

## DESCRIPTION OF OPERATION OF NO. 14 AND NO. 20

### TRANSMITTER DISTRIBUTORS

This section describes the operation of the No. 14 and No. 20 Transmitter Distributors. 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.

This machine is a motor driven, combination tape transmitter and distributor. Its purpose is to translate the code combination, perforated in the tape, into electrical impulses and transmit these impulses to the receiving station.

There are two types of distributors of this class - one (the No. 14 type) operates on the five unit code and the other (the No. 20 type) on the six unit code. The two, however, are almost identical, the only difference being that the six unit type has an additional contact, lever, and commutator segment to take care of the additional sixth unit.

The transmitter distributor is made up of two principal units; the tape transmitter and the commutator distributor. The tape transmitter, utilizing the perforated tape, sets up the code combinations to be transmitted. The commutator distributor sends the code combinations out over the line as marking and spacing impulses, in proper sequence and at a predetermined speed. The two units are driven together by either a governor controlled motor or a synchronous motor operating at a fixed and constant speed.

The description of operation which follows covers the basic operating features and does not include recent improvements and changes.

#### COMMUTATOR DISTRIBUTOR

##### Five Unit Code Distributor

The commutator (Illus. 2) is made up of two concentric conducting segment rings attached to an insulating disc. The outer commutator ring is composed of seven segments. Five of these segments correspond to the five intervals of the code. Immediately preceding the No. 1 segment is the "start" segment, while the segment following No. 5 is the "stop"

segment. (See Fig. 1) When the brush passes over the start segment, a spacing impulse is always transmitted, whereas a marking impulse results when it passes over the stop segment. These two invariable impulses cause the receiving mechanism to operate in unison with the distributor brush arm.

The inner commutator ring is a solid ring which is connected to the line; and as the distributor brush arm revolves, it connects the segments of the outer ring successively to the line.

##### Six Unit Code Distributor

The six unit code commutator distributor differs from that of the five unit code only in the number of segments composing the outer ring. The outer ring for the six unit type has six code segments, making a total of eight instead of seven segments.

#### TRANSMISSION

##### Five Unit Code

As indicated by the wiring diagram (Fig. 1) the five tongues on the tape transmitter move between upper and lower contacts, called the "spacing" and "marking" contacts respectively. The perforations in the tape determine which contact tongues will be on spacing and which on the marking contacts.

When the distributor brush is on the stop segment, no signals are transmitted and marking current is sent to the line. At such a time the selector at the receiving terminal will be held at rest. To transmit a combination of impulses, the distributor brush revolves in the direction indicated. It will first pass over the start segment, sending a spacing impulse over the line. This impulse starts the receiving mechanism. Each of the five code segments of the distributor is connected by a contact tongue to either an upper (spacing) or lower (marking) contact, depending on the character of the signal to be sent. As the brush revolves, it will successively connect the five code segments to the line, each in turn sending out a marking or a spacing impulse. Finally the brush reaches the stop segment again and sends out the stop impulse which stops the receiving mechanism. This start-stop system keeps the receiver in synchronism with the distributor.

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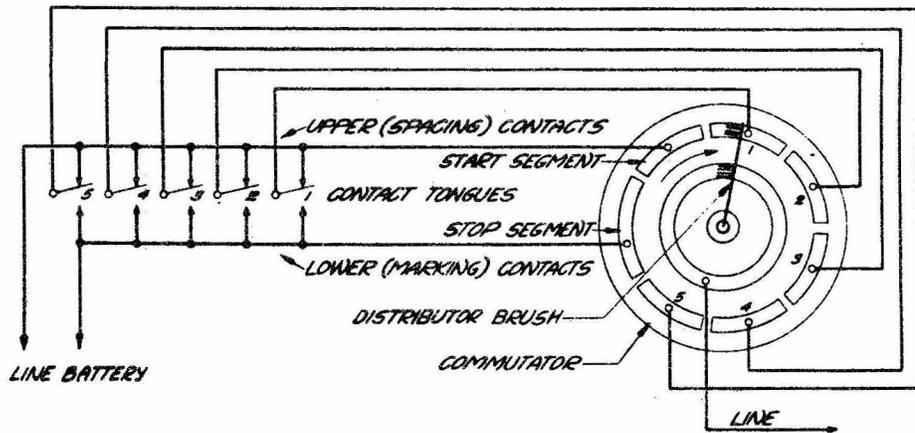


Fig. 1

Six Unit Code

The wiring diagram for a machine operating with the six unit code is identical to that used for a five unit code machine except for an additional contact tongue connected to the sixth code segment. The sequence of operations is the same as that described for the five unit type.

