March 7, 1944. C. R. DOTY 2,343,405

COMMUNICATION APPARATUS

Filed June 17, 1943 5 Sheets-Sheet 1

FIG. 1.

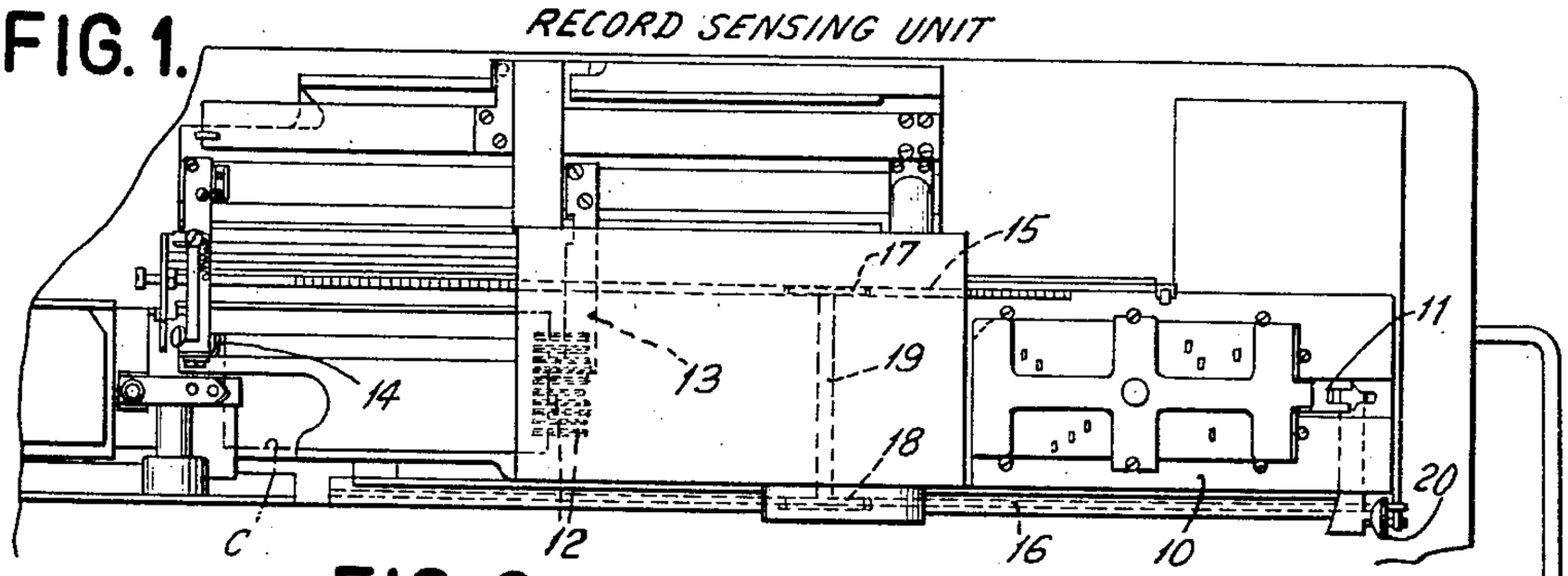


FIG. 2.

