

*J. C.*

DESCRIPTION OF OPERATION OF NO. 15-TYPE  
PERFORATOR TRANSMITTER

This section describes the operation of the No. 15 Perforator Transmitter. It has been issued principally for use in training Bell System teletypewriter repairmen. It is reproduced from material originally prepared for other purposes with such modifications as

seem desirable to facilitate its use in conjunction with other Bell System practices in the proposed training work. The basic operating principles are described but no attempt has been made to include recent improvements and changes.

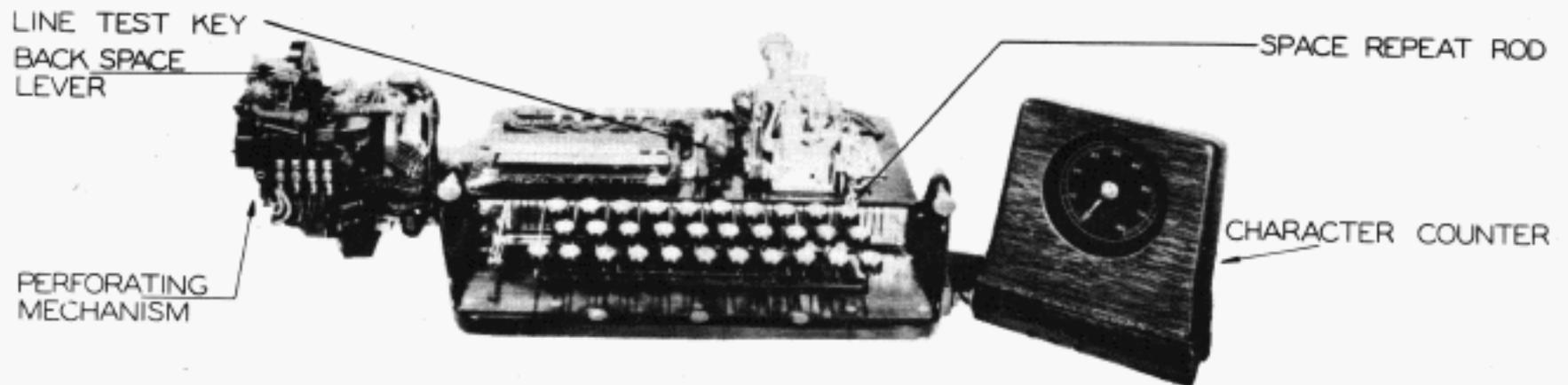


ILLUSTRATION 1

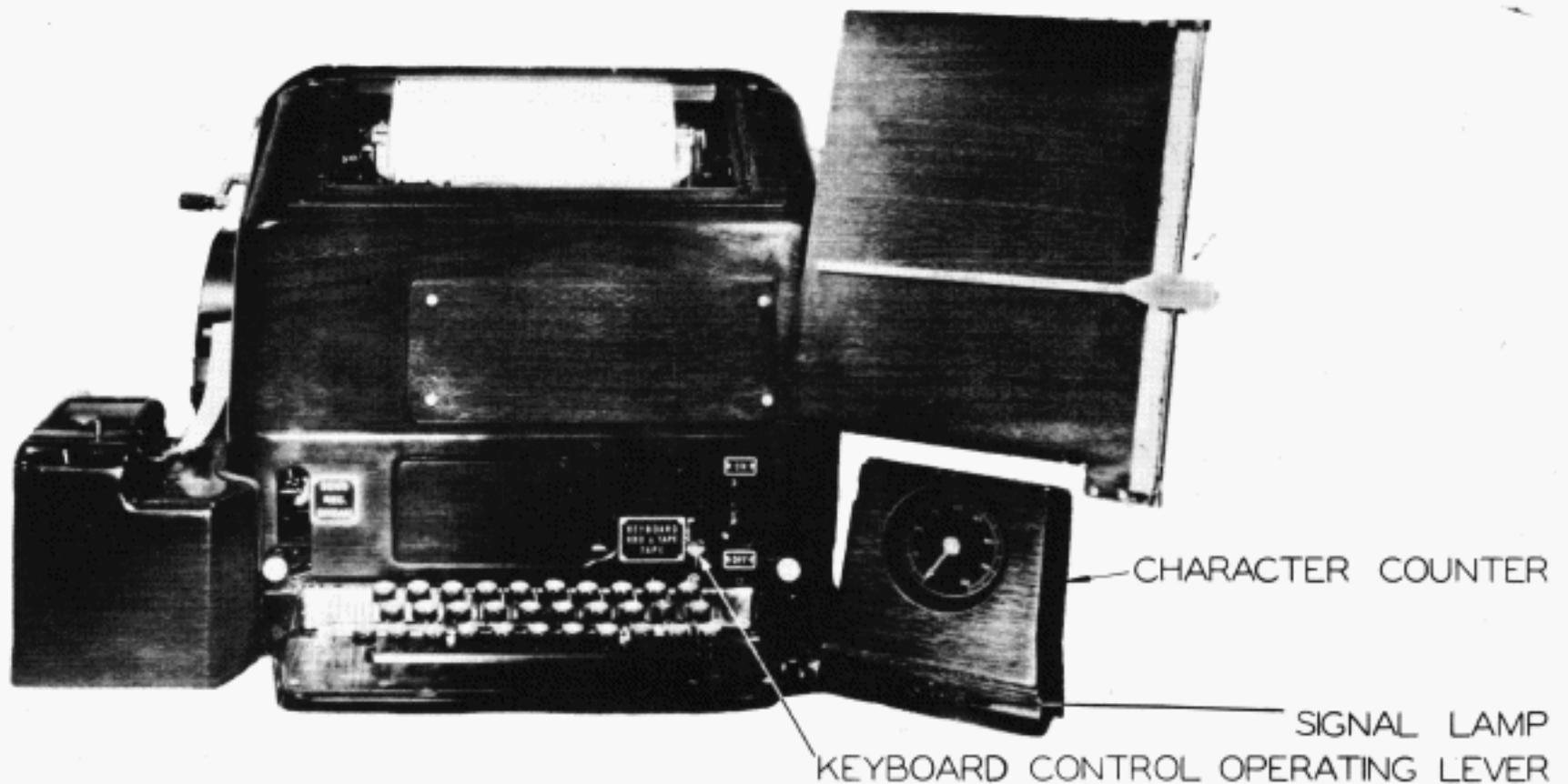


ILLUSTRATION 2

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GENERAL

The 15 type perforator transmitter (Illustration 1) is arranged for use on 15 type printer sets in place of the standard direct keyboard. It has a tape perforating mechanism and character counter in addition to the features on the standard direct keyboard unit. The perforator transmitter fits into the 15 type printer base, and the entire set is enclosed by a special cover to form the complete set as shown in Illustration 2.

A manually operated, three position keyboard control operating lever, mounted on the right side of the unit, permits the operator to select any of the following methods of operation:

1. Operating Lever in Upper or "Keyboard" Position

Direct keyboard transmission to the line with a printed record being produced at the transmitting point. The maximum speed of the keyboard is limited to the predetermined speed of the set.

2. Operating Lever in Middle or "Keyboard & Tape" Position

Simultaneous direct keyboard transmission to the line and perforation of tape with a printed record being produced at the transmitting point. The maximum speed of the keyboard is limited to the predetermined speed of the set.

3. Operating Lever in Lower or "Tape" Position

Perforation of tape only with the associated printer either receiving messages from a distant station, or monitoring the message perforated in the tape as it is being transmitted to the line.

The indicator on the character counter moves each time a character key is depressed and returns to its zero position when the "Carriage Return" key is depressed. The counter is provided with a signal lamp to indicate when the end of a line is being approached. The maximum speed of the keyboard in this case is not limited to the predetermined speed of the set and the operator may, therefore, perforate tape at speeds much higher than the speed at which a tape transmitter would send to the line.

