May 9, 1944. E. A. GUBISCH 2,348,214

PRINTING TELEGRAPH APPARATUS

Filed Sept. 29, 1941 4 Sheets-Sheet 1

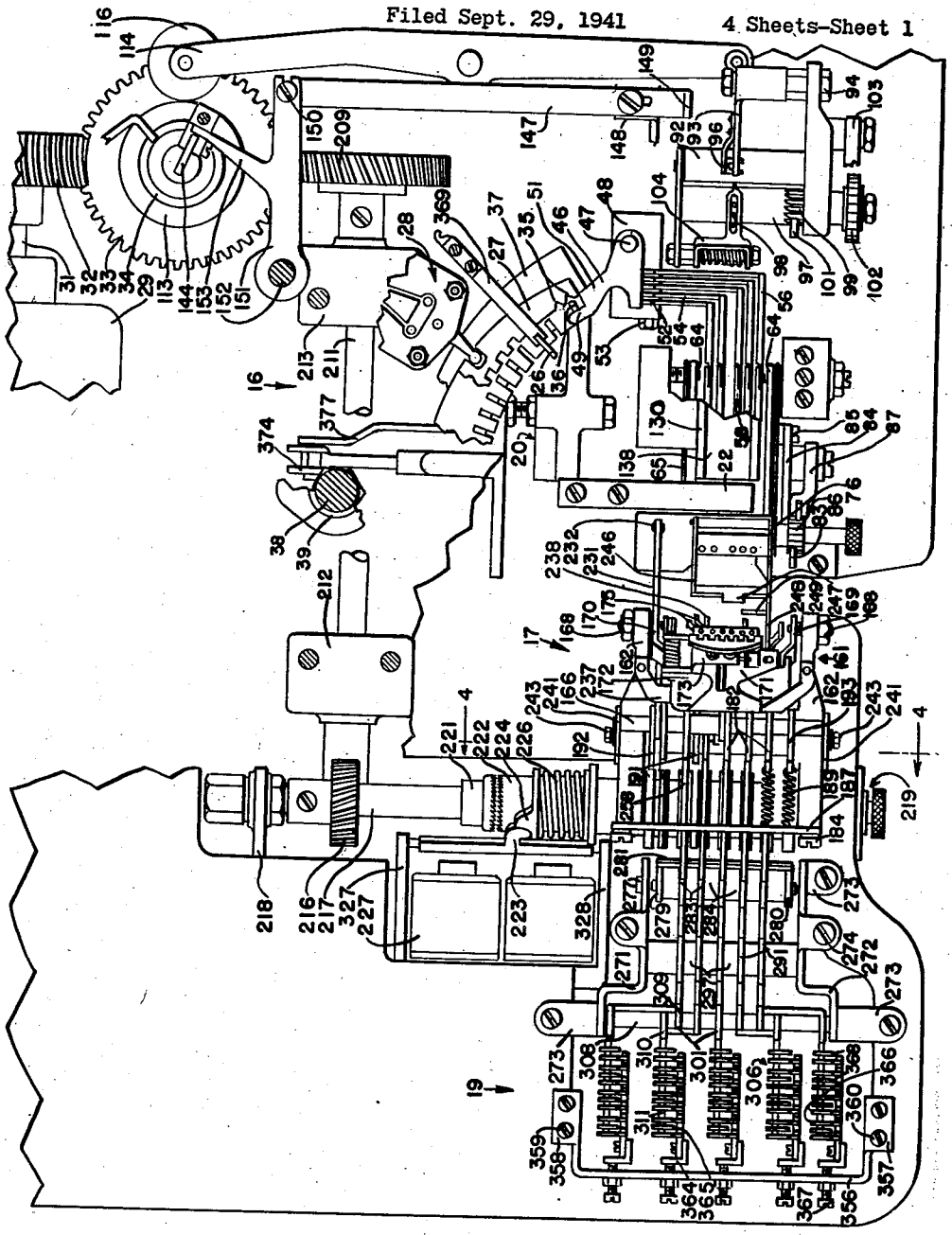


FIG. 1

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PRINTING TELEGRAPH APPARATUS

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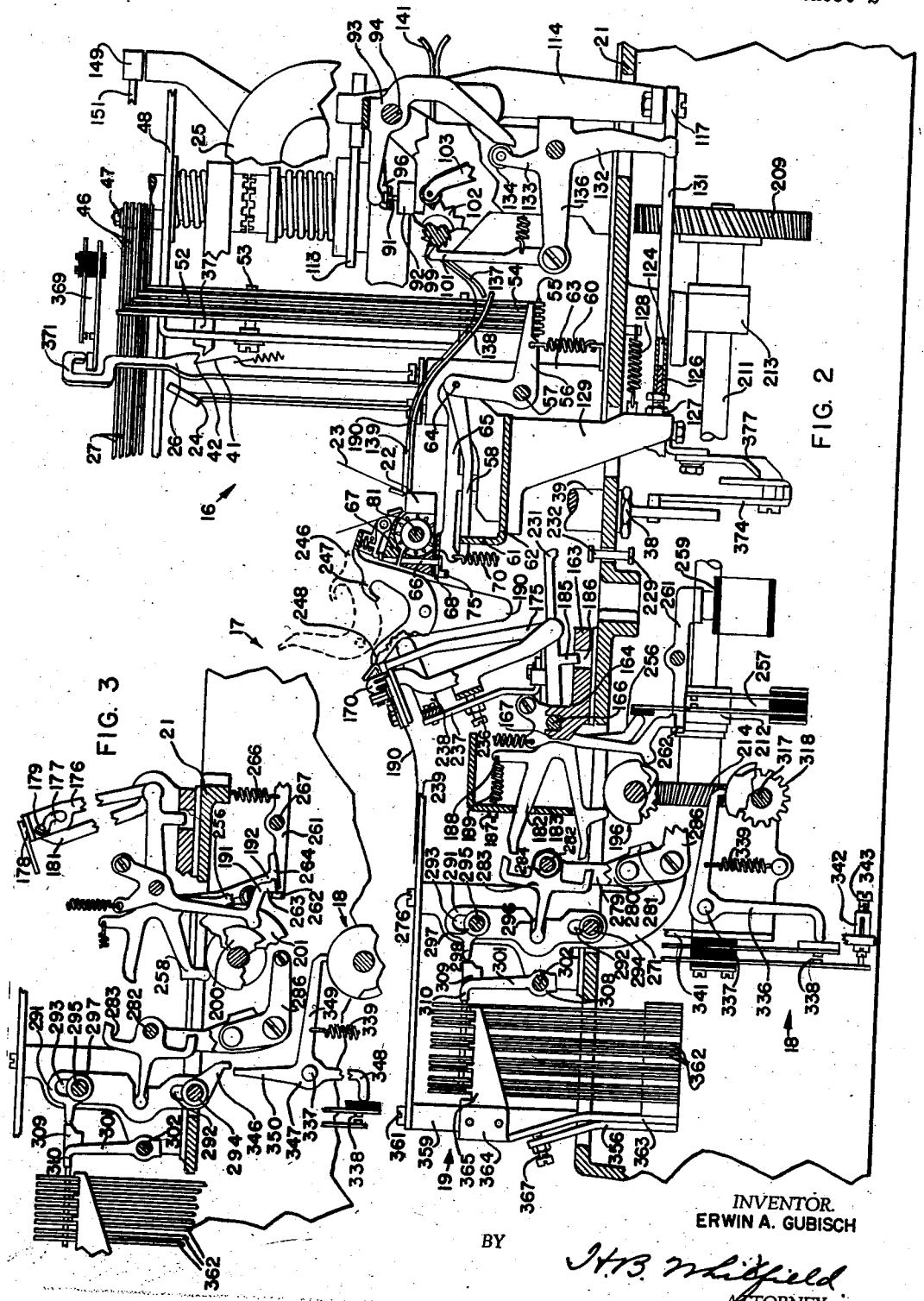


FIG. 2

FIG. 3

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PRINTING TELEGRAPH APPARATUS

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FIG. 8

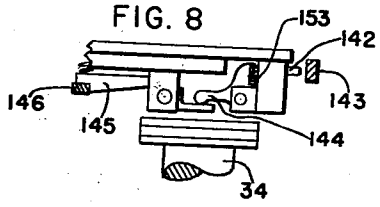


FIG. 4

FIG 6

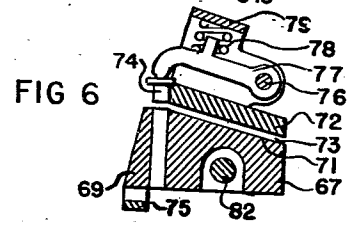


FIG. 7

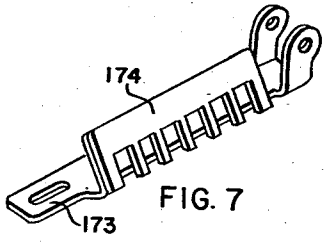
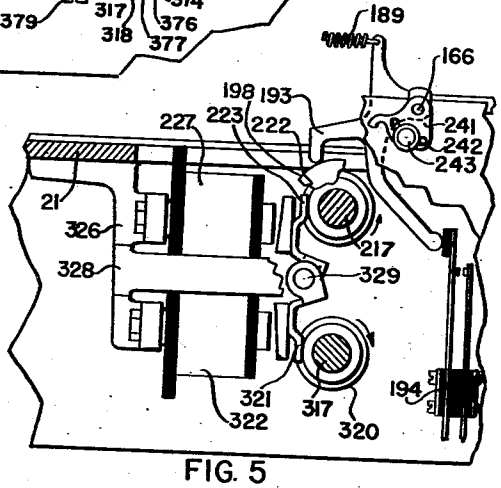


FIG. 5



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PRINTING TELEGRAPH APPARATUS

Filed Sept. 29, 1941 4 Sheets-Sheet 4

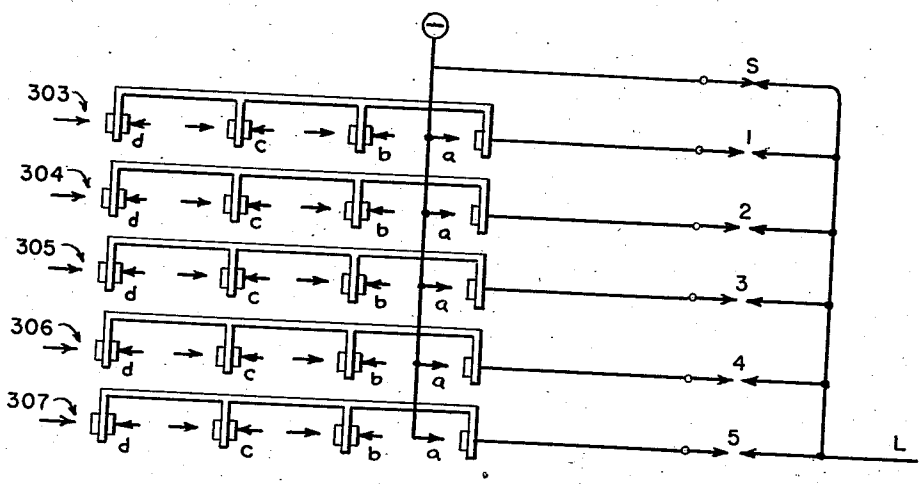


FIG. 9

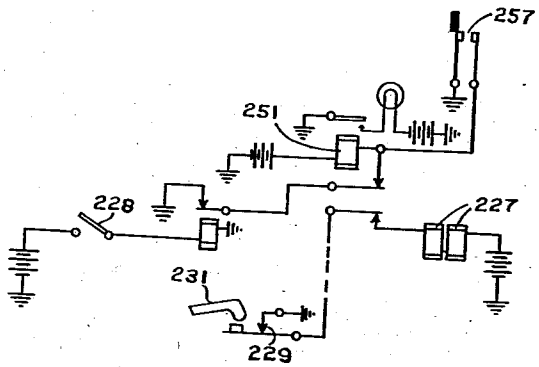


FIG. 10

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Patented May 9, 1944 2,348,214

UNITED STATES PATENT OFFICE

2,348,214

PRINTING TELEGRAPH APPARATUS

Erwin A. Gubisch, Chicago, Ill., assignor to Teletype Corporation, Chicago, Ill., a corporation of Delaware

Application September 29, 1941, Serial No. 412,829

20 Claims. (Cl. 178—17)

This invention relates to printing telegraph apparatus and more particularly to signal recording and repeating apparatus and switching mechanism controlled thereby.