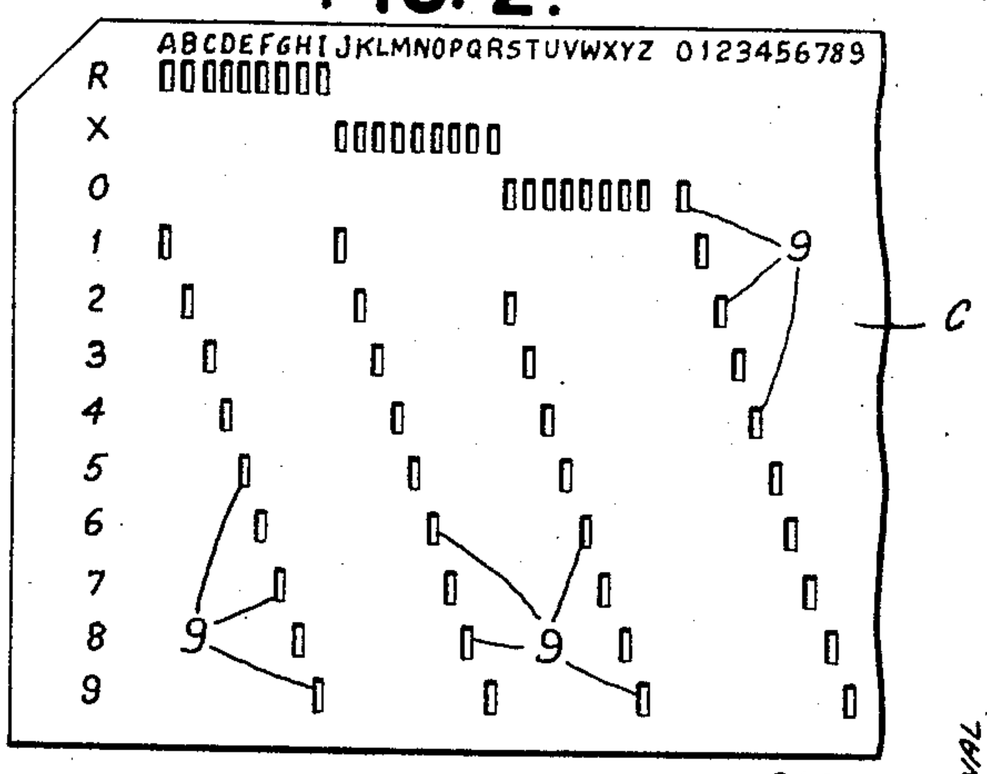


FIG. 3.

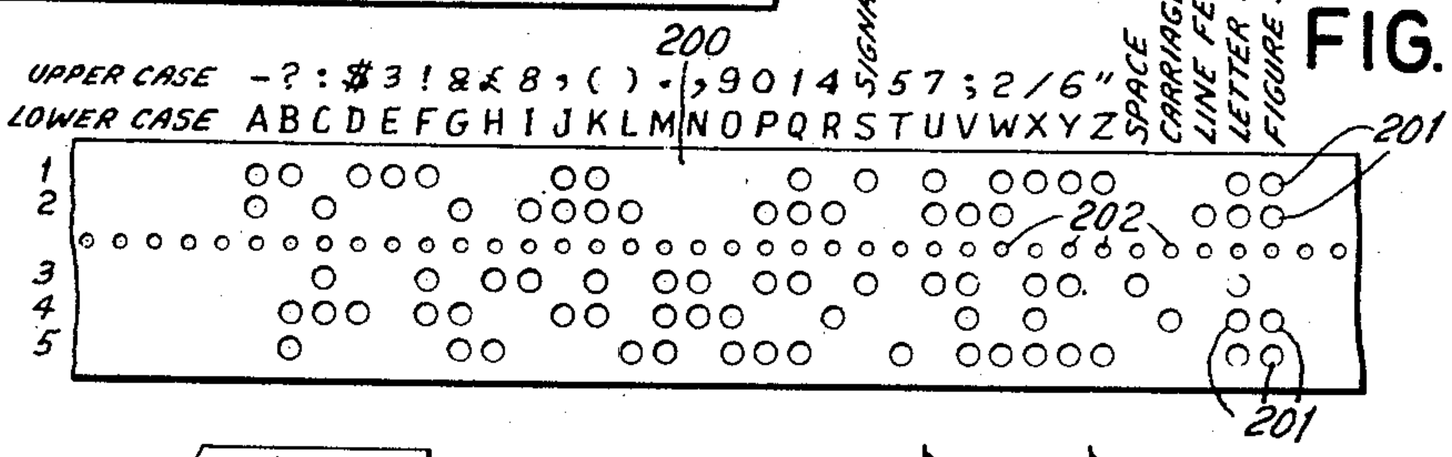


FIG. 4.

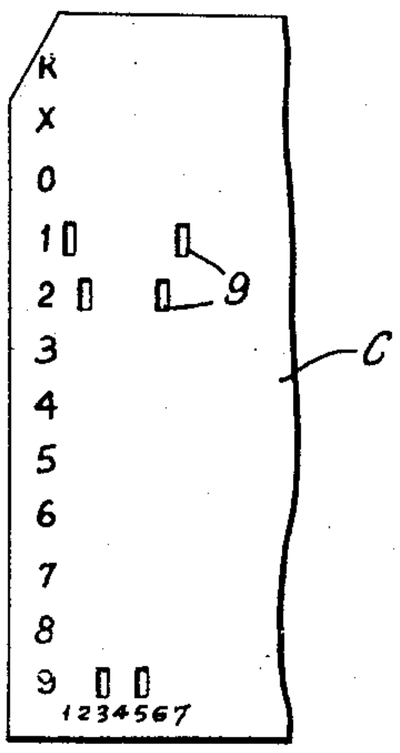
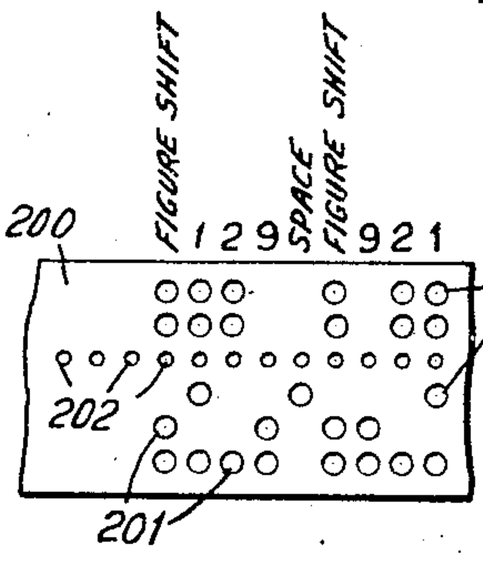