4. Operating Lever in Middle or "Keyboard & Tape" Position and Line Test Key in "Test" Position

It is also possible to perforate tape and print a home record without transmitting directly to the line when the line test key (located near the center of the keyboard) is

in the "Test" position. This method is helpful in preparing perforated tape for use in connection with printed forms. The maximum speed of the keyboard is limited to the predetermined speed of the set.

Signaling Code

The signaling code used to transmit characters is the "Start-stop" five-unit code, which consists of five selecting impulses used in various combinations of current and no-current intervals. Each group of five selecting impulses is preceded by a start impulse and followed by a stop impulse, which are used to maintain synchronism between all stations on the circuit. Impulses which operate the selector magnets on the printer are known as marking, and those which do not are known as spacing. Fig. 1 shows graphically the five unit code.

DIRECT KEYBOARD MECHANISM

The direct keyboard mechanism (Figs. 2 and 3) is mounted on the keyboard casting, and consists essentially of a set of key levers, selector bars, "Y" levers, "Y" lever connecting links, and locking levers used in selecting the code combination to be transmitted; a transmitting cam sleeve assembly, contact levers and contact springs for transmitting the selected code; a universal bar, trip off pawl, intermediate pawl, clutch throw out lever, and clutch used in starting and stopping transmission. The transmitting cam sleeve and its controlling clutch are supported by a transmitting shaft, which derives its motive force from a gear mounted on the main shaft of the typing unit. This gear engages a drive gear on the rear end of the transmitting shaft of the perforator transmitter. The transmitting cam sleeve assembly is normally held stationary due to the disengagement of the clutch teeth by the clutch throw out lever.

Beneath the key levers are six pairs of parallel motion selector bars and a universal bar, which extend across the width of the keyboard.

The selector bars are guided at both ends so that they may be moved upward or downward. They are provided with rectangular notches on their upper edges according to the requirements of the code. The notches in the front and rear selector bars of each pair are staggered so that there will always be a high portion on either one of the pair in the path of each key lever. The ends of each pair of selector bars rest on the arms of "Y" levers; the front selector bar of each pair resting on the left arms of the "Y" levers; and the rear bar of each pair resting on the right arms.

