor attached to one end of the motor shaft (Figure 9).

The governor contact arm is a bent strip of metal which has a contact mounted on one end and is fastened by a flat spring at the other end. A spring attached to the middle of the contact arm holds the contact point against a companion contact point until the centrifugal force of the contact arm overcomes the tension of the spring. When the contacts open, a resistance is connected into the motor circuit which tends to reduce the speed of the motor. The closing and opening of the contact points holds the motor speed constant depending on the tension at which the spring is set. The spring tension (which determines the motor speed) is adjusted by rotating the speed adjusting wheel which projects through the governor cover.

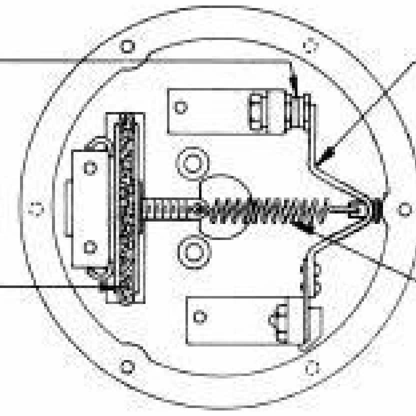


FIGURE 9

The governor is equipped with a speed target consisting of alternate black and white spots. A tuning fork, with shutters attached to the ends of the tines, is used to visually check the motor speed. With the contact arm spring adjusted for the proper spring tension, the spots on the target will appear to be stationary when observed through the shutters of the tuning fork, which should be tapped lightly to cause the tines to vibrate.

Some reperforators have a lamp with a switch mounted on a bracket to provide illumination for the speed target when a governor equipped motor is used.

Reperforators equipped with synchronous motors (which are constant speed motors) require no speed setting.

Synchronism

Transmitted signals sent out by the transmitting mechanism will not be interpreted correctly by the receiving mechanism, unless the receiving mechanism is kept in synchronism with the transmitted signals.

Synchronism is maintained by having the receiving cam sleeve rotate faster than the transmitter and by use of the start and stop impulses in the following manner:

The reception of the start impulse starts the receiving cam sleeve revolving and at that moment, the transmitting shaft and receiving cam sleeve are in unison. The receiving cam sleeve revolves one-twelfth faster (on 20 type six-unit reperforators the speed difference is one-twelfth, while on 14 type five-unit reperforators the speed difference is one-seventh) than the transmitting shaft, but the receiving cam sleeve is so constructed that the distance traveled from the position where the receiving cam sleeve starts to move a selector lever to the position where it starts to move the next selector lever is one-twelfth greater than the distance traveled by the transmitting shaft from where it can control the transmission of one impulse to where it can control the next. In other words, for a certain travel of the transmitting shaft, the corresponding travel for the receiving cam sleeve is one-twelfth greater, but as the receiving cam sleeve travels one-twelfth faster, it will reach its second position at the same time the transmitting shaft reaches its second position.

The receiving cam sleeve completes its revolution before the transmitting shaft completes its revolution, but the transmitting shaft will cause a stop impulse to be transmitted which stops the receiving cam sleeve until the transmitting shaft again causes the start impulse to be transmitted. Normally, when the receiving cam sleeve is one-twelfth faster than the transmitting shaft, the receiving cam sleeve is at rest one-twelfth of the transmission time. If the speed of the receiving cam sleeve is slightly faster than its proper speed, the only effect will be that it will remain at rest just that much longer. If its speed is slightly slower than its proper speed, it will remain at rest just that much less time. Of course, there will be a slight error in the relative position of the receiving cam sleeve in the various positions, but the mechanism is constructed to provide for this and due to the fact that the receiving cam sleeve starts each revolution in unison with the transmitting shaft, this error does not become accumulative.

Orientation

In order to properly operate the selector mechanism, it is necessary to place the starting point of the receiving cam sleeve in the most favorable position. This is accomplished by means of the range finding mechanism, which is used to orient or take a range.

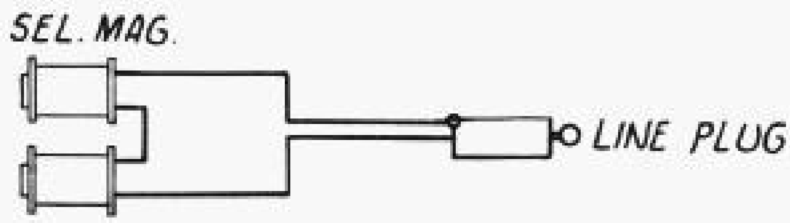
Mounted on the stop lever plate (which is a part of the range finding mechanism) are the stop lever and the trip latch which may be rotated, thereby varying the relation between the start of the receiving cam sleeve and the time the receiving cam sleeve operates a selector lever (Figure 4). A graduated scale indicates the setting of the stop mechanism, and a clamping screw holds it in place after having been set.