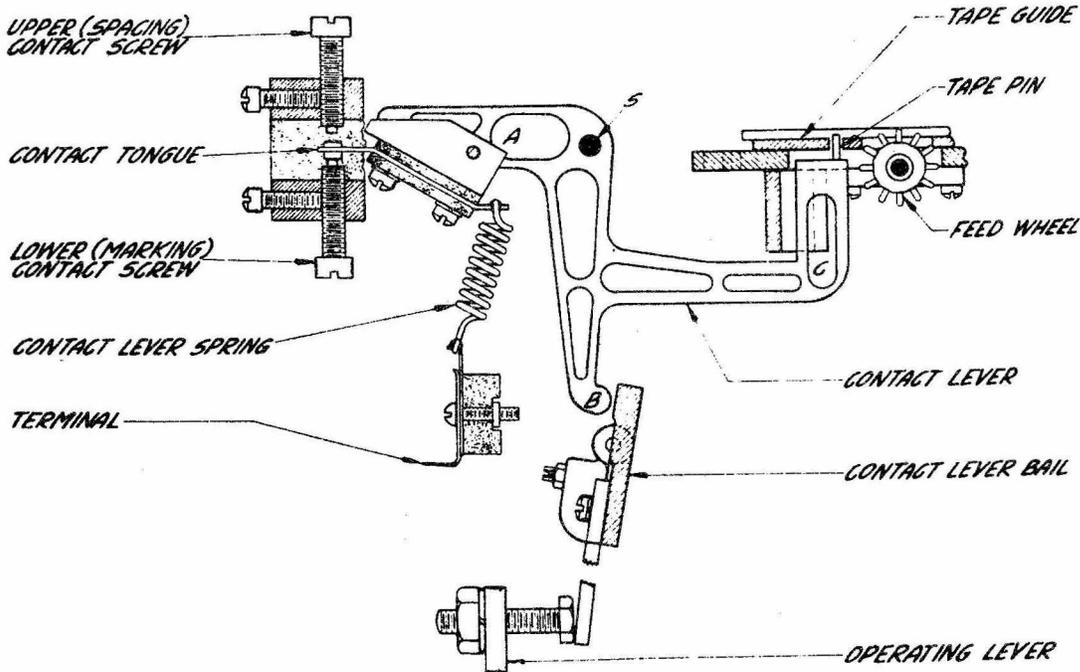
THE TAPE TRANSMITTER

General (Five Unit Type)

As previously stated, the five contact tongues on the tape transmitter move between

two sets of contacts, one set being connected to marking battery and the other set to spacing battery. In case of "Make-Break" operation battery is connected to the marking side only. These five contact tongues are mechanically connected to the ends of five irregularly shaped levers, known as Contact Levers, shown in Fig. 2. It will be seen that each of these levers has three extensions, A, B, and C and that they are pivoted on a shaft, S.

When a contact lever is in its normal position, extensions A and C are approximately horizontal. Extension B is normally in a vertical position. The extension C is turned up at the end, and set into it is a small tape



(SEE ILLUSTRATION 2-3)

Fig. 2

pin projecting vertically upward. The arrangement of the levers is as shown in Illus. 2. The distance between the upward projecting tape pins is the same as the distance between the holes in the perforated tape.