When a key lever is depressed, those selector bars having their high portions in line with that key lever are moved downward. This

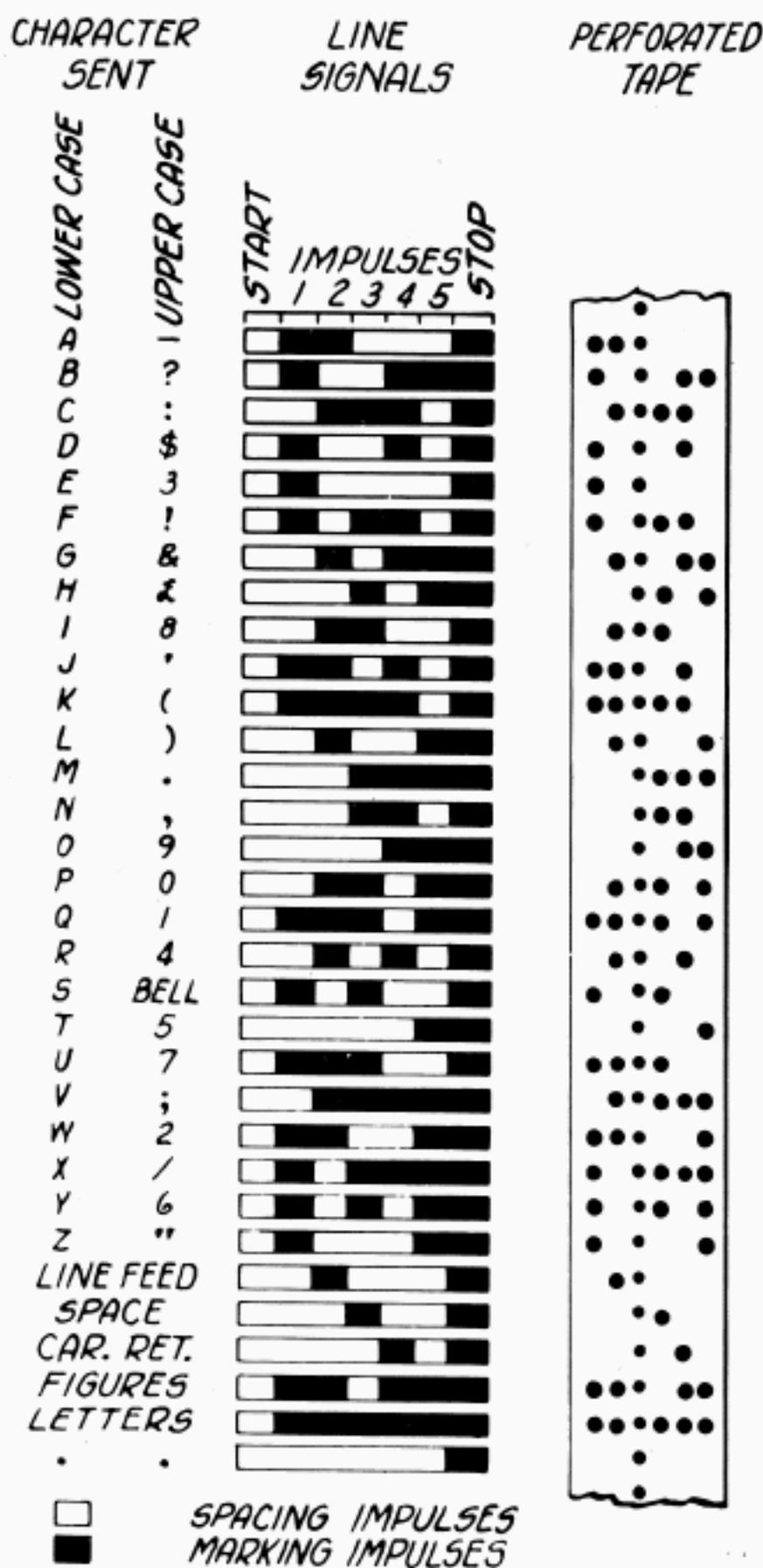


Fig. 1

causes the "Y" levers to move the other bar of each pair upward. Should the rear bar of any pair be moved downward, the lower extensions of the corresponding "Y" levers will be moved to the left; similarly, they will be moved to the right when the corresponding front selector bars are moved downward. Thus, it may be seen that the "Y" lever connecting links which are attached to the ends of the lower extensions of the "Y" levers will be moved to the

left when the rear selector bar is moved downward, and to the right when the front selector bar is moved downward. Each of the first five "Y" lever connecting links engages a locking lever and positions it to correspond with the signal impulse to be transmitted. Each locking lever controls the motion of a contact lever by either allowing the contact lever to rotate on its pivot due to the pressure exerted by the contact spring upon the contact lever, thereby permitting the contact to close, or by engaging the contact lever and preventing closure of the contacts. If the upper end of the locking lever is positioned to the left, corresponding to a spacing impulse, it engages the contact lever and prevents it from rising into the indent of its corresponding cam as the cam sleeve rotates, thus holding the circuit open for that interval. If the upper end of the locking lever is positioned to the right, corresponding to a marking impulse, it does not interfere with the movement of the contact lever. Then, as the cam sleeve revolves, the contact lever riding on the cam surface rises into the indent of the cam, permitting its contact to close and to send out a marking impulse.

The universal bar, which is connected to the trip off pawl, controls the starting of the transmitting cam sleeve. It is pivoted at both ends in such a manner that the depressing of any key lever rotates it downward, and moves the trip off pawl forward. This action releases the clutch throw out lever from the driven member of the clutch by means of the intermediate pawl, permitting the sending cams to start rotating. As the cams rotate, the impulses, either marking or spacing, are transmitted in succession.

The start-stop cam (Fig. 3) controls an additional contact lever which, in turn, actuates the start-stop contacts. These contacts are opened at the beginning of each revolution of the cam sleeve assembly to transmit the start impulse (spacing or no-current impulse), and remain open during the transmission of the five selected impulses. After the last selected impulse has been transmitted, the start-stop contacts will again close, sending the stop impulse (marking or current impulse) to the line. At the end of the revolution of the cam sleeve assembly, the clutch driven member is cammed out of mesh with the driving member by the clutch throw out lever, which prevents the cams from rotating further until the next key lever is depressed.