FIG. 5.



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COMMUNICATION APPARATUS

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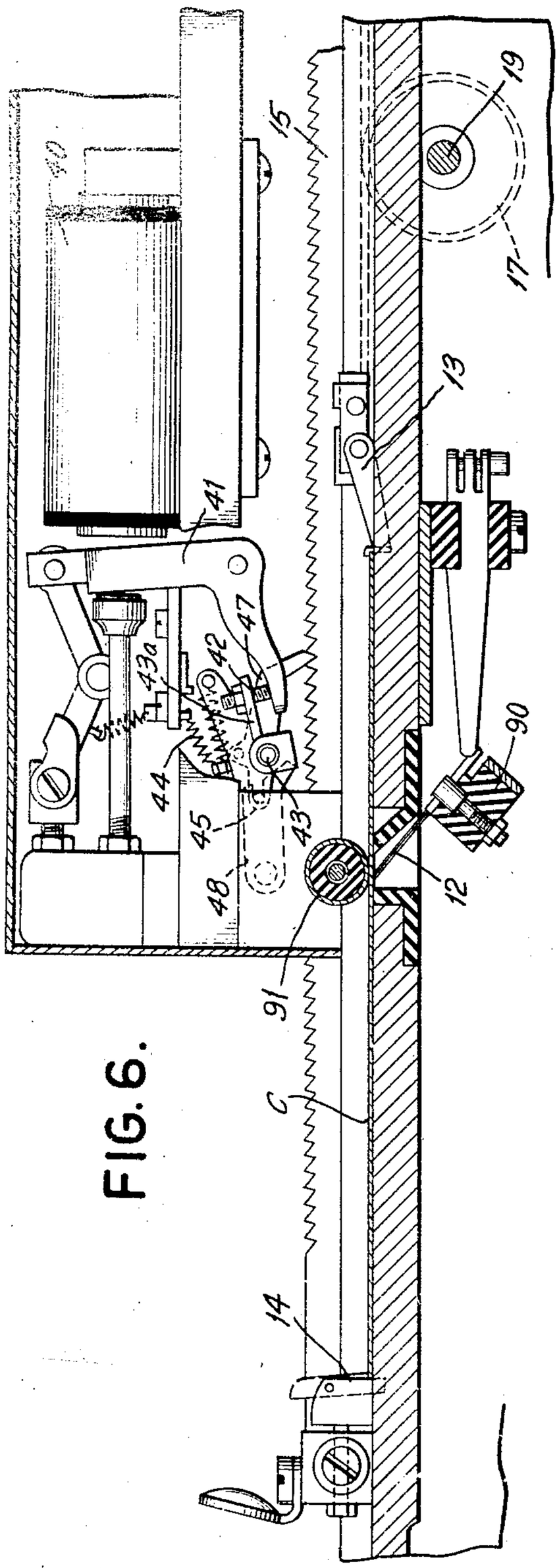

FIG. 6.