An object of this invention is to provide telegraph apparatus of a simplified mechanical structure which will receive and store telegraph signal combinations, record the characters represented thereby, and repeat the signal combinations.

Another object of this invention is to provide a unitary machine including a printing reperforator, a tape transmitter, switching mechanism, and a simplified mechanical interconnection between the tape transmitter and the switching mechanism.

This invention features a telegraph apparatus which may be utilized in a communication system to facilitate and expedite message transmission between substations which apparatus includes within one compact unit a printing reperforator, a tape transmitter, and a signal responsive switching unit. Telegraph signal combinations received by this apparatus are recorded in a control strip and a sensing device senses the strip to condition a retransmitting distributor in accordance with the received signal combinations to retransmit the message. The switching mechanism of this apparatus also operates in response to received signal combinations under the control of the strip and the sensing device and may be effective to interconnect telegraph lines for the purpose of completing a communication channel over which the signal combinations are retransmitted or for performing any desired switching function by conditioning associated work circuits.

This invention also features a retransmitting distributor which may be controlled either mechanically or electrically by the tape sensing device to retransmit the received signal combinations.

The apparatus for accomplishing the objects of this invention includes a printing reperforator, a sensing or transmitting device, a retransmitting distributor, and a switching mechanism. Code signal combinations received by the apparatus condition the printing reperforator to store the received signal combinations and print the characters represented thereby on a control strip. The printing reperforator includes a pre-punch unit as well as a code punch unit to prepare feed holes in the strip and a perforating cam located on the selector cam shaft operates these units concomitantly with each rotation of the selector cam shaft so that in every cycle of the printing reperforator selector mechanism there is accomplished a printing, code punching, and feed hole punching operation. The selector mechanism is adapted to be manually released for continuous rotation to feed a desired length of tape or control strip through the printing reperforator by the repeated operations of the feeding mechanisms located in the perforating units. In order to conserve space and to provide a compact mechanism the reperforator is equipped with a novel code punch block in which a sprocket wheel utilized to feed the strip is located within the code punch block. From the printing reperforator the control strip passes into the sensing or transmitting device to control that device in accordance with received signal combinations stored in the tape.

The sensing or transmitting device, being of the pivoted type, is movable with respect to the printing reperforator and may, therefore, probe each signal combination, including the last, stored in the tape by the code punching unit. The probing elements of the sensing device are adjustable transversely of the tape path. In addition to the code component probing elements, a tape out probing element which operates cyclically with the code component probing elements is provided and is operable in response to tape exhaustion, a break in the tape, or in response to a special perforation in the tape to arrest the operation of the sensing device. Each setting of the probing elements is transferred to a cam type retransmitting distributor for the purpose of repeating the sensed signal combination. The transfer, in one modification, is accomplished by a plurality of transfer levers that are brought into contact with the sensing elements to be permutably set thereby and this setting is established on a corresponding plurality of contacts through sliders articulated to the transfer levers which actuate contact operators. The contacts are electrically connected to the contacts of a cam type distributor and, accordingly, control the signal transmitted thereby to correspond to the setting transferred from the sensing elements.

In another modification, the sliders are similarly articulated to the transfer levers but each slider is provided with an extension adapted to mechanically block or free the contact operating levers included within the cam type distributor in accordance with setting of the transfer levers to determine the signal to be retransmitted. In each modification the sensing device is freed to sense the next succeeding signal combination in the tape immediately following the transfer oper-

ation, affording signal overlap, so that while the retransmitting distributor is retransmitting the transferred signal combination, the sensing device may sense the next signal combination.

The switching mechanism includes a plurality of contact groups, one indvidual to each slider to be operated thereby. Within each contact group there are several contact pairs or assemblies and the switching circuits or function controlling circuits are in electrical association with corresponding contact assemblies in the several contact groups so that the switching may be selectively accomplished through a series of contact assemblies which are operated in permutations by the plurality of sliders under the control of the perforated tape. Preferably, the switching circuits or function controlling circuits include elements which respond to a predetermined sequence of operations of the contact assemblies whereby switching is effected only in response to a predetermined sequence of signal combinations in the control strip representing switching signals. Communication channels, therefore, established through the switching operations are conditioned and disabled only during switching intervals and not in response to the operation of the sliders in relaying message signals through the retransmitting distributor.

The idle condition of the apparatus, that is, when neither the printing reperforator nor the transmitter is operating, is characterized by the fact that the pivoted transmitter is in abutting relation with the code punch block of the reperforator. With each operation of the perforating mechanism, the sensing device traveling with the tape, is moved a short distance away from punch block, but as the sensing device completes its corresponding cycle, its rectilinear feed device returns it into contact with the punch block. If the perforator operates continuously and at a greater rate than the transmitting device, the transmitter will be moved by the tape away from the punch block until it reaches a limiting position when a loop forming device will operate to form the tape into a depending loop intermediate the transmitting and perforating devices. The loop former also serves to lock the transmitter and render it immovable with respect to the perforating unit. Eventually, however, as the apparatus continues operation, the transmitter will operate for a longer period or at a greater rate than the printing reperforator and take up the depending tape loop. As the loop is foreshortened, it engages the loop former and cams it out of blocking relation with respect to the transmitter, freeing the transmitter to approach the perforating unit as it continues sensing and feeding the tape until it ultimately senses the last perforation in the tape, approaches the punch block, and is arrested. It occasionally is desirable to transmit the same signal combination a plurality of times and for this purpose a feed suppression device is provided in the transmitting mechanism. The suppressor, when operated, disables the rectilinear feed mechanism of the transmitter so that although the transmitter operates continuously, the movement of the tape is interrupted whereby the same signal combination is sensed and transmitted a plurality of consecutive times by the transmitter.

Many features included in the disclosure of the present application are also disclosed in the following copending applications, filed September 20, 1941; namely, Serial No. 411,660, filed by R. A. Lake, and Serial No. 411,665, filed by M. T. Goetz.

For a more complete understanding of the foregoing object and features of this invention reference may be had to the following detailed description which is to be interpreted in the light of the accompanying drawings wherein:

Fig. 1 is a plan view partly broken away of a telegraph apparatus embodying the features of this invention;

Fig. 2 is a front elevational view, partly in section, of the apparatus of Fig. 1;

Fig. 3 is a view similar to Fig. 2 illustrating a modification of the apparatus of Fig. 1;

Fig. 4 is a sectional view taken on the lines 4—4 of Fig. 1;

Fig. 5 is a detailed view illustrating the release magnet assembly including the transmitter release magnet and the distributor release magnet;

Fig. 6 is a detailed view of the code punch block;

Fig. 7 is a detailed view of the tape gate of the pivoted transmitter;

Fig. 8 is a detailed view of the selector cam sleeve stop gate;

Fig. 9 is an electrical circuit diagram for the modification of Fig. 2; and

Fig. 10 is an electrical circuit diagram of the circuit for the transmitter release magnet.

The apparatus disclosed in the drawings embodies the several features of this invention and may be considered as including the following principal units and associated driving mechanisms; a printing reperforator unit **16**, a tape sensing unit **17**, a transmitting distributor **18**, and an automatic switching device **19**. The several units are supported by a base casting **21**.

Printing reperforator

The printing reperforator **16** included in the apparatus under consideration is substantially the same as that printing reperforator which is the subject of a copending application filed in the name of Ross A. Lake, Serial No. 274,796, filed May 20, 1939, and for a more complete understanding of the structure and mode of operation of this unit, reference may be had to the afore-mentioned copending application which is incorporated herein by reference. Since the unit under consideration is substantially the same as that disclosed in the above-identified copending application, the description of that mechanism to be set out hereinafter will be of a general nature and will be detailed only in the description of those features of the present unit which are different from features in the above-identified copending application.

A printing platen **22** is located in the front and central portion of the reperforator and is asciated with an improved platen shift mechanism **20** which is the subject of a copending application, Serial No. 411,660, filed by R. A. Lake on September 20, 1941. An inking ribbon **23** is directed thereover in well-known manner from ribbon supply reels **25** (only one of which is shown). A plurality of type bars **24**, Fig. 2 (only one of which is illustrated), is positioned in an arcuate path about and to the rear of the printing platen **22** and are articulated to their supports in a manner to permit their striking forwardly and downwardly into cooperation with the platen to effect printing. A plurality of pull bars **26** (only one of which is shown) is assembled to the rear of the type bars **24** and is adapted to

operate the type bars through a gear and rack connection (not shown). The pull bars are normally urged against a series of notched code bars 27 which are semi-circular in shape and which may be conditioned in various permutable settings by means of a selector mechanism 28 (Fig. 1, of the sword and T-lever type, shown in U. S. Patent No. 1,745,633), to bring into alignment the notches on the code surfaces so that the pull bars may be individually selected for operation. A continuously operating driving motor 29 carries on its shaft 31 a gear 32 which meshes with a gear 33 carried on the main shaft 34 of the reperforator to drive the reperforating mechanism; a selecting cam sleeve (not shown) is rotatably supported upon continuously rotating shaft 34 and is adapted to be driven therefrom through a suitable friction or slip clutch.

A receiving magnet (not shown) is adapted to be conditioned in response to received line signals to release the friction clutch and cause the rotation of the selecting cam sleeve from driving shaft 34 in a manner set out in detail in the afore-mentioned patent. The cam sleeve is thereupon rotated at a speed substantially synchronous with the speed of the code impulsing so that the energization of the receiving magnet in response to marking and spacing code signals may be effective through the selector 28 to condition the individual code bars 27 in a clockwise or counterclockwise direction in accordance with a received code signal combination. The permutable setting of the code bars 27 results in the selection of one particular pull bar 26, depending upon the alignment of the code notches in code bars 27, and with the selection thus determined the code bars are locked during the printing operation by means of a locking bar 36, Fig. 1, through its engagement with locking notches 35 provided in each of the code bars. The locking bar 36, which has the same general contour as pull bars 26, is moved into and out of locking engagement with code bars 27 by means of the printing bail 37, Figs. 1 and 2, as it is raised and lowered. The printing bail 37 is suitably articulated to a bail operating plunger 38, Fig. 1, slidably mounted within a guide sleeve 39, and a plunger 38 is controlled by means of a cam (not shown) on the main shaft 34.

When the bail 37 is in its lowermost position under the control of plunger 38, it cooperates with beveled surfaces 41, Fig. 2, on the plurality of pull bars 26 to hold the pull bars out of engagement with code bars 27 so that the code bars may be readily shifted in accordance with the operation of the selector mechanism 28 under the control of received code signal impulses. When the printing bail 37 is operated upwardly to perform the printing operation, the bars 26 and 36 due to their cam surfaces 41 are permitted to be actuated gradually toward the code bars 27 by their individual springs. Pull bars 26 are provided with a hook projection 42 which cooperates with the printing bail 37 when a pull bar is permitted by the alignment of notches in the code bars 27 to be operated by its biasing spring into the path of bail 37 which in its upward movement engages hook projection 42 to lift the pull bar, and through the rack and pinion engagement with the type bar causes the type bar to rotate about its pivot and bring the type face downwardly to impinge upon platen 22. The locking bar 36 is not provided with a hook portion since its function is merely to rock on its pivot into and out of locking engagement with code bars 27 under the control of bail 37 to retain the permutable setting of the code bars during the printing operation. For a more comprehensive and detailed description of the printing operation performed by the printing reperforator, reference may be had to the aforesaid Patent No. 1,745,633 which is specifically directed to a printing mechanism of the type incorporated in the printing reperforator unit.