The keyboard is equipped with a space repeat device which permits the transmission of continuous spaces. When the spacer bar is held depressed, the space repeat rod, (Illustration 1) attached to the spacer loop extension, will move the intermediate pawl forward, in turn, holding the clutch throw out lever out of engagement with the projection on the

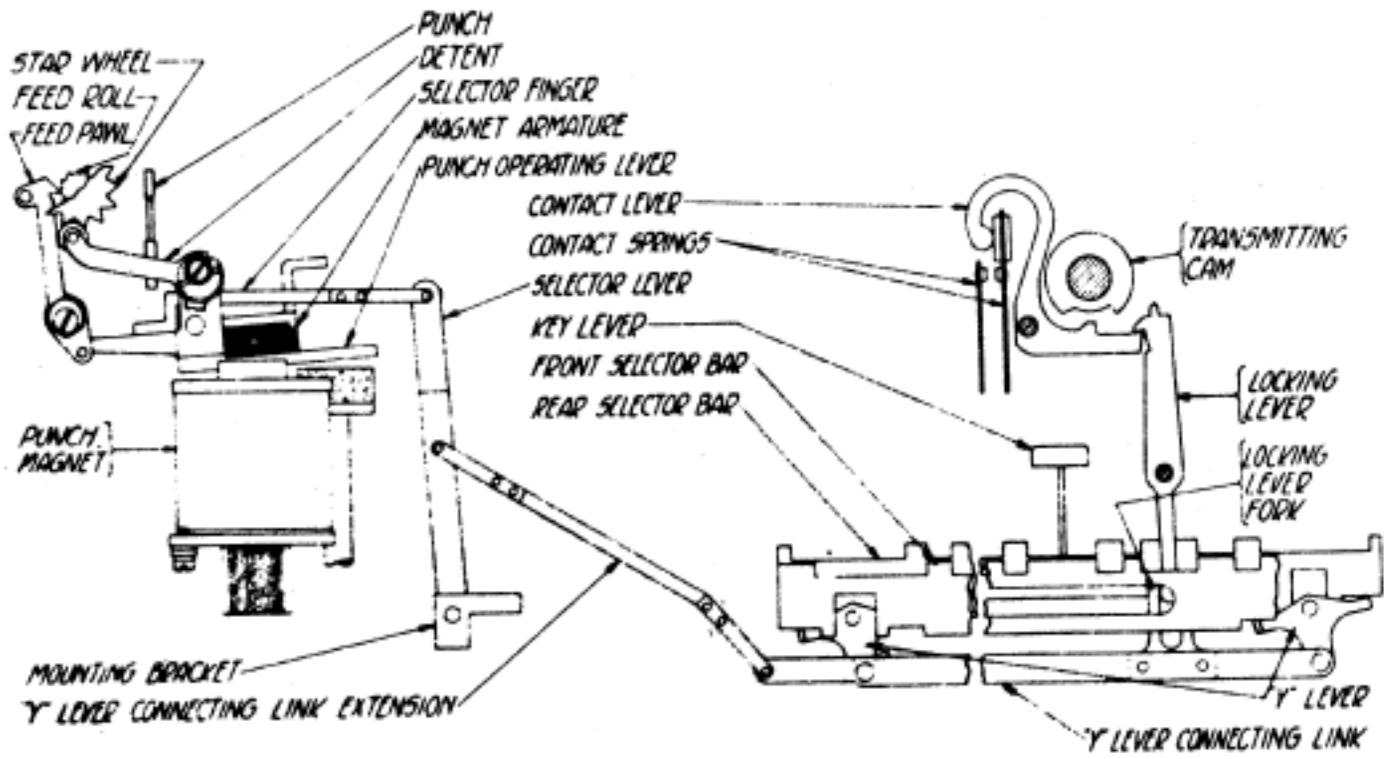


Fig. 2

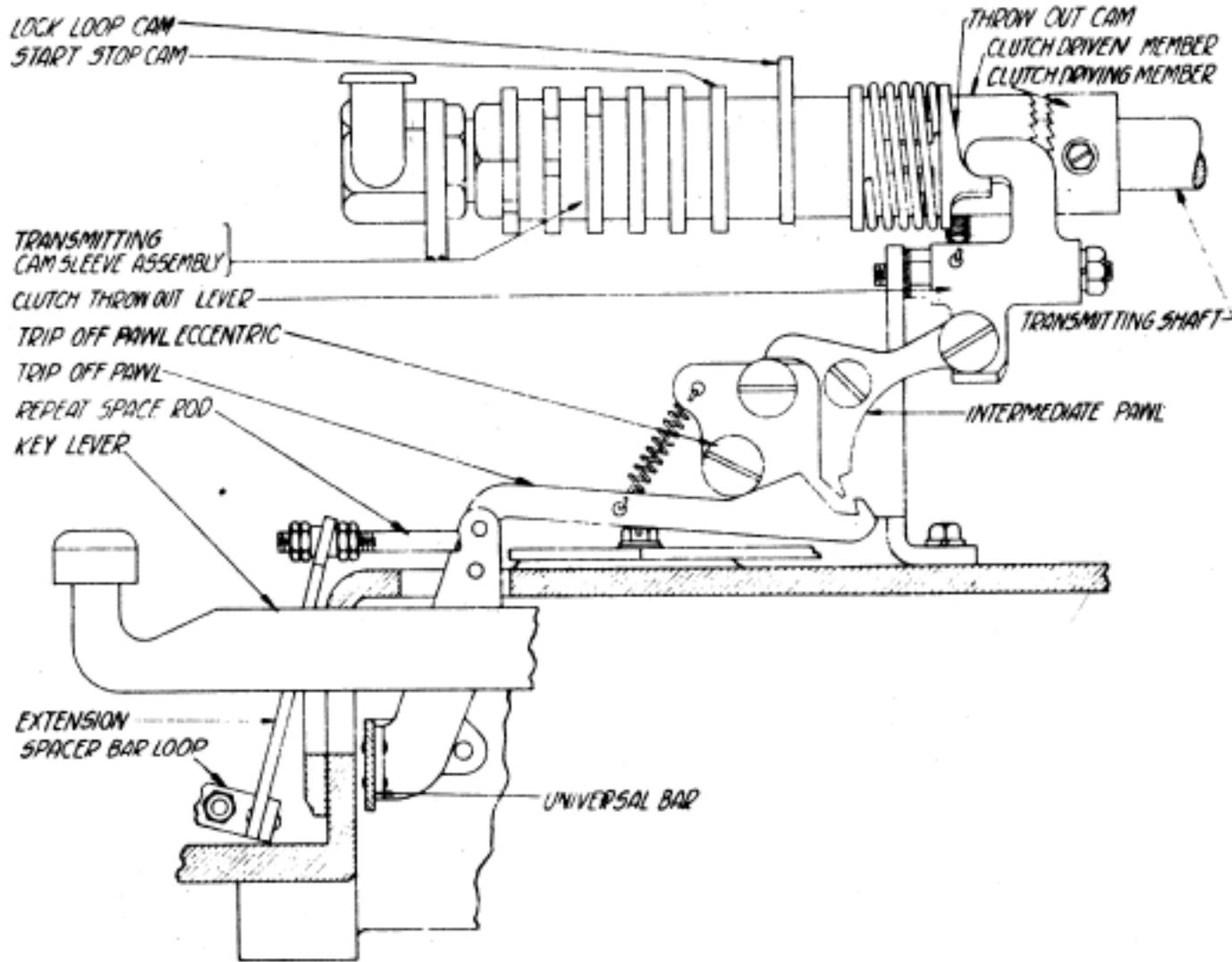


Fig. 3

driven clutch. Thus the transmitting cam sleeve will be permitted to revolve continuously until the spacer bar is released.

#### PERFORATOR MECHANISM

Attached to the left side of the keyboard casting is a bracket which mounts the perforator mechanism consisting, essentially, of a set of punches for perforating the tape; a punch magnet and punch operating lever for operating the punches; a set of selector fingers, selector levers and "Y" lever connecting link extensions used in selecting the punches; and a tape feed mechanism (Fig. 2).

The selector fingers rest in horizontal guide slots in the punch operating lever just below the punches and in line with them. The right end of each selector finger is attached to a selector lever that pivots on a mounting bracket at its lower end. A "Y" lever connecting link extension connects the left end of each "Y" lever connecting link to the central portion of its corresponding selector lever in such a manner that each selector finger will move to the right or left in accordance with the movements of the "Y" lever connecting links. It should be noted that both the selector fingers and the locking levers respond to the code selection whenever a key lever is depressed.

The magnet armature is mounted on a centrally pivoted punch operating lever. When the right end of the punch operating lever is attracted by the magnet, the left end rises, carrying the left ends of the selector fingers upward. If a selector finger is in its left or operated position when the punch operating lever rises, the corresponding punch will be pushed through the tape. If a selector finger is in its right or unoperated position, it will clear the corresponding punch as it moves upward, and that punch will not perforate the tape.