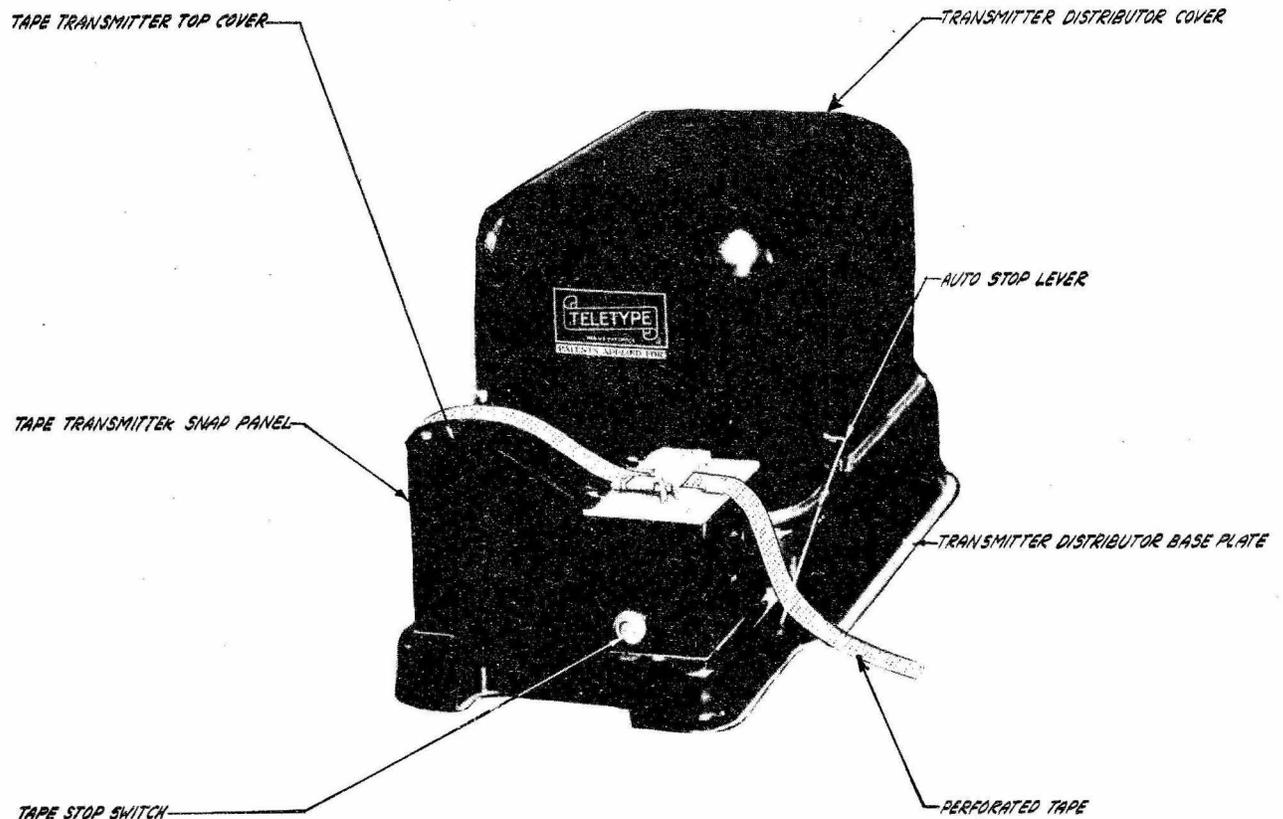
Mounted just to the right of the B extensions of the five contact levers is a pivoted contact lever bail (Illustr. 4). When the contact lever bail is actuated by the operating lever, it moves the B extensions of the contact levers to the left. This movement draws the tape pins, in the ends of the C extensions of the levers, below the surface of the tape guide over which the perforated tape passes and it also causes the outer ends of the A extensions to move upward. Being pivotally attached to these extensions, the contact tongues will also move upward, and will be pressed against the upper (spacing) contact screws.

The contact tongues are so attached to the A extensions of the levers that after the tongues have touched the upper contacts, any further travel of the lever extensions is absorbed by the springs attached to the contact tongues.