For the purpose of controlling code punches in the reperforating operation to record the code combination in a tape as well as print the corresponding character on the tape, there is provided a plurality of bell cranks 46, Figs. 1 and 2, one associated with each code bar and pivotally supported upon a stud 47 which is mounted in a supporting plate 48 secured to the frame of the reperforating unit. Each of the bell cranks 46 is provided with a projecting finger 49 adapted to overlap the locking bar 36 and be operated thereby to position the bell cranks 46 in a counterclockwise direction as the bar 36 under the influence of bail 37 is cammed out of locking engagement with code bars 27 preparatory to conditioning the code bars in accordance with a received code signal combination. The bell cranks are biased in a clockwise direction and each is provided with a shoulder portion 51 which performs a sensing operation on the associated code bars 27 when locking bar 36 under the control of bail 37 is moved into the locking notch 35 releasing the bell cranks to respond to their clockwise bias. If a code bar is in its counterclockwise position, as indicated in Fig. 1, the shoulder portion 51 of the associated bell crank 46 will be clear of the code bar and when locking bar 36 responds to the bail 37 and enters locking notch 35 as shown, the bell crank 46 will be permitted to assume its clockwise position. However, in the event that a code bar is in its extreme clockwise position, locking bar 36 would engage the alternate locking notch on the particular code bar and that bar would be positioned in the path of its associated bell crank 46 so that when locking bar 36 has moved into engagement with the alternate locking notch 35 releasing the particular bell crank 46 for rotation, that rotation will be restrained. Accordingly, through the cooperation of the individual code bars 27 and the blocking shoulders 51 of the bell cranks associated with the particular code bars, the permutable setting of the code bars is transferred to the plurality of bell cranks 46 when those bell cranks are permitted to sense the positionment of the code bars as locking bar 36 is moved into a locking notch 35.

The frontward portion of supporting plate 48 as viewed in Fig. 1, is slotted to provide a comb-like structure which guides a plurality of vertically disposed pivoted levers 52 which are pivotally supported upon a stud 53, Fig. 2, carried in support member 48. The levers 52 which are guided by the comb portion of member 48 project into the path of operation of bell cranks 46 and each lever 52 is controlled by one of the bell cranks 46. The lower ends of levers 52 cooperate with and control a series of bell cranks 54 pivoted on a pivot shaft 55, Fig. 2, secured to the casting 63. Bell cranks 54, in turn, extend beneath the horizontal portion of a second set of bell cranks 56 pivoted on shaft 57 supported in the perforator casting 63. The bell cranks 56 are normally urged in a clockwise direction by means of individual springs 60 which springs also serve through the engagement of bell cranks 56, bell cranks 54,

pivoted levers 52, and bell cranks 46 to impart a clockwise bias on each of the bell cranks 46. Pivotally articulated to the vertical arms of bell cranks 56 are a plurality of punch interponents 58. Interponents 58 are guided by a comb cut in a flanged portion 61 of a cradle member 62 pivotally supported by the casting 63 of the printing reperforator and serving as a punch operator as will appear hereinafter. The pivot for cradle member 62 is in substantial alignment with the pivotal connection between the interponent members 58 and the vertical arms of bell cranks 56. This pivot pin is indicated 64. Through the mechanical linkage above described, each permutable setting of the code bars 27 is transferred when locking bar 36 assumes its locking relation with respect to the code bars, to the interponents 58 to permutably condition the interponents with respect to code punches 66, Fig. 2.

Locking bar 36, in being retracted from a locking notch 35 preparatory to setting up a signal combination in code bars 27, rocks bell cranks 46 in a counterclockwise direction and through the mechanical linkage described, similarly rocks bell cranks 56 and advances all interponents 58 leftwardly. After the code bars have been set, locking bar 36 releases bell cranks 46 permitting the interponents 58 to be selectively moved from their normal, leftward position. If any of the bell crank levers 46 is held in its counterclockwise position by the engagement of its locking shoulder 51 with its associated code bar 27, the corresponding interponent 58 through the mechanical linkage above described is retained in its leftward position in alignment with its code punch 66. However, if a bell crank 46 is permitted to assume its clockwise position by its associated code bar 27, its spring 60 is effective to shift its associated interponent 58 to its rightward position, as illustrated in Fig. 2, out of alignment with punches 66. The connection between the selector mechanism 28 and code bars 27 is such that when a marking impulse is received a code bar is moved to its clockwise position, the associated interponent 58 is retained in alignment with its code punch 66 and conversely, when a code bar is positioned in its counterclockwise position in response to the reception of a spacing impulse, its associated interponent is shifted from its normal position and moved out of alignment with its associated code punch.

An punch block 67, Fig. 2, secured to the reperforator casting is suitably apertured to receive in a slidable manner the code punches 66 which project through the punch block and a guide comb 68, formed in the leftward extremity of a punch stripper bail 65 that is pivoted on the same pivot studs as cradle 62. A spring 70 is secured to a depending projection of bail 65 and a spring post (not shown) located on the perforator casting and serves to urge the bail in a counterclockwise direction to withdraw the code punches from their operated positions. The code punches have a limited downward travel, being limited by a yoke member 75, Fig. 6, that depends from the code punch 67 and which is overlapped by the leftward extremity of comb 68. The punches 66 are flattened or hammered out at their lower extremities to provide suitable shoulders beneath comb 68 so that as cradle 62 is rocked in a counterclockwise direction, comb 68 under the influence of spring 70 may withdraw punches 66 to their lowermost positions. The front surface 69, Fig. 6, of the punch block is at an angle inclined to the vertical for a purpose which will be hereinafter described, and the top surface 71 is at an acute angle with respect to the axes of the punches to provide an inclined path for a tape through the punch block. The front surface 69 of the punch block is chamfered back to the apertures which accommodate the code punches to prevent the accumulation of tape chips over the code punches. The punch elements 66 may be associated with the punch block 67 in much the same manner as disclosed in detail in the first mentioned copending application and that detail will not be repeated here.

Disposed above the punch block 67 is a die plate 72 and there is provided in the die plate a die sector for each code punch located in punch block 67. The die sectors are similar to the die openings described in detail in the first mentioned copending application and illustrated in particular in Fig. 6 thereof at 107, the construction being such that the cooperation of a die punch with such a die opening will produce a lidded aperture in the tape. The bottom surface of die plate 72 is cut at such an angle that, when the die plate is assembled into a punching unit with punch block 67, the lower surface thereof will define with the upper surface 71 of the punch block, a tape guideway 73 for directing a tape to be perforated at an angle to the top surface of the code punches 66. With this construction, the lidded aperture is provided in the tape through a shearing rather than a blanking operation; that is, with the tape lying at an angle across the top surface of a code punch, as the punch is elevated in the perforating stroke into cooperating engagement with the die plate 72, the punch, due to the incline of the die plate, initially blanks a small sector in the tape and, as the punch is further advanced into the die plate, the punch and die plate engage along an inclined shearing plate to produce a perforation.

A lidded aperture is produced in the tape with each perforating operation and because of the angular relationship of the tape and code punches, the lagging edge of the lid is forced well above the tape web and into the die plate while the neck of the lid is not raised appreciably. A plurality of stripper pins 74 is provided to remove the lids from the die plate at the end of each perforating cycle. Secured to the die plate 72 is a pivot pin 76 upon which is pivotally supported a plurality of spring operated levers 77 operated by compression springs 78 to depress the stripper or ejector pins 74 at the end of each perforating cycle and eject the lids from the die plate. The compression springs 78 are held between a frame member 79 secured to die plate 72 and a projecting lug extending from each of the levers 77. In each perforating cycle, the operated code punches 66 project into the sector openings provided in die plate 72 and force the stripper pins 74 upwardly and at the completion of the perforating cycle, the code punches 66 are retracted from the die plate by comb 68 rendering the levers 77 operative under the influence of springs 78 to depress the ejector pins 74 and eject the lids from the die plate.

A feed wheel 81, Fig. 2, provided with sprocket teeth to engage feed perforations in the tape and feed the tape through the code perforating mechanism, is rotatably supported within the punch block on a shaft 82, Fig. 6, and is stepped intermittently by means of a feed pawl 83, Fig. 1, pivotally supported on a lever 84 which is secured by screw 85 to cradle member 62 and

a feed ratchet 86 with each operation of the cradle 62 in a well-known manner. A spring pressed detent 87 is provided to bear against the ratchet and hold the feed wheel immovable between feeding strokes of the pawl 83.

A pre-punch unit is provided to perforate a feed hole in the tape prior to the code perforating operation and comprises a feed punch 91, Figs. 1 and 2, which is adapted to be reciprocated vertically in a feed hole punch block 92 by means of a bell crank 93 pivoted on stud shaft 94 and provided with a fork shaped extension member 96, the tines of which engage beneath the flared upper end of the punch 91 and confine the head of the punch between the fork member and the bell crank so that the punch is reciprocated as the bell crank is oscillated about pivot 94. Feed pins 98, Fig. 1, are secured to a shaft 97 rotatably supported in the pre-punch unit and provided at one end with milled ratchet teeth 99 to be engaged by a feed pawl 101 to intermittently advance the pins 98 and cause the feed of the tape by the engagement of pins 98 with the feed perforations invariably provided in the tape by the pre-punch 91. A star wheel 102 and detent 103 are provided for holding the feed shaft intermediate the feeding strokes of pawl 101. A spring pressed guide 104, Fig. 1, of the general contour of shaft 97 presses the tape against the feed pins to assure positive tape feed from the pre-punch in the direction of the printing platen and code perforating point.

By providing a pre-punch for perforating feed holes in the tape and independent feeding mechanisms at both the pre-punch and code punching units, it is possible to vary the position of the code holes with respect to the feed holes in the tape. That is, with the feed holes already prepared in the tape, the detent 87 associated with feed wheel 81 may be adjusted so that each operation of feed pawl 83 positions a feed hole in or out of alignment with code punches 66. Thus the code perforations and feed hole perforations may or may not be aligned transversely of the tape.

The code perforating punches and the pre-punch are operated cyclically from a common operating means which is controlled by a perforating cam located on main shaft 34. Main operating shaft 34, as described in the first mentioned copending application, supports a selector cam drum (not shown) which is released for rotation in response to the reception of a code signal combination and a second cam drum 106, Fig. 4, that is released for rotation with each operation of the selector cam drum. Cam drum 106 is driven through a grab clutch comprising driving member 107 and driven member 108 which has a clutch throwout cam 111 formed on its periphery to control the engagement of the clutch. A pivotally supported clutch throwout lever 109 is spring urged about its pivot into engagement with cam 111 to hold the clutch elements normally disengaged. When, however, the selector cam drum rotates, a cam therein actuates clutch throwout lever 109 and pivots it away from cam 111 permitting spring 112 to slide driven element 108 into engagement with driving element 107 to drive cam drum 106 through one cycle. At the completion of that cycle, lever 109 again cooperates with cam 111 to slide driven member 108 from driving member 107 and arrest the rotation of the cam drum. When the selector receives a continuous succession of code signals, it will be effective to release cam drum 106 for a corresponding succession of cycles of operation.

A perforating cam 113 is included in the cam drum 106 and actuates a pivoted, punch operating lever 114 through a cam following roller 116 rotatably supported upon a stud which extends transversely of a bifurcation provided in the rightward extremity of lever 114. Lever 114 extends obliquely from main operating shaft 34 at the rear of apparatus casting 21 downwardly and forwardly and is pivotally articulated at its lower extremity to a horizontally disposed link 117, Fig. 2, located near the front of the casting. Lever 114 has a vertical projection 118 bored so as to be assembled in the perforator by means of a pivot shaft 119 secured in bearing blocks 121 and 122 formed integrally with an upstanding supporting structure 123 to be described more fully hereinafter.

At its leftward extremity, Fig. 2, link 117 is provided with an aperture 124 which receives a projection 126 adjustably carried by cradle 62. Cradle 62, which serves as the code punch hammer, is urged by means of a spring 128 secured thereto and to a spring post depending from base casting 21 into abutting relation with the leftward extremity of link 117, adjustable stop 127 secured to depending portion 129 of cradle 62 serving to limit this counterclockwise movement of the cradle. Cradle 62 is guided in its movement by the engagement of stud 126 with the guiding aperture 124 of link 117.

Link 117 is slidably articulated through a slot 131 to pivoted three-arm lever 132 which carries an eccentric 134 on arm 133, and the eccentric provides an adjustable engagement between lever 132 and the bell crank 93 of the pre-punch. Feed pawl 101 for the pre-punch is adjustably secured to arm 136 of the lever 132 by means of an eccentric so that the feed stroke may be adjusted. Through the engagement of abutment 129 with link 117 and the articulation of link 117 to lever 132, the code punches and the pre-punch are operated with each oscillation of pivoted lever 114 under the control of cam 113.