When any key lever is depressed, the punch magnet is operated either by means of a pair of universal selector bar contacts, mounted on the perforator bracket (Fig. 4); or by means of a set of cam pulsing contacts, located above the transmitting cam sleeve (Fig. 5); or it may remain unoperated, depending on the setting of the keyboard control operating lever and its associated perforator control contacts (Fig. 6).

With the keyboard control operating lever in its upper "Keyboard" position, the perforator control contacts, of which there are three pairs, will be opened. With these contacts open, the punch magnet cannot be energized, due to both the universal selector bar contacts and the cam pulsing contacts being wired in series with them. Only direct keyboard transmission is possible with the lever in its upper position.

With the keyboard control operating lever in the middle or "Keyboard and Tape" position, the lower pair of perforator control contacts only are closed. This permits the punch magnet to be energized by means of the cam pulsing contacts. These contacts, of which there are two pairs, are wired in parallel and close as a result of their operating springs riding into the indents on two of the transmitting cams (Fig. 5). The sequence of this operation is such that the first pair of cam pulsing contacts closes the circuit through the punch magnet just as the start-stop contact is opened to transmit the start impulse. Just before the first pair of contacts open, the second pair closes. Through this overlapping action of the contacts, the magnet is energized long enough to insure proper operation. With the keyboard control operating lever in this position, one may transmit from the keyboard directly to the line and simultaneously perforate a tape.