The range is determined while receiving "4Y" for six unit and "RY" for five unit on the reperforator, by first moving the range finder index arm in one direction until errors appear and then back slowly until the errors disappear and noting the position on the scale. In a similar manner the other limit of the range is located by moving the index arm toward the opposite end of the scale. The proper setting is the midpoint of these two limits.

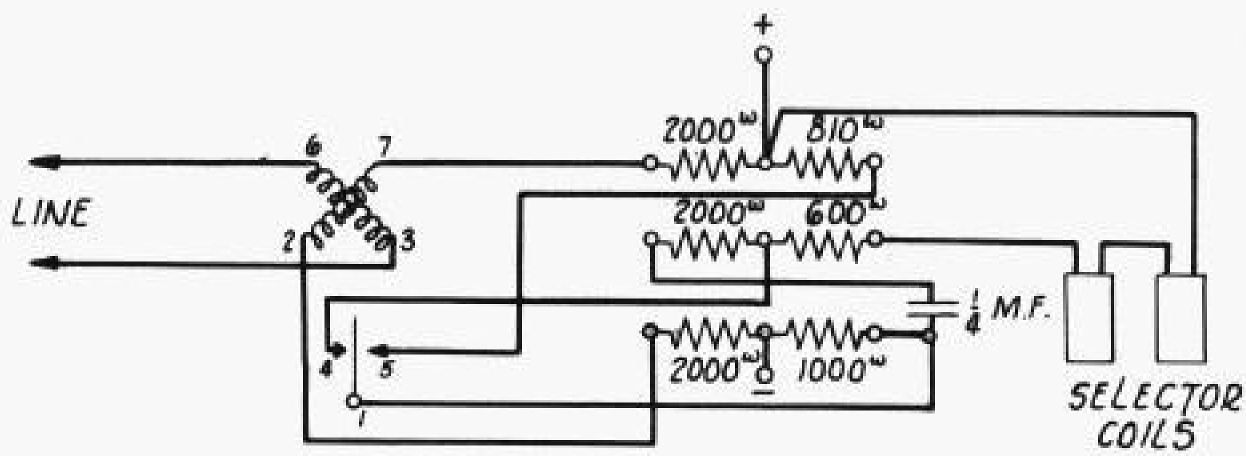
Wiring Diagram

Wiring diagram W.D. 1591 shows the theoretical wiring of 14 and 20 type reperforators.

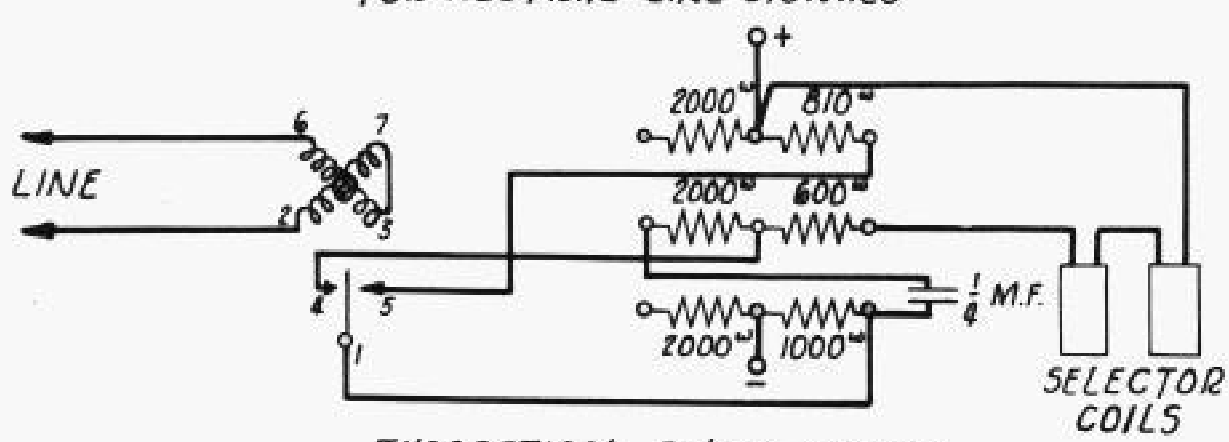
REVISIONS



THEORETICAL LINE CIRCUIT
WITHOUT LINE RELAY



THEORETICAL RELAY CIRCUIT
FOR NEUTRAL LINE SIGNALS



THEORETICAL RELAY CIRCUIT
FOR POLAR LINE SIGNALS

TELETYPE CORPORATION

W.D. 1591
JAN. 29, 1936

THEORETICAL WIRING DIAGRAM #14 AND #20 TYPE REPERFORATORS

DRAWN H.W.H.
TRACED E.W.
CHECKED E.F.R.
ENG'RD. H.W.H.
APPROVED JCP