As has already been pointed out, the selector mechanism 28 which controls the code bars 27 conditions in this one operation both the printing mechanism through the alignment of the code notches in the code bars 27 and the code punches through the conditionment of punch interponents 58. Cam assembly 106, however, responds to the operation of selector mechanism 28 so that upon the receipt of a code signal combination by the selector mechanism, there is accomplished a printing operation which records on the tape a character corresponding to the received code signal combination and, simultaneously, there is accomplished one perforating operation that stores the received code signal combination in the tape and another perforating operation that prepares a feed hole in the tape.

A tape guide, Fig. 2, extends from the feed pins 98 at the pre-punch unit to the printing platen 22 to serve as a guide for the tape and prevent the tape from becoming engaged with the perforating unit mechanism. This guide for the sake of a better understanding of the perforating mechanism has been disclosed only partially in Fig. 1. The tape guide consists of two sections, one section 137 extending leftwardly and downwardly from the feeding pins 98 of the pre-punch, and another section 138 extending rightwardly and downwardly from platen 22 and being

overlapped by the leftward extremity of section 137. The guide sections are supported by the castings of the pre-punch unit and code punch unit, respectively. In order to guide the tape to the platen accurately, section 138 is provided with bent-over flange portions 139 leading to platen 22. A similar guide 141 directs the tape from a supply into the pre-punch unit. By providing individual tape feeding mechanisms at both the pre-punch unit and the code punch unit, a tape loop may be maintained between the units and supported by the tape guide. This tape loop removes the drag of the tape supply reel from the feeding mechanism at the code perforating unit and consequently greatly reduces the tape load at this point. Further, since the feed pawl at the code punch unit may be secured to the cradle member 62 in an adjustable manner similar to the articulation of the feed pawl at the pre-punch unit to its operator, there is given a flexibility to the printing reperforator not otherwise attainable through the use of a single tape feeding device.

Tape feed out mechanism

Although it is contemplated that the perforating unit operate as an incident to printing in response to received code signal combinations, it may sometimes be desirable to initiate the operation of the perforating mechanism independently of received code signal combinations; that is, independently of the selector receiving magnet which usually initiates the operation of the perforating mechanism. For this purpose, a manual release of the selector cam assembly has been provided enabling an operator to cause the perforating unit to operate a number of times so that through the resultant actuation of the feeding devices, any required length of tape may be fed through the printing reperforator.

As has been set forth above, the printing reperforator includes a selector mechanism which is the subject of U. S. Patent 1,745,633. This selector mechanism, however, has been modified by including therein an improved stop gate for the selector cam assembly which stop gate is the subject of U. S. Patent 1,884,743, Figs. 5 and 9 of which illustrate the improved stop gate. The improved stop gate, Fig. 8, includes a mechanical linkage comprising a slidably mounted pin 142 which may be shifted leftwardly by the armature 143 of the selector magnet (not shown), a pivoted bell crank 144 to be operated by the leftward extremity of pin 142, a second pivoted bell crank 145 that is rotated in a clockwise direction in response to a counterclockwise rotation of bell crank 144, and a third bell crank 146 (only one arm of which is shown) engaging the stop arm (not shown) of the selector cam assembly which is operated in response to the clockwise rotation of bell crank 145 to release the selector cam assembly for rotation.

In the idle condition of the printing reperforator, that is, when no code signal combinations are being received by the selector magnet, the stop gate controlling mechanism is in the condition illustrated in Fig. 8 in which bell crank 146 engages the stop gate and holds the selector cam assembly arrested. When the start impulse of a code signal combination is received, the armature 143 is released by its magnet (not shown) and shifts pin 142 leftwardly and causes bell crank 146 to be released through the described linkage system which, in turn, releases the stop gate permitting the selector cam assembly to rotate. The normal operation of the stop gate is fully described in U. S. Patent 1,884,743 and resort may be had to that patent, which is incorporated herein by reference, for the details of structure and operation not here disclosed.

Manual release of the stop gate may be effected by operating a release rod 147, Fig. 1, which is slidably supported upon a bracket 148. Bracket 148 may be carried by any suitable portion of the printer frame structure, preferably finding its support at the support for ribbon reel 25. Release rod 147 extends from the front to the rear of the apparatus and its foremost extremity is bent upwardly forming a thumb piece 149 while its rearmost extremity carries a pin 150 which projects through a crank 151 pivoted to the supporting plate of the selector mechanism at 152. The arm 153 of crank 151 is disposed rightwardly of bell crank 144 of the stop gate release device so that when release rod 147 is shifted toward the rear of the apparatus rotating crank 151 in a counterclockwise direction, arm 153 releases the stop gate in a manner similar to the shifting of pin 142 by the selector release magnet. Release rod 147 is biased forwardly and it is necessary to hold the rod in its rearward position to cause a plurality of cycles of operations of the perforating units and their feeding mechanisms whereby a desired length of tape may be fed through the apparatus.

Sensing unit

Associated with the hereinbefore described printing reperforator, is a sensing unit 17 provided to sense the perforated tape as it leaves the printing reperforator to control functions to be hereinafter indicated and described. In order to take full advantage of line time, the sensing or transmitting unit employed with the printing reperforator is of the pivoted or traveling type which is adapted to sense every code perforation recorded in a tape by the printing reperforator, without the necessity of stepping the perforated tape a plurality of feeding distances from the perforating unit into the transmitting or sensing unit. This pivoted transmitter, is described in detail in U. S. Patent No. 2,262,012, granted November 11, 1941, to Ross A. Lake, and reference may be had to that copending application for the details both in structure and mode of operation of the pivoted transmitter. The transmitter comprises essentially a plurality of sensing elements to sense the perforations in a tape, a member for feeding the tape through the transmitter having imparted to it rectilinear motion, and a cam drum for controlling the operation of the sensing elements and the tape feeding member.

Unit 17 has a base casting 161, Fig. 1, which is removably mounted upon the base casting 21 of the apparatus. The casting 161 consists of a pair of parallel vertical wall sections 162 interconnected by a relatively flat web portion 163, Fig. 2. The leftward extremity of portion 163 is formed into a vertical portion 164 which is channeled to serve as a journal for a shaft 166 and slotted to provide a comb 167 which serves to guide the vertical oscillations of the members which support and operate the sensing elements. The rightward portion of wall sections 162, as viewed in Fig. 1, support pivot studs 168 upon which the movable or pivoted portion of the sensing unit is secured. Specifically, the frame members 169 and 170 are secured to the pivots 168. A plate 171 is secured to the pivoted frame members and carries a hinge post 172 upon

which is hingedly supported a tape gate 173 which in conjunction with the plate 171 defines the passage way for the perforated tape through the transmitter. A spring latch holds the tape gate in cooperating relation with the plate 171. This structure of the transmitter is substantially identical with that disclosed in the above-identified copending application, and reference may be had to that application, particularly to Fig. 1 thereof, for a more detailed disclosure of the mechanical details of the transmitter frame. Both plate 171 and the tape gate 173 are provided with a plurality of apertures which are in alignment when the tape gate is in cooperative relation with plate 171. A comb 174, Fig. 7, has been added to tape gate 173 with its fingers depending into the tape path and between the rows of perforations when the gate is latched to the plate 171. The fingers by engaging the web serve to hold the tape down preventing buckling under the probing action of the tape sensing elements to be described presently.

Apertures in plate 171 receive the reduced portions of sensing pins 175, Fig. 2. There is provided a sensing pin or finger for each of the possible perforations appearing in a transverse row of perforations in the tape, plus an additional pin to be employed as a tape-out indicator in a manner to be hereinafter described. In the particular apparatus under consideration there are provided six sensing fingers, inasmuch as it is contemplated to utilize a five-unit code.

A slidably movable feed member 176, Fig. 3, which is formed with a cam groove 177 is provided to feed the tape through the transmitter in accordance with a rectilinear feeding movement precisely as has been described in great detail in the above-identified Patent No. 2,262,012, and illustrated in Figs. 9 to 12 thereof. In view of the detailed description of this tape feeding mechanism, in the latter copending application, the apparatus description and the mode of operation will be set out herein only briefly, and reference should be had to the aforementioned application for a more complete understanding of both the structural details and the precise mode of operation of this rectilinearly operable feed mechanism. Member 176 carries on its upper extremity pins 178 which enter and normally engage the feed perforations in a tape to advance the tape or advance the transmitter, depending on which of the two is held immovable and cooperating with cam groove 177 in lever 176 is a pin 179 secured to the free end of a cam operated lever 181.

As will be described hereinafter, members 176 and 181 are operated in timed relation, and as lever 181 is drawn downwardly in slot 177, the pin 179 due to the particular shape of cam groove 177 will oscillate member 176 in a counterclockwise direction to effect relative movement between the pivoted frame of sensing unit 17 and the tape. Following this operation, lever 176 is moved downwardly to withdraw pins 178 from engagement with the feed perforations in the tape after which arm 181 is moved upwardly and under the influence of the cam groove, member 176 is moved in a clockwise direction as viewed in Fig. 3, and the member 176 is thereafter elevated to cause the pins 178 to engage other feed perforations in the tape to achieve on a subsequent cycle, a relative movement between the sensing unit 17 and the perforated tape.

On the shaft 166 which is supported by the channel 164, Fig. 2, formed in the base casting of the sensing unit are pivotally supported a plurality of Y-levers 182 as well as other levers including those required to control the operation of the members 176 and 181 of the tape feeding mechanism. The Y-levers are individual to the sensing fingers 175 and those fingers are pivotally secured to one arm of the Y-levers on a centerline substantially coincident with the pivots 168. The leftward portions of the Y-levers are supported in a member 183 secured by screws 184, Fig. 1, to the vertical wall sections of the base casting of the sensing unit, and member 183 is suitably slotted to provide a comb guide structure to guide the vertical oscillations of the Y-levers about the shaft 166. Depending from the rightward extremities of the Y-levers, as viewed in Fig. 2, are guide fingers 185 which when the Y-levers are rotated in a clockwise direction about shaft 166 are received in horizontal slots 186 of the casting of the sensing unit, which in this manner guide the oscillating movements of the Y-levers. Each Y-lever is provided leftwardly of the shaft 166 as viewed in Fig. 2, with an upstanding projection 188 to which is secured a spring 189 the other end of which is anchored to a spring post 187 carried by member 183, and springs 189 tend normally to rotate the Y-levers 182 in a counterclockwise direction about shaft 166, and elevate the sensing fingers 175 to sense the perforations in a tape 190 presented to the transmitter.

It is preferred that the sensing fingers 175 be secured to the Y-levers in the same manner in which the sensing elements 125 of the above-identified Patent No. 2,262,012 are secured to their operating bell cranks 148, 152; that is, each sensing finger is provided near its lower extremity with an aperture arranged to be engaged by a pin secured near the end of the horizontally extending arm of the Y-levers. A reed spring riveted to the horizontal arm of the Y-lever serves to retain the lower end of the sensing finger and prevents accidental displacements. This described preferred association of the sensing fingers and Y-levers is not illustrated in the drawings but is adequately illustrated in Fig. 2 of the latter copending application.

Also pivotally supported by shaft 166 is a lever 191, Fig. 1, which is cam controlled to effect the vertical reciprocation of feed member 176, a lever 192 which controls the operation of lever 181, and the resulting oscillation of member 176 about its pivot, and a lever 193 which operates a pair of contacts 194, Fig. 5, for a purpose to be hereinafter described.

A cam drum 196, Fig. 4, carries a plurality of cams which operate, as followers, the several levers pivotally supported by shaft 166, and located on this cam drum, are a plurality of cams 197, six in number to control the operation of the Y-levers, and the operation of the sixth sensing pin which may be carried by a Y-lever or a bell crank lever, a cam 198 to control the operation of contacts 194, a transfer cam 199 for a purpose to be hereinafter described, a cam 200 for controlling the operation of feed lever 176 through lever 191, and cam 201 for controlling the operation of feed lever 181 through lever 192. In Fig. 4, the cam drum has been illustrated and the elements of the structure which would obscure the view of the cam drum have been omitted for the purpose of giving a clear showing of the drum.