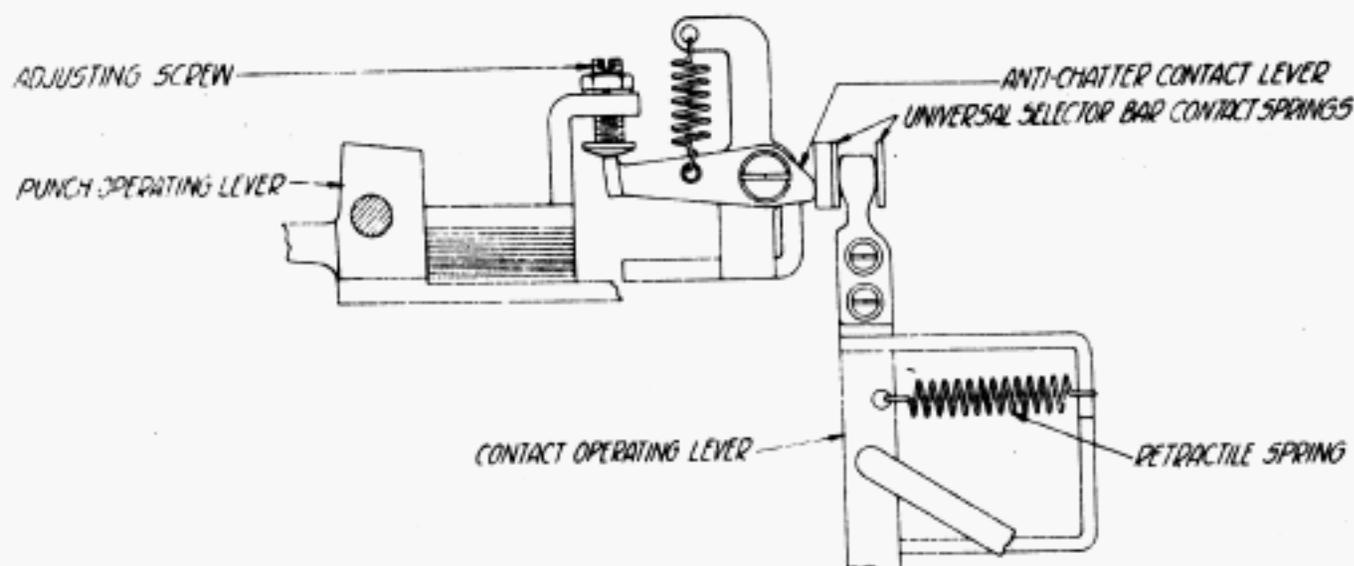


Fig. 4

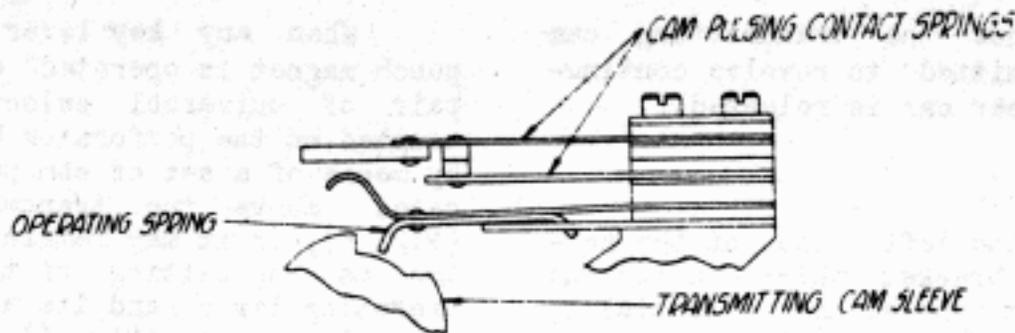


Fig. 5

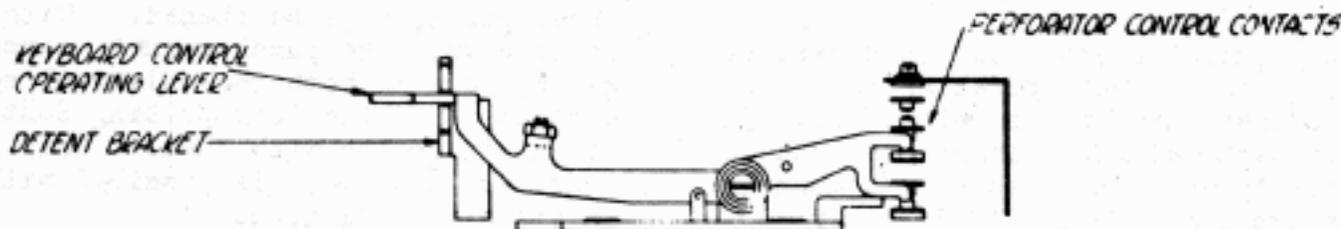


Fig. 6

With the keyboard control operating lever in the lower or "Tape" position, all the perforator control contacts are closed, and the trip off pawl is held down sufficiently to prevent it from engaging the intermediate pawl when any key lever is operated. The repeat space rod is also cammed outward, so that it will not strike the intermediate pawl when the spacer bar is depressed; thus no direct keyboard transmission is possible. The operation of any key lever, in addition to setting up combinations on the selector fingers, moves the universal selector bar downward. This causes the "Y" lever connecting link and "Y" lever connecting link extension to move the upper end of the universal selector bar contact operating lever to the left, against the tension of its retractile spring, which will permit the universal selector bar contacts to close (Fig. 4). It is to be noted that the operation of the universal selector bar contact operating lever is similar to the operation of the selector levers, except that a single universal selector bar is used, which is returned to normal by the operating lever retractile spring.