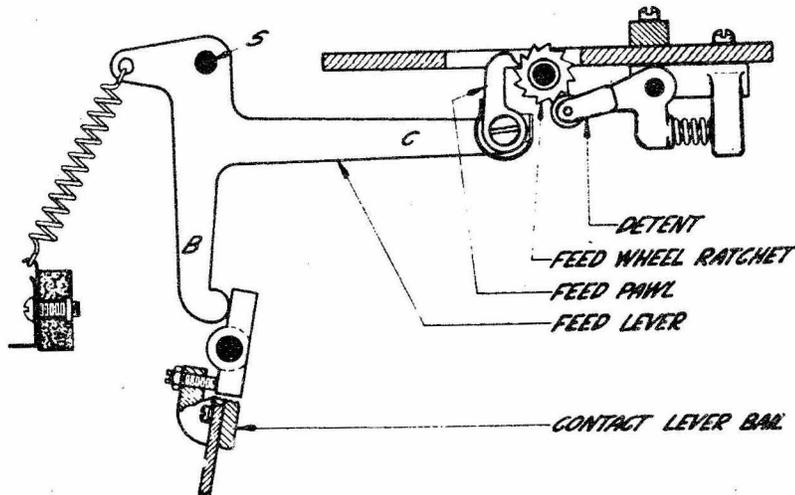
There is a feed wheel to the right of the tape pins. This feed wheel and the tape pins project through the tape guide (Fig. 2). Besides the five code perforations in the tape, there is also a smaller hole which is engaged by one of the pins on the feed wheel. As the feed wheel rotates, its pins engage these small holes, one after another, moving the tape from right to left over the tape pins.

#### FEED MECHANISM

Pivoted on the shaft S with the five contact levers is a sixth lever known as the feed lever (Fig. 3). When the vertical extension B of this lever is moved by the contact lever bail the outer end C moves downward. A feed pawl attached to the end of the C extension engages a tooth in a ratchet known as the feed wheel ratchet attached to the shaft carrying the feed wheel. The downward movement of this pawl causes the feed wheel to rotate a distance corresponding to that between two teeth on the feed wheel ratchet. To insure an even movement of the feed wheel a detent, which bears upon the ratchet teeth, is provided.



TRANSMITTER DISTRIBUTOR WITH COVER  
ILLUSTRATION 1.



(SEE ILLUSTRATION 2)

Fig. 3

The position of the feed pawl is such that the downward movement of the feed lever does not cause it to engage with the ratchet until the five tape pins have been drawn below the surface of the tape guide. This action prevents the tearing of the tape, making certain that it does not move before the pins are withdrawn.

#### The Six Unit Tape Transmitter

The six unit tape transmitter is exactly the same as the five unit transmitter except that it has an additional contact tongue and corresponding contact lever and tape pin.

#### Setting Up the Combination

When the contact lever bail is in its unoperated position (as it is in Fig. 2), the contact lever springs attached to the contact tongues exert a downward pull on the A extensions of the contact levers. This causes the C extensions to move upward and the tape pins are pressed against the tape. If any holes have been perforated in the tape, in this position, the pins corresponding to these holes will pass through. The additional upward movement of a contact lever, when its pin passes through a hole, moves the contact tongue attached to the A extension of this lever from its upper (spacing) contact screw to its lower (marking) contact screw. Where there is no hole in the tape, the pin will be blocked and the corresponding contact tongue will remain against the upper (spacing) contact screw.

It is readily seen from the foregoing that where there is a hole in the tape the corresponding contact tongue is moved against its lower (marking) contact screw. The commutator segment to which the tongue is connected will, therefore, send a marking impulse to the line. Where a pin is blocked by the tape the corresponding tongue rests against the upper (spacing) contact screw, and the commutator segment to which this tongue is connected will send a spacing impulse over the line.

#### THE MAIN SHAFT

The five and the six unit transmitter distributors use the same type of main shaft (Illus. 2). The distributor brush and the operating cam which controls the contact lever bail are mounted on the main shaft. The position of the contact lever bail bears a certain relation to the position of the distributor brush. Hence, the tape transmitter and the commutator distributor always operate in unison.