The power for driving cam drum 196 is derived

from motor 29 through continuously rotating shaft 34. Main shaft 34, Fig. 4, is rotatably supported by the vertical supporting structure 123 which also provides the support for punch operator 114. Formed integrally with structure 123 are horizontally extending members 202 and 203 in which are securely fixed the bearings 204, preferably ball bearings, for shaft 34. An extension 206 is secured to main shaft 34 through a suitable coupling 207 and carries a gear 208 in mesh with a gear 209, Fig. 2, affixed to a power transmission shaft 211 extending across the rear of the printing reperforator. Shaft 211 is rotatably supported by bearings 212 and 213 depending from the principal apparatus casting 21 and at its leftward extremity carries a second power transmitting gear 214. Gear 214, Fig. 2, which is continuously rotated by shaft 211 meshes with a gear 216 secured to shaft 217 which is journaled in suitable bearings, preferably ball bearings, 218 and 219 depending from the horizontal portion of base casting 21. Grab clutch driving element 221 is driven continuously from shaft 217. The driven element 222 of the clutch is loosely supported on shaft 217, and normally held out of engagement with driving element 221, by means of a clutch throwout lever 223 which normally is spring urged into engagement with a clutch throwout cam 224 formed on the periphery of driven element 222. A compression spring 226 normally urges the clutch elements into engagement with one another and by means of a splined connection driven element 222 of the clutch imparts rotation to the cam drum 196 when the clutch elements have been engaged. An electromagnet 227, when energized, retracts the clutch throwout lever 223 from engagement with the throwout cam on the driven element of the clutch and permits engagement of the driving and driven elements, to rotate the cam drum 196. So long as electromagnet 227 remains energized the cam drum will rotate continuously and upon de-energization of the electromagnet the clutch is disengaged after cam drum 196 completes its instant cycle of revolution.

The energization of electromagnet 227 is under the joint control of a manually operated switch 228, Fig. 10, and a transmitter operated switch 229 so that the operation of the transmitter may be initiated when desired and terminated automatically upon the operation of the transmitter as the transmitter senses the last code signal combination perforated in the tape by the printing reperforator. The manually operated switch 228 may be located within the apparatus or may be external to the apparatus as may be best suited for the installation, but the transmitter controlled switch 229 is located within and is part of the apparatus. Frame member 170 of the transmitter structure carries a rightwardly extending projection 231, Figs. 1 and 2, and when the transmitter in pivoting about pivots 168 has reached its limiting clockwise position, projection 231 will have been brought down into engagement with a plunger 232 which is reciprocally mounted within an aperture in the base casting 21 and normally rests upon a contact of switch 229 so that as the projection 231 bears against and depresses plunger 232, the plunger in turn depresses and operates the switch 229 to break the circuit to the electromagnet 227, and shut down the operation of cam sleeve 196.

Cams 197 are arranged on cam drum 196 with their respective cam recesses in axial alignment so that a cam recess is presented to each of the Y-levers 182 and to the operator of the sixth sensing finger simultaneously whereby the six sensing fingers are elevated to their probing positions simultaneously and, depending upon the presence or absence of a perforation in the tape over an individual finger, into its restrained or its extreme counterclockwise position. The recesses of cams 197 are of sufficient length circumferentially of the cam sleeve 196 to retain the fingers 175 in tape probing position until the operation of a transfer mechanism, to be hereinafter described, has been completed and thereafter the sams rotate the fingers simultaneously in a clockwise direction, retracting them from probing relation with the tape preparatory to advancing the tape through the transmitter. Cams 200 and 201 are orientated to operate, respectively, followers 191 and 192 in precisely the same manner in which cams 207 and 205 in the above-identified Patent No. 2,262,012 cooperate, respectively, with their followers 167 and 170, to impart a rectilinear feeding movement to members 176 and 181 of the transmitting device. Furthermore, cams 200 and 201 are orientated on cam drum 196 with respect to the cams 197, which operate the sensing fingers, in the same relation as the feed cams are orientated on the cam drum of the latter above-identified copending application with respect to the cams therein which operate the tape sensing fingers. This orientation, or a similar one, is important and necessary to assure the proper operation of the feeding mechanism for if the feeding mechanism were permitted to operate in other than the timed relation set forth in the above-mentioned copending application with respect to the operation of the sensing pins, there would result a tearing of the tape and incomplete transmission.

As has already been mentioned, the motion imparted to the transmitter, through the operation of the pin 179 carried on lever 181 which is in engagement with cam groove 177, imparts a feeding stroke to the tape to feed the tape through the transmitter, and so long as there is a tape loop or a tape surplus between the printing reperforator and the tape transmitter, the tape will be advanced in this manner, but when the tape is taut between the reperforator and the transmitter, the operating movement of the transmitter will be restrained in a counterclockwise direction because of the engagement of the pins 178 in the taut tape and will result in the clockwise movement of the transmitter frame about its pivots 168. This movement of the transmitter will continue so long as the tape remains taut between the transmitter and the reperforator, providing that no stop abutment has been reached and that sleeve 196 is maintained in operation. As may be clearly seen in Fig. 2, the sensing unit 17 is pivoted to oscillate about a vertical center; that is, to either side of a vertical center. This overcenter travel of the transmitter requires the inclined feed of the tape through the perforating punch block, which has been defined in detail above, in order that there may be a substantially straight line feed of the tape from the reperforator into the transmitter when the transmitter has assumed its most clockwise position; that is, in abutment with the punch block. The forward or leading surface 69 of the punch block, Fig. 6, is cut back at an inclined angle, inclined to the vertical, to present a plane which is substantially parallel

to the position of the transmitter frame when it has engaged the punch block so that there is in effect a plane of contact between the two units. With the transmitter in this extreme clockwise position, the tape guideway defined by plate 171 and the tape gate 173 above mentioned, will be in a plane inclined to the vertical necessitating the feed of the tape from the reperforator at a similar angle so that the tape may feed in one continuous line from the reperforator into the transmitter in this extreme position.

It is clear from the detailed description of the rectilinear movement of the feeding mechanism of the sensing unit, which has been pointed out above and which is defined in greater detail in the above-identified Patent No. 2,262,012, that the pins 178 are normally in engagement with the tape, and it follows that if the printing reperforator operates at a greater rate than the operation of the sensing unit accumulating tape therebetween, the tape will advance the transmitter in a counterclockwise direction about its pivots 168 until finally the transmitter has reached its extreme counterclockwise position; that is, in abutment with an adjustable limit stop 236, Fig. 2. This adjustable stop is suitably secured to a substantially U-shaped frame member 237 which spans the sensing unit and is secured thereto by means of screws engaging the vertical wall sections 162 thereof, Fig. 1.

Frame member 237 has a depending portion centrally thereof, which secures or supports the stop abutment 236, Fig. 2. A pair of tape supporting fingers 238, Figs. 1 and 2, are carried by the web portion of the frame 237 and extend forwardly of the transmitter unit toward the perforator unit, extending, when the transmitter is in its extreme counterclockwise position against the stop 236, between the spaces which intervene the first and second, and fifth and sixth tape sensing fingers. Fingers 238 may project between any desired sensing elements of unit 17. The tape supporting fingers by projecting through the tape sensing unit serve to support the tape and sustain the weight of the tape loop between the tape sensing unit and the tape reperforator preventing bending of the tape over plate 171 of the transmitter. Should the tape be supported by the sensing fingers and the edge of plate 171 and there be a substantially large tape loop intermediate the tape sensing unit and reperforator, it is possible for the weight of the tape to bend or substantially break the tape over the plate 171 and prevent the feed of the tape through the transmitter. The tape supporting fingers which are provided obviate this danger.

It is to be understood that the tape fingers which are shown in Fig. 2 as being mounted upon the frame 237 may, if desired, be supported by the frame members of the transmitter itself, so that the fingers would travel with the transmitter and support the tape in all positions of the transmitter. However, with such a construction it would be necessary to mount the fingers movably on the frame so that upon the frame's approaching the perforating punch block these fingers could be deflected downwardly or otherwise so as not to impede the movement of the transmitter to its extreme clockwise position against the code punch block which is necessary for the unit to sense the last code combination perforated in the tape.

The tape 190 as it leaves the sensing unit 17 is supported upon a tape guide 239, Fig. 2, and directed thereover out of the apparatus. The guide 239 supported by base casting 21, extends across the transfer mechanism and switching mechanism, to be described hereinafter, and has been omitted from certain of the remaining figures of the drawings for the sake of disclosing elements of the apparatus which would be obscured by the guide.

There has been provided an adjustment in the transmitter whereby the tape sensing elements 175 may be adjusted vertically with respect to the transmitter plate 171 and tape gate 173. The adjustment comprises a plate 241, Fig. 5, rotatably secured to each extremity of shaft 166. The plate has an arcuate slot 242 through which projects stud 243 which threads into the vertical wall section 162 of the transmitter casting. By adjusting plates 241 the position of shaft 166 within channel 164 may be varied resulting in an adjustment of fingers 175 with respect to the transmitter tape gate.

A tape deflector 246 of substantially U-shape, Figs. 1 and 2, is provided intermediate the sensing unit and reperforator and is pivotally secured to the punch block of the perforator, Fig. 1, with the rightwardly extending arms of the deflector 246 pivotally supported upon shaft 76 of the reperforator which also supports the stripper elements 77. A downwardly directed projection 247 depends from the web section of the deflector into the path of the tape as it emerges from the code punch block. The deflector normally tends to rotate in a counterclockwise direction under the influence of gravity and, if desired, a biasing spring. Due to projection 247, tape as it emerges from the reperforating punch block and abuts against the deflector is directed downwardly into a depending loop between the reperforator punch block and the sensing unit. A storage container may receive the tape as it accumulates between the units. The tape deflector is relatively narrow, Fig. 1, and exposes that portion of the tape on which is printed the code characters and, accordingly, the message printed on the tape intermediate the transmitter and reperforator may nevertheless be read even though the tape deflector is in its operative tape loop forming position. The deflector 246 may, if desired, be rotated over center in a clockwise direction to an inoperative position; that is, out of the path of the tape as it emerges from the perforating code punch block. The deflector may be rendered inoperative in this manner to thread the tape initially through the transmitter.

Extending forwardly of the deflector is a latching finger 248 which serves to engage the plate 171 of the transmitter when the transmitter is in its extreme counterclockwise position, as illustrated in Fig. 2, and renders the transmitter immovable with respect to the perforating punch block, so long as there is a sufficiently large tape loop intermediate the transmitter and reperforator. If, because the reperforator unit operated at a greater speed than the transmitter, there is a sufficiently large tape loop formed between the two units, the deflector 246 will pivot about its shaft 76 and come into locking engagement with the transmitter 17 which would have been advanced to its extreme counterclockwise position by reason of the movement of the tape with respect to the transmitter caused by the operation of the reperforator at a greater rate than the operation of the transmitter. Sensing will then be carried out with the sensing unit held

by the latching finger 248, so long as there remains a sufficiently large tape loop intermediate the two units. However, assuming that the sensing unit should operate at a rate greater than the rate of operation of the reperforator, the tape loop will be shortened as it is fed through the transmitter at a greater rate than incoming tape is fed from the reperforator. If the transmitter continues to operate at the greater rate, the tape loop will become entirely taken up, and in so doing, the tape will engage a pin 249 extending horizontally from finger 248, and as the tape becomes taut it will cam the deflector upwardly, and latching finger 248 will be lifted out of the path of the transmitter so that under the subsequent operations of the rectilinear feed mechanism of the transmitter, the pivoted transmitter will be permitted to advance toward the reperforating unit without having its movement in this direction impeded in any way by the latching projection 248 of the tape deflector. In Fig. 2 there is indicated in dotted construction, the position of the tape deflector when it has been cammed by the tape in a counterclockwise direction about shaft 76 due to a shortening of the tape loop.