To prevent chatter of the universal selector bar contacts, when the punch magnet operates, an anti-chatter contact lever is used. This lever is mounted on the contact bracket and is operated by an adjusting screw located on an extension of the magnet armature. It exerts pressure on the left hand contact spring and insures a firm contact pressure as the magnet operates.

#### Tape Feed Mechanism

The tape feed roll is located to the left of the punches (Fig. 2). Spaced at equal

intervals around the feed roll is a series of projecting feed pins which mesh with the feed holes punched in the tape. A tape tension lever holds the tape against the feed roll, keeping the feed holes in the tape in constant mesh with the tape feed pins.

During the upward movement of the punch operating lever, the feed pawl, which is attached to it, engages the next tooth on the feed roll. When the punch operating lever moves downward, the tape feed roll will revolve, advancing the tape one character space. A star wheel and detent insure equal spacing of the tape.

#### Back Space Lever

The back space lever (Illustration 1) is provided so that any errors made by the operator may be corrected in the tape before it is used for transmission. The back space lever moves the tape backwards. The "Letters" key may then be depressed, causing five holes to be perforated over the error.

#### CHARACTER COUNTER

The character counter (Illustration 1, and Figs. 7 and 8) is mounted on a bracket attached to the right side of the keyboard casting. It consists essentially of a dial and indicator; a ratchet wheel mounted on the indicator shaft; a counter magnet and feed pawl for advancing the ratchet wheel; a latch pawl used to retain the ratchet wheel in its advanced position; a release magnet for disengaging both the feed and latch pawls from the ratchet wheel, and a signal lamp.