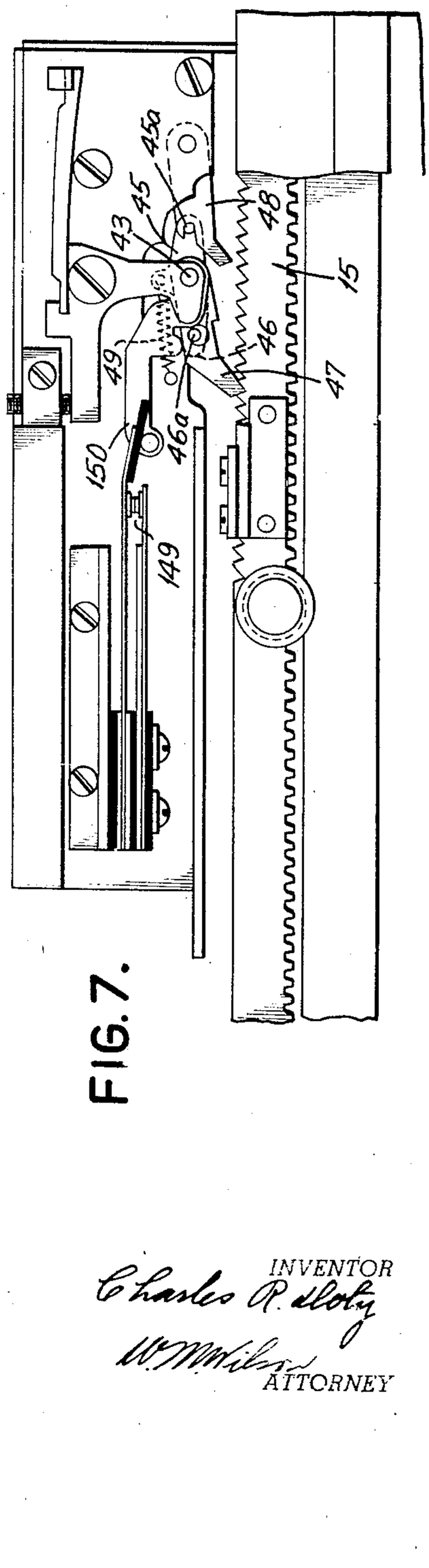

FIG. 7.

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FIG. 8.