Briefly the operation of the transmitting or sensing unit is as follows:

Assume switch 228 to be manually closed and that the transmitter 17 is in its extreme clockwise position against the perforator code punch block. In this condition projection 231 secured to frame member 170 of the transmitter, will have depressed plunger 232 and opened switch 229, de-energizing the electromagnet 227 and disabling the power drive to the cam drum 196 by reason of the engagement of clutch throwout lever 223 and the throwout cam 224 on the periphery of the clutch driven element 222. Toward the completion of a cycle of operation of the printing reperforator in response to a received code signal, a perforated code combination will be stored in the tape and advanced from the reperforator to the transmitter, and this advancing movement of the tape, because of the fact that the pins 178 of feed member 176 are in engagement with feed perforations in the tape, will rock the pivoted transmitter in a counterclockwise direction for a distance corresponding to the tape feed, and this movement is sufficient to withdraw projection 231 from engagement with plunger 232 and permit the spring element of the switch 229 to elevate the plunger and close the switch 229 completing the circuit to electromagnet 227 which attracts its armature resulting in the removal of clutch throwout lever 223 from the path of the throwout cam on the clutch driven element 222 permitting the engagement nder the influence of spring 226 of the elements 221 and 222 of the clutch and connecting the power drive from motor 29 through to the cam drum 196. As cam drum 196 rotates, cams 197 simultaneously present cam depressions to the plurality of Y-levers 182 to elevate the sensing fingers 175 into tape probing position under the influence of biasing springs 189 individual to each Y-lever. If a given Y-lever finds a perforation in the tape, its associated spring 189 will be permitted to rotate the Y-lever to its extreme counterclockwise position about shaft 186, positioning the leftward extremity of the Y-lever in the lowermost position in its guide comb 183 but if a sensing finger 175 does not find a code perforation in the tape, the counterclockwise rotation of its associated Y-lever is restrained so that its spring 189 can rotate the Y-lever 182 to a very limited extent about shaft 186 resulting in a positionment of the Y-lever in an upper position in the guide comb 183. The relative position of the Y-levers, that is, whether the Y-levers remain in a relatively high portion of the guide comb 183, or are positioned in the lower portion of the guide comb, controlled in accordance with the code perforated in the tape, is utilized in a manner to be hereinafter described, to control a transmitting distributor and switching devices to perform switching operations in accordance with the permutable setting of the Y-levers. As cam drum 196 continues its cycle of rotation, cams 197 retract fingers 175 from probing engagement with the tape, cams 200 and 201, controlling the operation of levers 176 and 181 in a manner above described, effect a rectilinear feed of member 176 and advance the transmitter again to its extreme clockwise position to cause projection 231 to open switch 229 and interrupt the operation of the transmitting cam shaft at the completion of the cycle of operation of the sensing unit.

If during the operation of the sensing unit, a second advancement is given to the tape and consequently to the sensing unit by the operation of feed wheel 81 in the printing reperforator, the movement of the transmitter frame at the completion of the instant cycle of operation of cam drum 196 will not cause the switch 229 to open and the sensing unit will continue to operate. If the printing reperforator continues to operate at a greater rate than the sensing unit, a tape loop will form intermediate the units and the tape deflector 246 will be effective to latch the sensing unit against its counterclockwise stop 236 until the deflector is cammed out of engagement with the sensing unit by the tape resulting from a subsequent operation of the transmitter at a greater rate than that of the printing reperforator. With the deflector 246 cammed out of the path of the transmitter, the continued operation of the transmitter and its rectilinearly operated feed member 176 will advance the transmitter toward the printing reperforator and ultimately interrupt the operation of the transmitter by opening switch 229 as the transmitter is moved into a position to sense the last code perforation in the tape.

Tape-out indicator

In Fig. 1, it may be clearly seen that there are provided six sensing fingers 175 only five of which are employed to probe the code perforations in the tape as indicated above, the sixth finger being employed as a tape-out indicator to interrupt the operation of cam drum 196 when the tape in the transmitter has become exhausted or broken or in response to the probing of a special perforation in the tape. The sixth sensing finger may be carried by a Y-letter similar to the Y-levers which carry the code sensing fingers but provided with a depending projection 256, Fig. 2, which is effective to momentarily operate normally open contacts 257 and close the circuit, Fig. 10, to the electromagnet 251 when the spring 189 associated with the lever carrying the sixth sensing pin, is permitted to rotate that lever in its extreme counterclockwise position about shaft 186, moving projection 256 to engagement with the contact 257. In view of the fact that contact 257 is closed cyclically upon each rotation of cam drum 196 and is immediately reopened, and since the electromagnet 227 should remain de-energized during the depletion of tape supply,

the contacts 257 are connected to a control circuit shown in Fig. 10. This control circuit forms no part of the present invention but is illustrated only for the purpose of showing the relation between contacts 257 and clutch magnet 227. The control circuit shown in Fig. 10 is described and claimed in copending application Serial No. 448,878, filed by D. E. Branson et al. Briefly, however, the momentary closing of contact 257 effects the energization of magnet 251 over an obvious circuit, which is locked up over an obvious locking circuit. The circuit for a warning lamp is closed, and the circuit of the clutch magnet 227 is opened due to the operation of armatures of magnet 251. By the closing of manually operated contacts 228, the locking circuit of magnet 251 is broken, and the reenergization of clutch magnet 227 is effected. However, instead of employing a Y-lever to support the sixth finger, a pivoted lever pivoted about shaft 166 and supporting at its rightward extremity, Fig. 2, a sensing pin 175 associated therewith in a manner similar to the association of the fingers 175 with the Y-levers and terminating at its leftward extremity in a simple cam follower 258 may be provided. It is, of course, understood that the contact operating projection 256 would be carried by such lever when that lever is employed rather than the Y-lever for supporting the sixth pin.

The sixth sensing pin or tape-out pin will be permitted to be rocked into its extreme counterclockwise position to operate contacts 257 when the tape is exhausted or broken If it is desirable to arrest the operation of transmitter 17 at a predetermined point, a special perforation may be made in the tape in alignment with the sixth sensing pin so that as this special perforation is presented in the transmitter over the sixth pin, that pin in moving to tape probing position will sense the special perforation and interrupt the operation of the transmitter at this predetermined point.

Tape feed suppression

Under certain conditions of operation of communication systems in which the apparatus according to this invention may be employed, it may be desirable to sense and transmit the same perforated code combination a plurality of times and for that purpose, a tape feed suppression means is provided which, when operated, disables the operation of the tape feeding mechanism in the transmitter so that as the cam drum 196 effects a plurality of operations of the sensing unit, the unit will sense one code combination in the tape a plurality of times. In Figs. 2 and 3, the details of the tape suppression device are illustrated. The device comprises a tape suppression magnet 259 which may be energized by any local, manually closed circuit or relay operated circuit, not shown, a pivoted armature 261 provided with a laterally extending blocking projection 262 and projections 263 and 264 provided on follower levers 191 and 192, respectively, of the tape feeding mechanism. A spring 266 extending between the base casting 21 of the apparatus and armature 261 normally holds the armature in its counterclockwise position about its pivot 267 out of engagement with projections 263 and 264.

When it is desired to operate the tape suppression device, the circuit to magnet 259 is manually conditioned, energizing the magnet which attracts its armature, rocking the armature in a clockwise direction about pivot 267 introducing the blocking projection 262 of armature 261 into blocking relation with respect to projections 263 and 264 on feed levers 191 and 192, respectively, holding the members 191 and 192 of the feed mechanism from responding to the influence of their respective biasing springs when a depression in their cams 200 and 201, respectively, is presented to the cam followers secured to levers 191 and 192. Accordingly, as cam drum 196 continues this cycle of revolution, the cams 200 and 201 are ineffective upon the feed levers 176 and 181 since their operating levers 191 and 192, respectively, are held nonresponsive to the control of said cams. Therefore, as cam drum 196 is rotated through a plurality of revolutions it causes the sensing elements 175 under the control of cams 197 to sense the same code combination of the tape a plurality of times.

Transfer mechanism and transmitting distributor

The sensing unit, in the manner described above senses the successive code perforations in the tape as the tape passes from the printing reperforator to the sensing unit, and in each sensing operation positions the Y-levers 182 in guide comb 183 in accordance with the code combination sensed; that is, the Y-levers are permutably positioned in the upper or lower portions of the guide slots in comb 183 in accordance with the extent of the counterclockwise rotation of the Y-levers under the influence of their biasing springs 189 as controlled by the perforations in the tape. The permutable setting of the Y-levers 182 is transferred through a transfer mechanism to control the contacts of a cam type transmitter distributor 18, Figs. 2 and 4, which redistributes or retransmits the received and recorded code signal combinations.

The transfer mechanism is supported by a pair of brackets 271, 272, Fig. 1, which are provided with horizontally extending flanges 273 through which the brackets are bolted to base casting 21. Each bracket includes a second, horizontally extending flange 274 having a tapped aperture to receive screws 273 which secure the tape guide plate 239 into the apparatus assembly. Pivot studs 277 and 278, Fig. 4 are carried at the lower extremity of brackets 271 and 272, respectively, and support the frame of the transfer mechanism in a pivotal manner. The frame comprises a pair of vertical arms 279 and 280 interconnected by a horizontally disposed member 281, Figs. 1 and 2. A horizontally disposed pivot shaft 282, Fig. 2. extends between the upper portions of vertical frame members 279 and 280 of the transfer frame and there is mounted on the shaft a plurality of transfer levers 283 which are substantially T shaped and suitably spaced horizontally along shaft 282 by means of spacing discs 284. The upper and lower extremities of the vertical sections of T-levers 283 face the fork elements of the Y-levers 182, Fig. 2, and when the Y-levers are positioned in the upper portion of comb 183, the upper tines of the Y-levers are in substantial alignment with the upper extremities of the T-levers and, conversely, when the Y-levers are positioned in the lower portion of the comb, as illustrated in Fig. 2, the lower tines are in substantial alignment with the lower extremities of the T-levers. Shaft 282 is preferably eccentric in cross section so that by rotating the shaft an accurate alignment of the T-levers and Y-levers may be obtained.

In order to transfer the permutable setting of the Y-levers to the transfer levers, the frame of the transfer mechanism is pivotally supported

as described above, and cam 199, Fig. 4, which is included in cam drum 196, operates upon a cam follower 286, Figs. 3 and 4, formed as a projection on the member 280 of the frame of the transfer mechanism. A biasing spring (not shown) operates normally to hold the transfer frame in its counterclockwise position, but the operation of cam 199 on cam follower 286 is sufficient to overcome this spring bias and rotate the transfer frame and the T-levers 283 into a clockwise position in which the terminals of the T-levers come into abutting relation with the tines of the Y-levers in accordance with the permutable setting of the Y-levers, and this engagement of the T-levers with the Y-levers rocks the T-levers in a clockwise or counterclockwise direction about shaft 282 and transfers, in this manner, the setting of the Y-levers to the T-levers.

More particularly, if a Y-lever is assumed to be in its lower position in comb 183, in response to the projection of its associated sensing finger 175 through a code perforation in the tape under the influence of its biasing spring 189, when the cam 199 operates the transfer mechanism in timed relation to the probing of the tape under the control of cams 197, it will bring the T-lever associated with the particular Y-lever toward the Y-lever, the lower time of which will engage the lower extremity of the vertical section of the T-lever 283, and through this engagement will rock the T-lever 283 in a clockwise direction about shaft 282. Conversely, when the Y-lever is in its upper position in the comb 183 due to the failure of its finger 175 to enter a perforation in the tape, when the associated T-lever is brought into engagement with the Y-lever, the upper tine of the Y-lever will engage the upper extremity of the vertical section of the T-lever and in this engagement rock the T-lever in a counterclockwise direction about shaft 282. The transfer of the setting of the individual Y-levers to the associated individual T-levers takes place simultaneously and after it has taken place, the return spring on the transfer mechanism is effective under the control of cam 199 to rotate the transfer mechanism, and the T-levers in their permutable relation with respect to one another, to their normal or counterclockwise position and, in this manner, free the plurality of Y-levers which may then be returned to their normal position by cams 197 retracting the fingers 175 from engagement with the perforated tape, preparatory to the sensing of a subsequent code combination. When the transfer mechanism is returned to normal, it maintains control over a transmitting distributor to transmit the signal combination transferred from the Y-levers and during this transmission, cam drum 196 initiates another cycle of the sensing unit, setting the Y-levers in accordance with the following code signal combination recorded in the tape, thereby providing signal overlap between the sensing unit and transfer mechanism.

There is associated with each T-lever a vertically disposed slider 291 having vertically arranged slots 292 and 293 through which shafts 294 and 295 extend to support the sliders and guide their vertical reciprocations. Shafts 294 and 295 are supported by brackets 271 and 272. Each slider has a horizontally disposed slot 296 into which the stem portion of its associated T-lever projects when the sliders are properly positioned along shafts 294 and 295, the sliders being spaced therealong by spacers 297. Near its upper extremity each slider has a cam projection 298 to engage an associated contact operator 301 pivotally supported on shaft 302 which is carried by brackets 271 and 272. A plurality of groups of contacts 303, 304, 305, 306, 307, Fig. 9, is assembled in the apparatus in a manner to be hereinafter described to control a transmitting distributor 18 and to effect switching or other functions. The contact groups require more space than the transfer mechanism and sliders, Fig. 1, and in order to be able to operate the contact groups by the sliders 291 most of the contact operators 301 take the form of a bail and spacers 303 carried by shaft 302 keep the bails in proper alignment with the sliders and the contact groups.