The operating cam (Illus. 1) actuates the operating lever which in turn moves the contact lever bail. The position of the cam with respect to the distributor brush is set so that the bail starts to move just as the brush comes in contact with the stop segment, causing the B extensions of the contact levers to move the contact tongues away from their lower (marking) contact screws.

The main shaft is driven by the motor through the medium of gears and a friction clutch (Illus. 2).

The stop cam is pinned to the main shaft. The main shaft gear drives this cam by means of the friction between the gear surface, a felt friction washer, and the hub of the stop cam. The necessary pressure is supplied by a flat spring, bearing on the upper side of the gear against a steel disc and felt washer. (See Illus. 2).

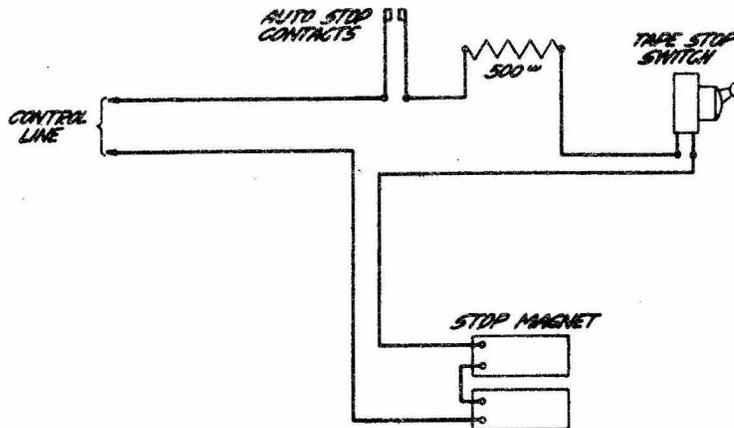


Fig. 4

### AUTO STOP

An automatic stop is provided to take care of any difference between the rate of transmission and that at which the perforator operates. Since the tape is fed directly from the perforator to the transmitter it is evident that if the perforator operation is interrupted the transmitter will use up the slack tape and mutilate the feed holes unless such a device is used to stop the transmitter automatically. Fig. 4 is a schematic diagram of the control circuit which includes the auto stop switch.

The auto stop is mounted on the transmitter distributor base. It consists of a contact mechanism (see Illus. 2) whose contacts are opened by the lifting of a lever called the auto stop lever. This lever projects forward between the perforator and the transmitter, so that the tape feeding into the transmitter passes under it, as shown in Illustration 1. If the transmitter is operating at a greater rate of speed than the perforator the tape will be pulled taut, raising the lever, opening the auto stop contacts, and stopping the transmitter. As the perforator continues to operate the tape will become slack and the contacts will close, allowing the transmitter distributor to operate again.

The mechanical operations of stopping and starting the transmitter distributor are performed as follows:

Opening the auto stop contacts opens the control circuit. The stop magnet which is in this circuit is therefore demagnetized, releasing the stop arm. The stop arm, actuated by the spring, engages the lug on the stop cam. The stop cam, and hence the main shaft, will then be held stationary, stopping both distributor and transmitter. The position of the distributor brush is fixed with respect to the stop cam lug position so that the distributor brush will always be stopped on the stop segment. The transmitter, of course, will be in its stopped position.

When the auto stop contacts are again closed, the stop magnet will pull its arm away from the stop cam, releasing the main shaft and transmission will be resumed.

### TAPE STOP SWITCH

Transmission can also be stopped by manually operating the tape stop switch (Illus. 1). This switch controls the stop magnet in much the same way as it is controlled by the auto stop contact mechanism.