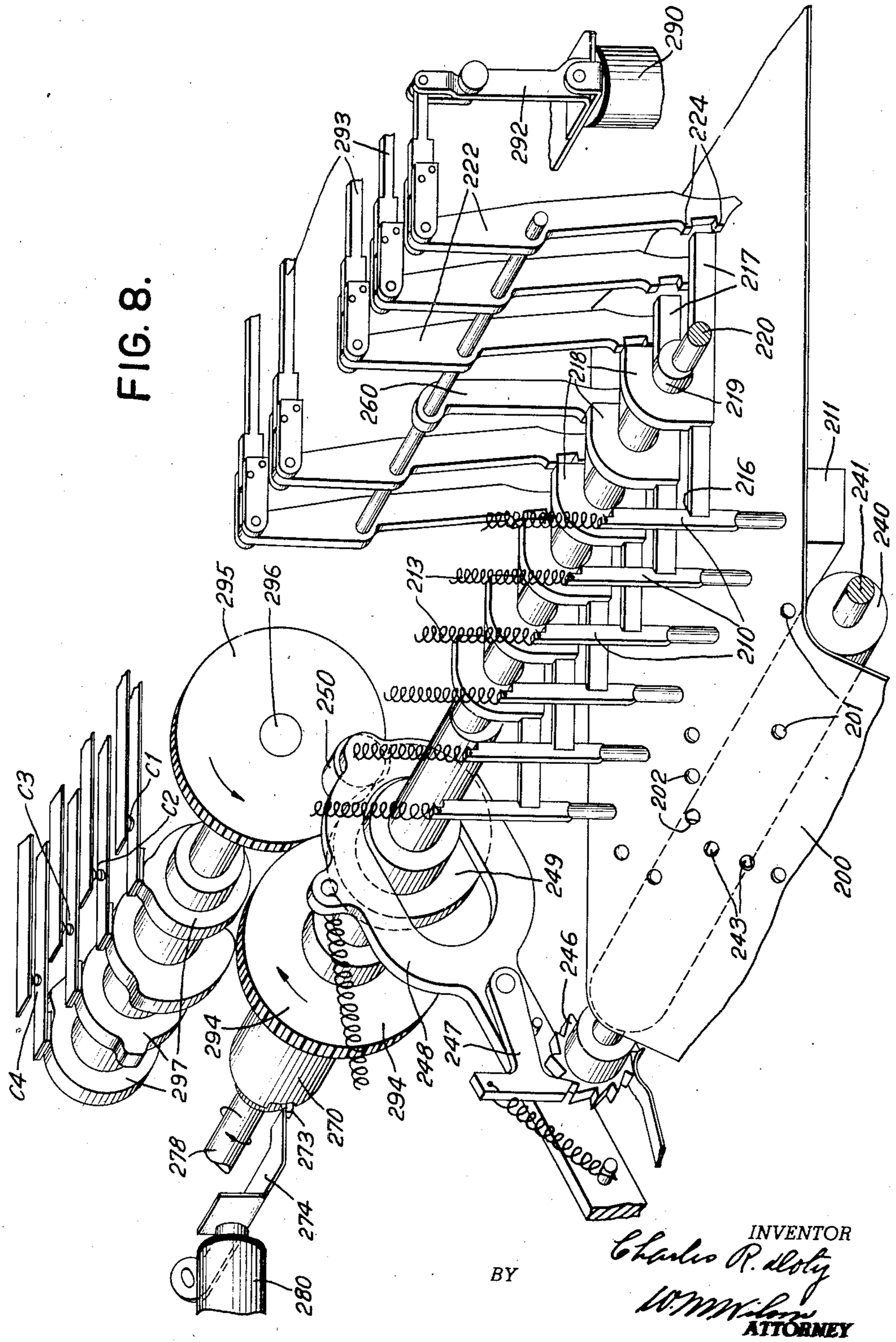

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FIG. 9A.

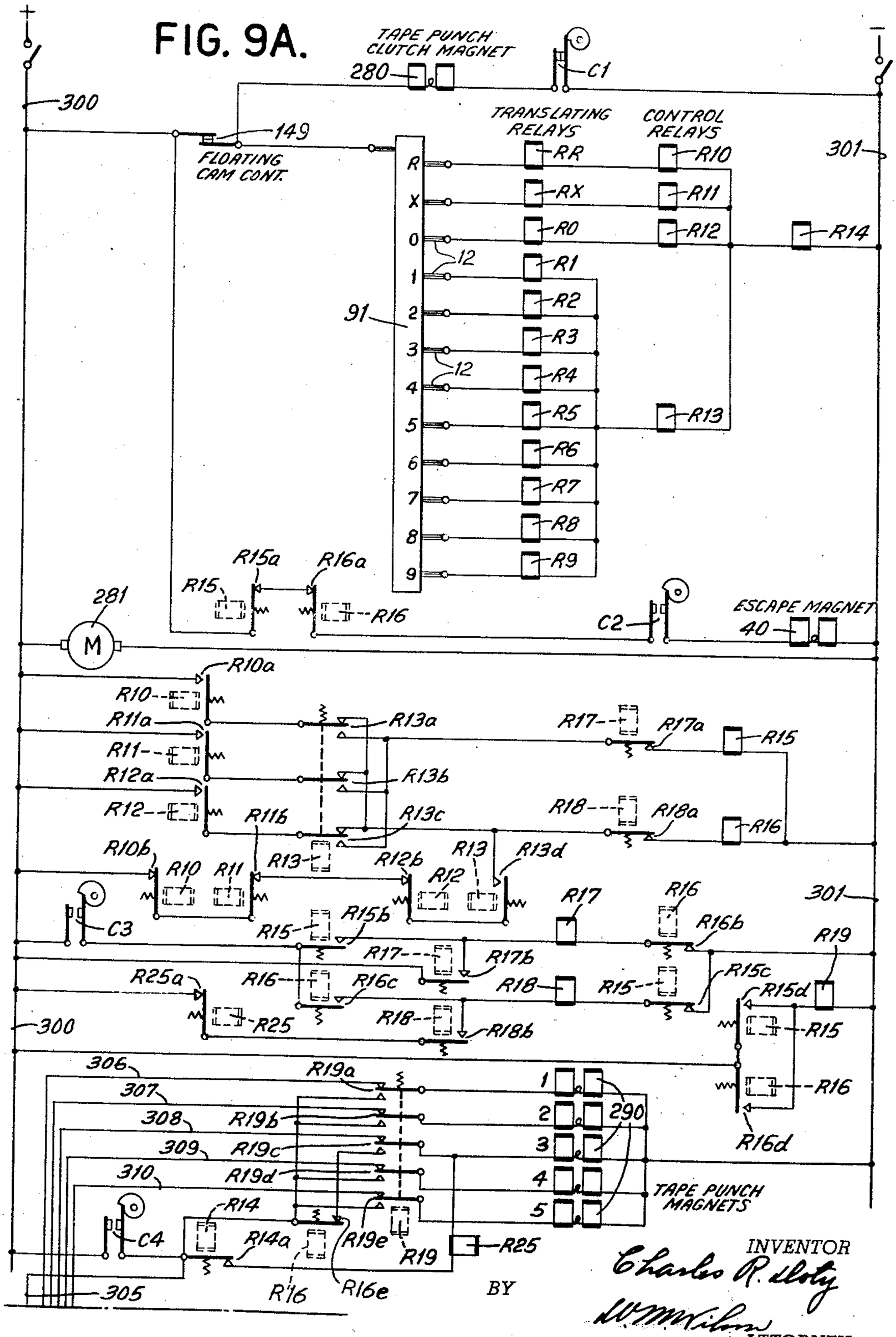

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FIG. 9B.