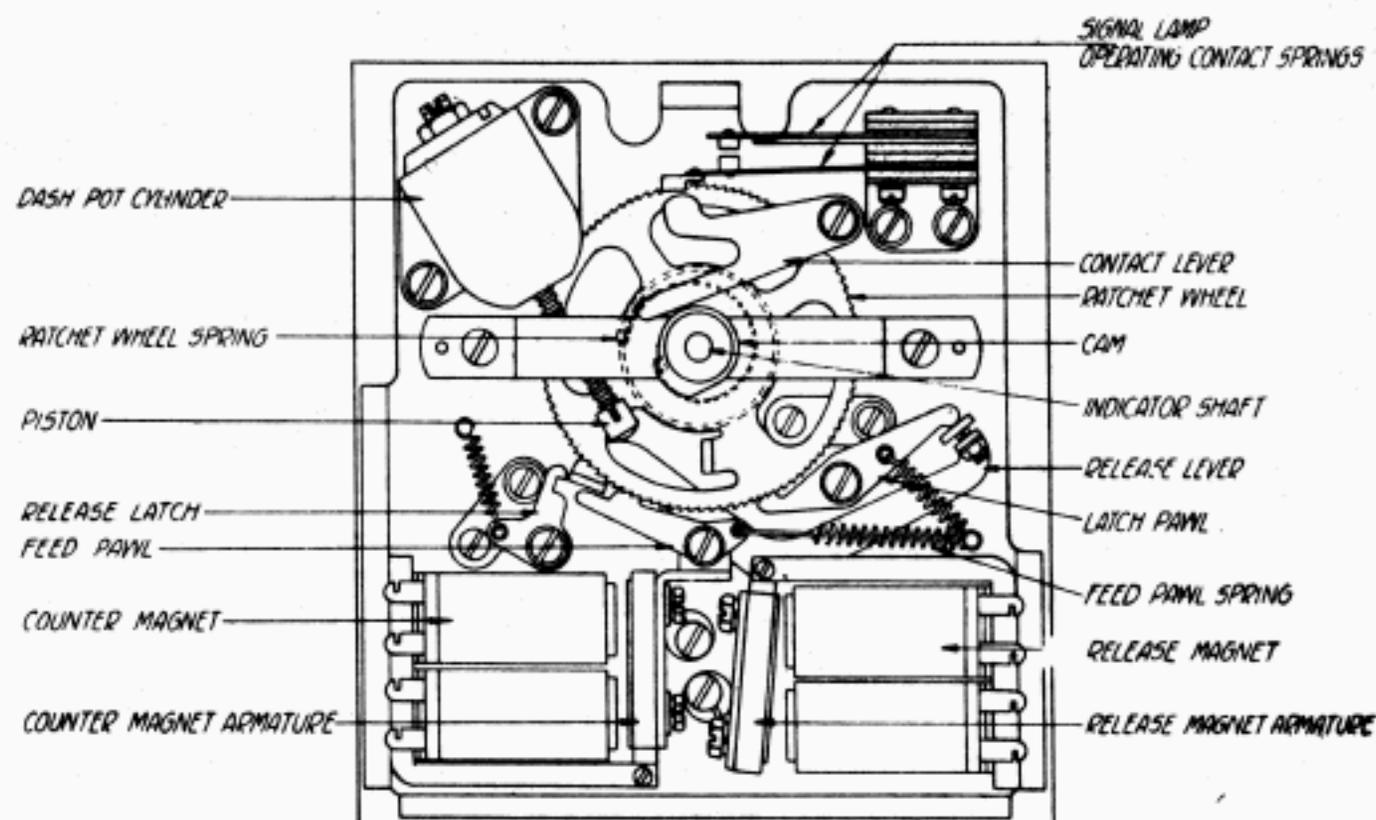


Fig. 7

The electrical circuit for the perforator transmitter is so arranged, that the closing of the universal selector bar contacts may operate the character counter in addition to operating the punch magnet (See wiring diagram). The counter control contacts are located directly below the universal selector bar contacts and consists of three springs carrying two pairs of contacts. The left pair (counter contacts) are normally closed, and the right pair (release contacts) are normally open. Battery from the universal selector bar contacts is applied to the center counter control contact, which carries it to either the left or right control contact. The left contact is connected to the counter magnets, while the right contact is connected to the release magnets. Since the left pair of counter control contacts are normally closed, the counter magnets will be energized (advancing the indicator one space) with each character or space operation of the perforator.

The operation of the counter magnet armature causes the feed pawl, which is pivoted to it, to engage the next tooth on the ratchet wheel (Fig. 7). As the armature is released, the feed pawl spring rotates the ratchet wheel sufficiently to cause the indicator to register one space on the dial. The latch pawl then engages the ratchet wheel and holds it in its advanced position. As previously described, the universal selector bar contacts are effective in their operation only when the keyboard control operating lever is in the lower or "Tape" position.

When any "Function" key lever is depressed, other than "Carriage Return", the

movement of the counter control selector bars causes the contact operating lever to break the left pair of counter control contacts. With both right and left counter control contacts open, no current reaches the counter unit, so the indicator remains stationary.

When the "Carriage Return" key lever is depressed, the movement of the counter control selector bars causes the contact operating lever to break the left pair of counter control contacts and close the right pair. This connects the release magnet circuit in series with the universal selector bar contacts so that the magnet will operate when these contacts close. The operation of the release magnet armature causes the release lever, which is attached to it, to disengage both the feed and latch pawls from the ratchet wheel. The ratchet wheel spring then returns the ratchet wheel to its starting position. A release latch holds the release lever operated and holds the pawls disengaged until the start of the next counting operation. A dash pot cylinder and piston are provided to act as a buffer for the return of the ratchet wheel.

A signal lamp is used in connection with the character counter to indicate when any desired number of characters are perforated in the tape. The signal lamp operating contacts are controlled by a contact lever which rides upon a cam attached to the indicator shaft. The cam may be positioned on the shaft so as to close the lamp contacts for any desired setting.

LINE TEST KEY

operating the printer independently of the line circuit.

Mounted on the keyboard to the left of the transmitting contact assembly is the "Line Test" key (Illustration 1). It is provided for the purpose of testing and

When the knob on the line test key is pulled outward, the line circuit is shunted from the printer and a local circuit established for printer operation.

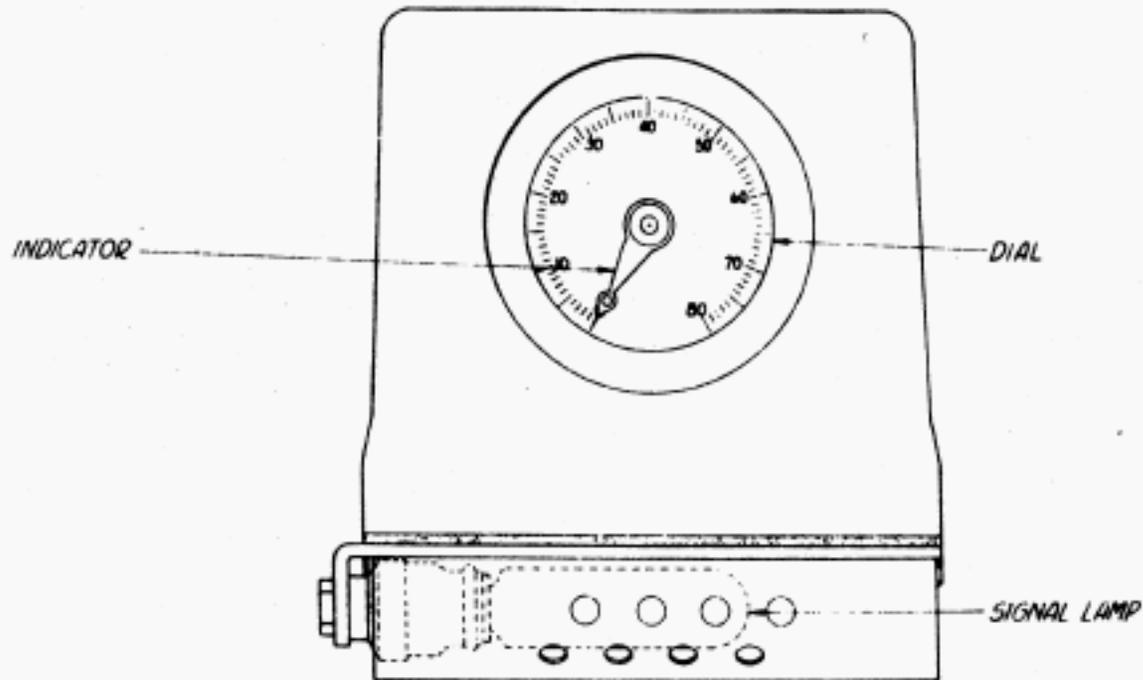


Fig. 8