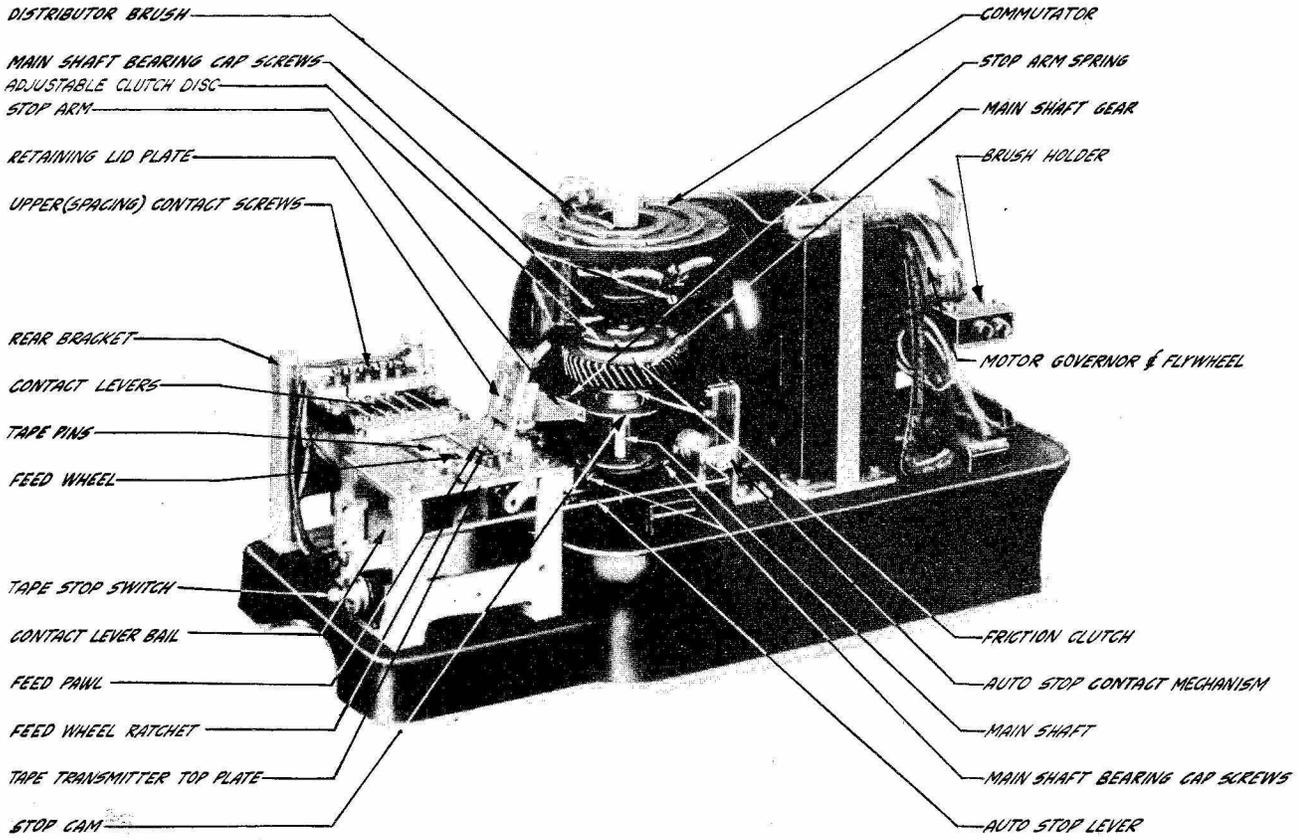
### MOTOR GOVERNOR

The Transmitter Distributor must operate at a constant, fixed speed and is therefore equipped with either a constant speed synchronous motor or a governor controlled motor.

The governor (Illus. 2) used on governor controlled motors is mounted on the inside of the flywheel and consists of two contacts. One of these contacts is stationary while the other contact is fixed to a hinged arm, this movable arm being held against the other contact by means of an adjustable spring. The tension of this spring may be varied by rotating the leather speed adjusting wheel to which it is attached.

The circuit from the power line to the motor passes through the governor contacts which are shunted by a resistance.

When the motor reaches a certain speed, centrifugal force opens the governor contacts. When the contacts open, the shunt resistance is inserted in the motor circuit causing the motor to slow down. The motor speed will be reduced to a point where the contacts are permitted to close after which the motor again speeds up. In this way the speed is kept constant by the opening and closing of the contacts, the resultant speed being determined by the amount of tension on the adjustable spring.



FRONT VIEW  
ILLUSTRATION 2.