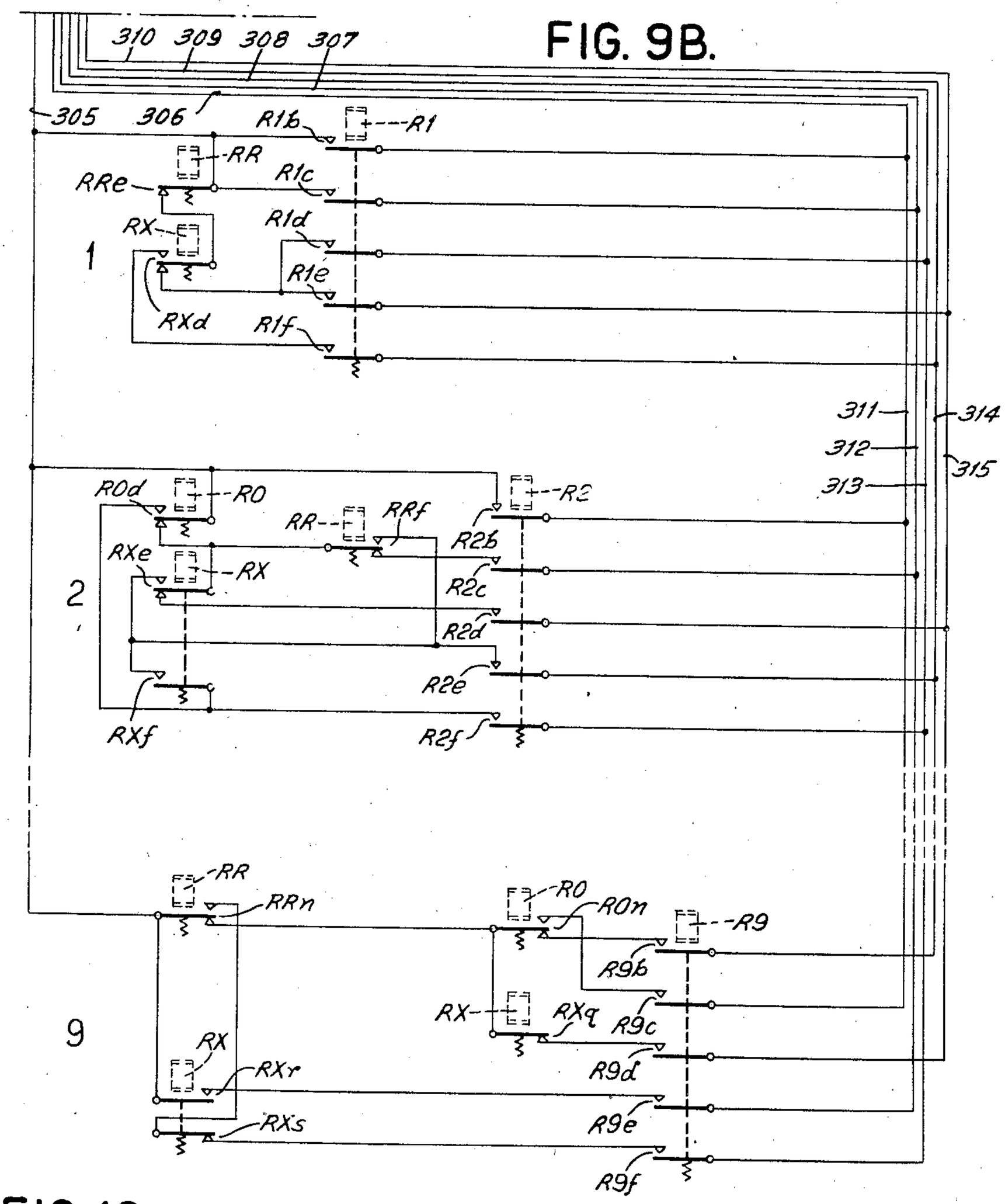
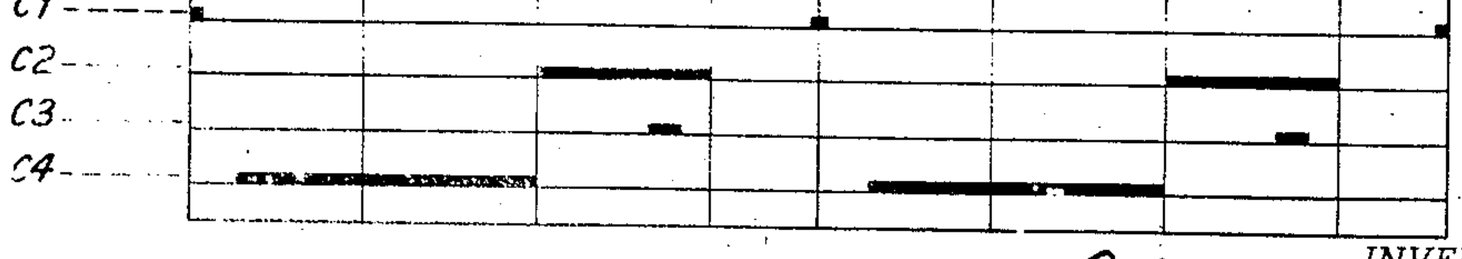