Each contact operator 301 includes a rightwardly extending projection 309 in alignment with cam projection 298 of its associated slider to be operated thereby and a leftwardly extending projection 310 in alignment with an insulated pin 311 which extends through its associated contact bank being secured to the movable elements of the contact group and being freely slidable through the stationary elements of the contact group so that as the operator is actuated by cam projection 298 it operates the contacts in its associated group correspondingly. Included in each contact group is a pair, designated *a* in Fig. 9, that determines signal transmission from transmitting distributor 18 in accordance with the actuation of the contact operators by the sliders 291.

When a given slider is in its uppermost position, due to the clockwise rotation of the T-lever 283 to which it is articulated, it holds its contact operator in a counterclockwise position about shaft 302 and closes that pair of its group that is associated with distributor 18 conditioning the signal generating circuit up to that point preparatory to the transmission of a marking impulse. When the slider is in its lowermost position, due to the counterclockwise rotation of the T-lever 283 to which it is articulated, it releases its associated contact operator which is rotated in a clockwise direction about shaft 302 by the resiliency of the movable elements of its contact group through pin 311 and projection 310 as the movable elements assume their normal positions opening the contact pair of the group that is in circuit with the distributor 18 preparatory to the transmission of a spacing signal.

The transmitting distributor 18, Figs. 2 and 4, is of the cam type comprising a cam drum 316 upon which are mounted the five code impulse controlling cams and the start-stop controlling cam, as is well known in the art, and described with particularity in Patent No. 1,595,472 to Krum. Cam drum 316 is loosely mounted on shaft 317 which receives its driving power from shaft 211, Fig. 2, which carries gear 214 meshing with a gear 318 secured to shaft 317. A grab or positive clutch comprising a driving element 319, Fig. 4, secured to shaft 317 and a driven portion 320 rotatably mounted upon shaft 317 and controlled by clutch throwout lever 321, Fig. 5, is provided to connect the power from shaft 317 through the grab clutch, to cam drum 316 when magnet 322 is energized, retracting the clutch throwout lever 321 from engagement with the throwout cam on the peripheral portion of clutch element 320 permitting engagement of

the elements of the grab clutch in a manner referred to hereinbefore in connection with another similar grab clutch construction. Shaft 317 is journaled in ball bearings 323 depending from the base casting 21.

The distributor release magnet 322 as well as the transmitter release magnet 227 is supported by a bracket 326, Fig. 5, that depends from main casting 21, the magnets being secured thereto in superposed relation. Bracket 326 has horizontally extending arms 327 and 328 that project to each side of the magnets, Fig. 1, and a pivot shaft 329 upon which is pivotally mounted clutch throwout levers 223 and 321 is supported by the rightward extremities of arms 327 and 328.

Associated with cam drum 316 is a plurality of bell crank levers 336, Fig. 2, pivoted on a shaft 337 suitably supported by main casting 21. A spring 339 individual to each bell crank tends to rotate the bell crank in a clockwise direction causing the bell crank to operate as a cam follower for a cam included in cam assembly 316. The opposite extremity of the bell crank abuts against an associated contact pair 338 and operates the pair cyclically under the control of cam drum 316. The several contact pairs 338, there being one pair for each bell crank, are supported by a bracket 341 secured to the main casting. Bracket 341 also supports a lever 342 which is tapped to receive adjusting screws 343. Screws 343 extend through member 342 and abut against the stationary element of each contact pair of the distributor and afford micrometric adjustability thereof to determine the length of signaling impulses.

The transmitting distributor includes six pairs of contacts which is customary for transmitting five unit code signal combinations, a start-stop contact pair S, Fig. 9, and a pair for each of the five elements of the code. The code element contact pairs are individually contacted in series with the distributor contact pair included in one of the above-mentioned contact groups 303 through 307 whereby the signal transmitted is determined by the above-described actuation of the contacts comprising the contact groups.

When cam drum 316 is permitted to rotate due to the energization of magnet 322, the code impulse controlling cams, successively present cam depressions to the bell cranks 336 and in response thereto, the biasing springs rotate the levers in a clockwise direction to close the associated contacts 338 and transmit over line L signaling impulses in accordance with the operation of the contact groups by the sliders 291. If a slider associated with a given contact group is in its uppermost position, illustrated in Fig. 2, due to the clockwise positionment of its respective transfer T-lever, the contacts of that group will be closed and when a cam recess is presented to the bell crank associated with that slider and contact group, a circuit will be completed from battery through the contact group and distributor contact to the line to transmit a marking impulse thereover. If the slider had been in its lowermost position, its contact group would be in its normal position, Fig. 9, interrupting the circuit to the distributor contact and causing the transmission of a spacing impulse over the line.

The energization of electromagnet 322 is under the control of cam 198 on cam sleeve 196 of the sensing unit which, through the orientation of cam 198 on the sleeve, releases the distributor shaft 317 to drive the cam sleeve 316 in timed relation to the sensing and transfer of the code combinations in the tape. Cam 198 operates a bell crank 193, Figs. 1 and 5, pivoted on shaft 166 to close contacts 194, which complete a simple energizing circuit (not shown) to the electromagnet 322 in each cycle of revolution of the sensing unit cam drum 196 to cause the grab clutch 319—320 in the transmitting distributor unit to be engaged for a single cycle of revolution.

The operation of the transfer mechanism and the transmitting distributor briefly is as follows:

In timed relation to the setting of the Y-levers 182, cam 199 operates to move the transfer mechanism including the transfer T-levers 283 to their clockwise position and permutably set the T-levers in their clockwise or counterclockwise position about shaft 282 in accordance with the engagement of the T and Y-levers; that is, by engagement of the Y-levers with the lower extremities of the T-levers, the latter are rotated in a clockwise direction in response to a marking impulse indicated in the perforated tape and, conversely, are rotated in a counterclockwise direction in response to the spacing impulse indicated in the tape. Through their association with the T-levers, the sliders 291 will be correspondingly conditioned in a permutable setting, the sliders articulated to the T-levers which have been rotated in a clockwise direction being in their uppermost position and those sliders articulated to the T-levers which have been rotated in a counterclockwise direction being in their lowermost position. The sliders condition their associated contact groups accordingly, preparing individual signaling circuits from one contact pair of each group to the number 1, 2, 3, 4, and 5 code element contacts pairs of the transmitting distributor which is released for rotation by the transmitting cam drum 198 in timed relation to the conditioning of the signaling circuits whereby the code combination that has been sensed by the sensing unit, transferred and stored in the sliders is established in the transmitting distributor and retransmitted.

Mechanically controlled transmitting distributor

Transmitting distributor 18 has been described as being controlled electrically from contact pairs located in the contact groups 303 through 307. With this construction, the bell cranks 336 of the distributor operate invariably in response to the control of cam assembly 316 to close the contact pairs 338 included in the distributor in succession for the transmission of the synchronizing impulses and the code element impulses of the five-unit code contemplated to be retransmitted in accordance with the signals stored in the tape 190. In Fig. 3, there is disclosed a modification of the transmitting distributor mechanism in which there is a mechanical association of the distributor with the vertical sliders 291 and in which the distributor is electrically independent of the several contact groups. Fig. 3 includes elements disclosed in Fig. 2 and those elements common to the two views bear the same reference numerals. The vertically disposed sliders 291, however, are provided with depending projections 346 which control distributor 18. In place of the bell cranks, the distributor is provided with a plurality of three-armed levers 347 pivoted upon shaft 337 one such lever being associated with each of the code element contact pairs of the distributor. A depending arm 348 of each three-armed lever is in engagement with and serves to operate the movable element of its

associated contact pair 338; horizontal arm 349 serves as a cam follower for the cams included within the distributor, and the vertically extending arm 350 projects into an operative position with respect to the depending projection carried by the associated slider 291. A biasing spring 339 tends to rotate each lever 347 in a clockwise direction and maintains the cam following arm 349 in contact with its associated cam. The alignment and relative size of arm 350 and depending projection 346 is such that when a given slider 291 is in its lowermost position, the projection 346 will overlap the extremity of arm 350 and block through this association the clockwise rotation of that lever under the force of its biasing spring 339 when the cam associated therewith presents a depression thereto and will prevent arm 348 from closing the contact pair 338 associated therewith. When vertical slider 291 is in its uppermost position, illustrated in Fig. 3, blocking projection 346 is removed from the path of arm 350 permitting the lever to rock in a clockwise direction in response to the control of this cam to close its associated contact pair 338.

The operation of this modification of the transmitting distributor is similar to that disclosed in Fig. 2 insofar as the sensing of the tape, the transferring of the setting of the Y-levers to the T-levers, and the consequent positioning of the vertical sliders 291, is concerned. The retransmitted signal, however, is generated through the permutable operation of the levers 347 under the control of the blocking projections 346 in accordance with which a marking impulse is generated when a slider is in its uppermost position permitting its associated lever 347 to respond to cam drum 316 and close its contact 318 to complete a signaling circuit (not shown) associated with the cam type distributor. A spacing impulse is generated due to the engagement of blocking projection 346 with arm 350 which prevents the clockwise rotation of lever 347 under the control of its associated cam and interrupts the signaling circuit of the distributor and contacts 338 associated with the particular lever 347.

This description of the signal transmission by distributor 318 is predicated upon a current-no current signaling system such as is disclosed in the above-identified patent to Krum in which in Fig. 10, there is illustrated a signaling circuit for the cam type distributor. It is to be understood that the method of signaling employed is immaterial and that instead of a current-no current signaling system, a variable polarity signaling system might be employed.

Automatic switching mechanism

In order to effect automatic switching or any of the various functions which it may be desired to control from the perforated tape, each contact group 303 through 307 includes, in addition to the contact pair associated with the transmitting distributor 18, a plurality of contact arrangements *b*, *c* and *d*, Fig. 9, each of which is associated with a switching or other function control circuit. Inasmuch as the functions controlled by the circuits included in these contact arrangements are immaterial, the work circuits have not been disclosed, the present invention being concerned only with apparatus for conditioning those circuits which terminate in the contact arrangements of each group.

Through the mechanics of each contact group, as will appear presently, the movable elements of each contact arrangement included in each group are operated simultaneously and, as has been pointed out above, the movable elements of the contacts of the several groups are in turn operated simultaneously through the contact operators 301 in response to the transfer of a permutable setting from the Y-levers through the T-levers to the vertical sliders. Through this construction, three series of contact arrangements are provided which operate simultaneously in permutations; that is, in Fig. 9, one series of permutably operated contacts is indicated 303*b* through 307*b*; a second series of permutably operable contacts is indicated 303*c* through 307*c*; and a third series of permutably operated contact elements is indicated 303*d* through 307*d*. In order to provide selective operation of the work circuits, those circuits should be associated with one or more of the above-defined series of permutably operable contact arrangements whereby selective operation will result through the permutable operation of the contact series by the sliders.

The several contact groups 303 through 307 are carried by the U-shaped bracket 356, Fig. 1, which is provided with horizontally extended flange sections 357, 358 each of which is apertured to receive shoulder screws, or the like, for assembling the bracket to the apparatus casting 21. Each flange also supports a vertical stud 359 and 360 the upper extremity of which is tapped to receive shoulder screws 361 which assemble the tape guide plate 239 into the apparatus along with the afore-mentioned shoulder screws 276. The assemblage of each contact group secured to bracket 356 includes in addition to the contact elements 362, Fig. 2, a resilient member 363 provided with an L-shaped piece 364 at its upper extremity to which is secured a comb 365 of Bakelite or any suitable insulating material. The stationary contact element 366 of each contact group are provided with projections which extend between the teeth of comb 365. Adjusting screws 367 are threadedly received by bracket 356 and extend therethrough into engagement with each resilient element 363 affording a micrometric adjustment of the contact arrangements of each contact group. The contact operating pin 311 of each contact group is in alignment with the leftwardly extending projection 310 of each contact operator. Pin 311 is freely slidable through the stationary contact elements 366 and is secured to each movable element 368 of each contact group so that upon operation of the pin 311 by its operator 301 each contact arrangement within a given contact group is operated simultaneously.