FIG. 10.



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Patented Mar. 7, 1944

2,343,405

UNITED STATES PATENT OFFICE

2,343,405

COMMUNICATION APPARATUS

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Application June 17, 1943, Serial No. 491,102

1 Claim. (Cl. 178—17)

This invention relates to apparatus used in reproducing records having data represented thereon in so called statistical code, through telegraphic channels operating on a telegraphic code, that is, a code which uses most or all of its signals to convey either of two different meanings. The different meanings are grouped into two classes and the single meaning intended is indicated by preceding a group of signals of the same class with one or another of two key signals. Usually the two meanings of the signals are classified as "letters" and "figures," the first class being composed of the alphabetical characters and the second including the ten digits and the punctuation marks. In ordinary telegraph work the signals are translated into printed characters at the receiving end by a printer having the "letters" characters in a lower case and the "figures" characters in an upper case. The above mentioned key signals cause the printer to shift from one case to the other; that is, the "figures shift" signal causes the printer to shift to "figures" case, where it remains (except for a condition to be mentioned presently) until a "letters shift" key signal causes it to shift back to "letters" case. The exception noted is where a printer shifted to "figures" case receives a "space" signal. Because of the fact that single punctuation marks, requiring a shift to "figures" case, occur frequently in the body of alphabetical text, the printers are sometimes constructed so as to drop into "letters" case in response to a "space" signal, so that the "space" signal which invariably follows a punctuation mark, in alphabetical text, will return the printer to "letters" case.

The patent applications of C. R. Doty, Serial No. 446,877, filed June 13, 1942; C. R. Doty and E. J. Rabenda, Serial No. 449,445, filed July 2, 1942 and A. W. Mills and E. J. Rabenda, Serial No. 450,248, filed July 9, 1942 describe apparatus, which can be used in conjunction with commercial telegraph apparatus employing a telegraphic code of the kind described, to reproduce or duplicate, at a remote point, records bearing data in statistical code. The duplicating apparatus described in the above identified applications includes, at the sending station, a record sensing mechanism which detects the change of the characters sensed, from "letters" to "figures," and from "figures" to "letters," and inserts the appropriate key signal at each change. At the receiving station the reproducing mechanism responds to the key signals by a shift of its translating means, whereby the telegraphic code signals cause the reproducing mechanism to produce "letters" characters following a "letters" key signal and "figures" characters following a "figures" key signal. The control means disclosed in the above mentioned applications remains in "figures" condition until, at the sending station, a change to "letters" characters is detected by the sensing mechanism, or at the reproducing station, a "letters" signal is received. The occurrence of a space on the original record, or the reception of a "space" signal by the reproducing mechanism, has no effect upon the control means. Thus, if a space occurs between two groups of "figures" characters, no "figures" key signal is given following the space, yet the reproducing mechanism correctly continues to record "figures" characters in the second group.

It is frequently desirable to make a printed record at the receiving station, of the matter to be duplicated in statistical code. The printer used for this purpose may be of the type which unshifts to "letters" case in response to a space signal. If such a printer were operated by a telegraphic code sequence produced under control of a sensing unit as described in the above mentioned applications of Doty, and Mills and Rabenda, the printer would print "letters" characters, instead of the desired "figures" characters, in response to signals following a space between two groups of "figures" characters read from a statistical code record.