Through the transfer mechanism the contact groups are operated in every cycle of operation of the transmitter. In order that the switching functions may be performed only at the proper time, that is, only when it is desired to effect a switching function, the circuits controlled by the permutable operation of the series of contacts should be designed, preferably, to respond and effect a switching or other function only upon the receipt of a predetermined sequence of code signal combinations by the transmitter; that is, the work circuits should be rendered operable only in response to a predetermined sequential operation of the permutably operable series of contact arrangements associated therewith. With the function circuits designed to respond to a predetermined sequence of operation of the contact groups, a switching function may

be accomplished to set up a communication channel or the like which would remain conditioned until the reception of another predetermined sequence of operations of the contact groups so that having set up the communication channel, it is maintained until such time as it may be desired to disable the channel. A switching system in which this method of circuit operation is fully disclosed is to be found in copending application, Serial No. 448,878, filed in the name of D. E. Branson et al., and reference may be had thereto for the details of such circuit construction and operation.

In order to utilize the automatic switching mechanism, the substation at which a message is to be originated transmits initially a sequence of code signal combinations required to effect a predetermined switching function through the several contact groups. This series of code signal combinations is received in printing reperforator 16 and stored in the tape 190. The tape is then sensed by the transmitting unit 17 and the series of code signal combinations is sensed and transferred therefrom through the sliders 291 to operate the switching mechanism 19 in accordance therewith; that is, to operate a switching mechanism in a predetermined sequential manner which will determine the required communication channel. Thereafter, the signal combinations comprising the message to be transmitted over the selected channel which have been received subsequent to the sequence of switching code signal combinations are transmitted from the transmitting distributor 18 through the operation of the sensing mechanism 17 and the contact pairs of the contact groups associated with the transmitting distributor. Finally, a second series of code signal combinations which has been sent by the originating station to disable the predetermined communication channel, is sensed by the sensing mechanism 17 to operate the switching mechanism 19 in a second predetermined sequence which is effective to disable the communication channel.

Additional functions may be effected through the control of function circuits associated with pull bar operated contacts provided at the printing reperforator 16. The pull bar operated contacts 369 are actuated when predetermined pull bars 26 provided with contact operating projections 371 are selected upon a predetermined operation of the notched code bars 27. A preferred association of the pull bar and the pull bar operated contacts is the subject of copending application Serial No. 405,301, filed under the name of Walter J. Zenner.

The function circuits controlled by the pull bar operated contacts 369 are preferably completed through contact pile up 372, Fig. 4, controlled by the main operating plunger 38 of the printing reperforator which is provided with a cam surface 373 to operate a contact operating bell crank 374 pivoted on a stud 376 which is secured to a bracket 377 depending from the apparatus casting 21. A spring 378 extended between one arm of bell crank 374 and bracket 377 urges the bell crank in a counterclockwise direction to follow the cam surface 373 of the main operating plunger 38. Bell crank 374 at its opposite extremity carries an adjustable screw 379 which engages the movable element of the contact pile up 372.

With this mechanical construction and electrical circuit arrangement when it is desired to accomplish a function through a circuit associated with a pair of pull bar operated contacts 369, the associated pull bar 26 is selected through a predetermined operation of the code bars 27 in response to the received code signal combination characteristic of the particular function. Upon the selecetion of the pull bar, the contact pair 369 is closed immediately as in a manner fully described in the above-identified application to Zenner. Subsequently, as the printing reperforator continues the instant cycle of operation, the main operating plunger 38 is elevated and bell crank 374 which is normally held in a clockwise position riding upon the high portion of cam surface 373 follows the cam surface and is rotated by its biasing spring in a counterclockwise direction to a position, illustrated in Fig. 4, in which the contact pile up 372 is operated completing the circuit through the selected pull bar operated contact 369. Near the completion of this cycle of operation of the printing reperforator, plunger 38 is returned to its lowermost position rotating the bell crank 374 to its normal clockwise position which opens the contact pile up 372 and disables the function circuit closed through the pull bar operated contacts 369 and the contact pile up 372 and finally as the cycle is completed, the selected pull bar 26 is returned to its normal position which opens the contact pair 369 through which the function had been completed.

Although a specific embodiment of the invention has been disclosed in the drawings and described in the specification, it is to be understood that the invention is not limited to such specific embodiment but may be modified and rearranged without departing from the spirit and scope of the invention.

What is claimed is:

1. A strip controlled circuit operating mechanism comprising a strip reader having a plurality of sensing elements, a plurality of banks of circuit conditioning contacts, means for operating said banks of contacts permutably in accordance with circuit controlling signals, storage means controlled by said sensing elements for storing said circuit controlling signals, and a transfer device to subsequently transfer said stored circuit controlling signals from said storage means to said contact operating means.

2. A signal controlled apparatus comprising a transmitting distributor, a work circuit, a plurality of groups of contacts, certain of the contacts of said groups being associated with said transmitting distributor and other contacts of said groups being associated with said work circuit, and strip controlled contact operating means to operate said groups of contacts permutably in response to a received signal to condition said work circuit and to transmit the received signal.

3. Switching apparatus including a switching circuit, a transmitting distributor, switching contacts associated with said switching circuit, contacts associated with said transmitting distributor, and strip controlled means for operating said contacts simultaneously to effect switching and to transmit a signal corresponding to the operation of said contacts.

4. A signal controlled switching apparatus including a plurality of groups of contacts, a transmitting distributor, a switching circuit, certain of said contacts being connected to said distributor and others of said contacts being connected to said switching circuit, a plurality of contact operating levers, and means to actuate said operating

levers in various combinations to condition the switching circuit and to condition the transmitting contacts to transmit a signal combination representative of the actuation of said levers.

5. A signal controlled apparatus including a transmitting distributor, a plurality of work circuits, a plurality of groups of contacts, certain of said contacts being associated with said distributor and the remaining contacts being associated with said work circuits, contact operating means, and means for actuating said contact operating means permutably to condition said work circuits correspondingly and simultaneously to condition said transmitting distributor to transmit a signal combination representative of the actuation of said contact operating means.

6. A telegraph apparatus including a transmitting distributor, a work circuit, contacts connected to said work circuit, contact operating means to condition said work circuit, means to actuate said contact operating means, and a mechanical association of said contact operating means and said distributor whereby said distributor is conditioned in accordance with the actuation of said contact operating means to transmit a signal combination representative of the actuation of said contact operating means.

7. A signal controlled apparatus including a transmitting distributor, a plurality of work circuits, a plurality of contacts, and contact operating means, means for actuating said contact operating means in variable permutations to condition said work circuits selectively, and a mechanical interconnection between said contact operating means and said transmitting distributor operable to condition said transmitting distributor to transmit a signal combination representative of the actuation of said contact operating means.

8. A signal controlled apparatus including a transmitting distributor, a plurality of work circuits, a plurality of contacts controlling said work circuits, contact operating means, strip controlled means to actuate said contact operating means to condition said work circuits selectively, and a mechanical association of said operating means and said transmitting distributor whereby said distributor is conditioned to transmit a signal combination identical to the signal of the control strip in accordance with which said contact operating means has been actuated.

9. A telegraph transmitter comprising a sensing mechanism including a plurality of sensing elements to sense control indicia on a control strip, a cam type transmitting distributor including transmitting contacts and cam controlled contact operating members, and control means to condition said contact operating members for operation, said control means comprising blocking elements and a transfer mechanism effective to store and subsequently transfer the condition set up in said sensing mechanism to said blocking elements to condition said elements with respect to said contact operating levers to operate said transmitting contacts in accordance with the operation of said sensing elements under the control of the strip.

10. A tape transmitter comprising a sensing device including sensing elements to probe control indicia on a control tape, a cam type transmitting distributor including transmitting contacts and a plurality of contact operating levers, a plurality of permutably settable blocking levers associated with said contact operating levers, and a transfer mechanism effective to store and subsequently transfer the condition set up in said sensing device to said blocking levers comprising a corresponding plurality of transfer elements connected directly to said blocking elements, and means to condition said transfer levers to permit the operation of said transmitting contacts by said contact operating levers in accordance with the setting of said sensing elements under the control of the tape.

11. A strip reader including a base, a plurality of sensing elements, a cam assembly for cyclically operating said sensing elements, and a shaft upon which said sensing elements are pivotally mounted, said shaft being supported by said base through a pair of shaft supporting instrumentalities, one at each end of said shaft, comprising eccentric agencies cooperable with said instrumentalities whereby said sensing elements may be adjustably positioned transversely of the control strip to be read.

12. A telegraph apparatus including means to apply control indicia to a strip, means having sensing elements to sense the control indicia, a plurality of contacts, a work circuit, a transmitting distributor, certain of said contacts being connected to said distributor, the remaining contacts being connected to said work circuit, permutably operable contact actuating means, and a transfer mechanism to transfer the setting of said sensing elements to said contact actuating means to operate said contacts to condition said work circuit and to condition said distributor to transmit a signal corresponding to the control indicia.

13. A telegraph apparatus including means to apply control indicia to a strip, means having sensing elements to read the indicia on the strip, a plurality of contact groups, a plurality of work circuits, a transmitting distributor, one contact of each group being connected to said transmitting distributor and the remaining contacts of each group being connected to said work circuits, operating means for each contact group, a transfer mechanism associated with said operating means, and means to condition said transfer mechanism in accordance with conditioning of said sensing elements in response to a reading of the strip whereby said transfer mechanism actuates said contact operating means to condition said work circuits selectively and to condition said transmitting distributor to transmit a signal combination corresponding to the reading of the strip.

14. A telegraph apparatus including means for applying indicia to a control strip, means having sensing elements to sense the strip, a work circuit, a transmitting distributor, contacts associated with said work circuit, mechanical means for conditioning said contacts and said transmitting distributor, a transfer mechanism to operate said mechanical means, and means to condition said transfer mechanism in accordance with the conditioning of said sensing elements by the strip whereby said work circuit is conditioned and transmitting distributor is conditioned in accordance with the control indicia of the strip.

15. A telegraph apparatus comprising means for applying indicia to a control strip, means including sensing elements to sense the strip, a plurality of work circuits, a transmitting distributor, a plurality of contacts connected to said work circuits, contact operating devices, mechanical means for actuating said contact operating devices and for conditioning said transmitting distributor, a transfer mechanism to operate said

mechanical actuating means, and means to operate said transfer mechanism in accordance with the conditioning of said sensing elements to condition said work circuits selectively and to condition said transmitting distributor in accordance with the sensed indicia.

16. A telegraph apparatus comprising means to apply indicia on a control strip, means including sensing elements to sense the strip, a plurality of work circuits, a plurality of contacts associated with said circuits, a transmitting distributor, a transfer mechanism, and means to operate said mechanism in timed relation to the operation of said sensing means, said transfer mechanism including a plurality of members to be sensed permutably by said sensing elements with each operation of said transfer mechanism to condition said work circuits selectively through said contact, and to condition said transmitting distributor in accordance with sensed indicia.

17. A telegraph apparatus including means to apply code combinations of control indicia to a strip, a plurality of sensing pins for sensing the individual elements of each code combination, means comprising a set of transfer levers for storing the record sensed by said sensing pins, and means to subsequently transfer the setting of said transfer levers to a plurality of sets of contacts associated with said sensing pins.

18. A telegraph apparatus including means to apply a plurality of code combinations of control indicia to a storage medium, a plurality of sensing members for sensing the individual elements of each code combination, means comprising a set of transfer instrumentalities for storing the record sensed by said sensing members, and means to subsequently transfer the setting of said instrumentalities to a plurality of sets of contacts associated with said sensing members.

19. A telegraph apparatus including means to apply code combinations of control indicia to a storage medium, a plurality of sensing means for sensing the individual elements of each code combination, means comprising a set of transfer T-levers for storing the record sensed by said sensing means, slidable actuators articulated to said levers, and means to subsequently transfer the setting of said levers to said actuators to control correspondingly a plurality of sets of contacts associated with said sensing means.

20. A strip reader including a base, a plurality of sensing elements, a cam assembly for cylically operating said sensing elements, a shaft upon which said sensing elements are pivotally mounted, guide means for said shaft in said base, and a pair of shaft supporting instrumentalities one at each end of said shaft, comprising eccentric agencies cooperable with said instrumentalities whereby said sensing elements may be adjustably positioned transversely of the control strip to be read.

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