It is the primary object of the present invention to provide a mechanism capable of converting data recorded in statistical code, into a telegraphic code sequence, which will correctly operate a printer that shifts to "letters" case in response to a "space" signal, and which will also correctly operate a duplicating apparatus to reproduce the original record in statistical code.

Other objects of the invention will be pointed out in the following description and claim and illustrated in the accompanying drawings, which disclose, by way of example, the principle of the invention and the best mode, which has been contemplated, of applying that principle.

In the drawings:

Fig. 1 is an outline plan view of a record sensing unit and a tape perforating unit interconnected for operation in accordance with the invention.

Fig. 2 is a face view of a portion of a record card illustrating the Hollerith code.

Fig. 3 is a view of a fragment of tape illustrating a five point telegraphic code.

Fig. 4 is a fragment of a record card showing an example of data recorded in Hollerith code.

Fig. 5 is a fragment of tape showing the same data perforated in telegraphic code.

Fig. 6 is a vertical section through a portion of the record sensing unit.

Fig. 7 is a rear elevation of a portion of the record sensing unit, showing the escapement mechanism.

Fig. 8 is an isometric projection of the tape perforating unit.

Figs. 9*a* and 9*b* are two parts of a wiring diagram, to be positioned in vertical sequence.

Fig. 10 is a timing diagram.

In the illustrative embodiment of the invention shown in the drawing the telegraphic code sequence into which the statistical code data from the original records is translated is recorded on a tape, which can then be handled in the usual way in a tape controlled transmitter. The step of recording on a tape may, however, be dispensed with and the transmitter controlled directly.

Record cards C (Fig. 4) having columns of alphabetical and numerical data recorded thereon, in the Hollerith code (Fig. 2), which is one example of a statistical code, are presented to the sensing station of a "Record sensing unit" (Fig. 1), by means of a reciprocable card carriage comprising a pusher **13** (Fig. 6) and guide **14**. The individual columns of data are fed, step by step, to the group of sensing brushes **12**. There is a sensing brush **12** for each index point position and these brushes are connected to individual translating relays of the group RR, RX, R0, R1–R9 (see Fig. 9*a*), which relays are controlled selectively in accordance with the sensed data designations on the record cards. A plurality of control relays R10–R14 are connected to certain ones of the translating relays so as to be controlled selectively, in accordance with the data sensed on the cards.

The individual translating relays are provided with groups of translating contacts (see Fig. 9*b*) connected in cascaded relationship, which contacts, in turn, are connected to the common conductors **311–315**. The said translating relays and associated contacts are effective to translate the data designations sensed in statistical code to the five-unit telegraphic code (Fig. 3), and, accordingly, control selectively the energization of the punch magnets **290** in various code combinations, thereby causing the code designating perforations representing the data sensed on the record cards to be punched in the telegraphic tape **200** (Fig. 5).

In order to distinguish the code designations in the telegraphic tape as alphabetical or numerical data, a plurality of supervisory circuits are provided, which circuits are selectively controlled by the said control relays. The said supervisory circuits include the relays R15–R19 (Fig. 9*a*), which relays are conditioned selectively in order to supervise the tape punching operations. Whenever, alphabetical data are sensed on the record cards, relays R15–R19 and their associated circuits are conditioned to cause the punch to record a "letters" key signal preceding the data designations representing the alphabetical data, and whenever numerical data are sensed the said relays and circuits are conditioned to cause the punch to record a "figures" key signal preceding the numerical data designations. A single key signal preceding a group of successive signals representing characters of the same class is sufficient; it is not necessary to precede every character by a key signal.

The tape punch unit is operated in a start-stop manner, under control of a clutch magnet **280**, and normally records one character signal each cycle. However, when the control relays R15–R19 are in their normal condition, or whenever a change from alphabetical to numerical characters, or vice versa, is sensed in the record cards, the sensed data is stored in the said translating relays during a preliminary punch cycle. Under these conditions, the said conditioned relays R15–R19 and associated circuits cause the punch unit to operate two cycles, so that during the first cycle the appropriate key signal is recorded, and during the second cycle the said character signal is recorded.

Whenever a blank column is detected in the record card, the said control relays R10–R14 condition circuits, whereby the punch unit is controlled to record automatically a "space" signal in the telegraphic tape **200**, and the record card sensing unit is controlled to feed the next column of the card to the sensing brushes **12**, to be analyzed. In accordance with the invention, as will be explained in detail presently, if the control relays R15—R19 are conditioned for recording numerical characters, when a blank column is sensed on the record card, the said control relays will be restored to their normal condition. Thus, the next character sensed on the record card, whether it be alphabetical or numerical, will cause an appropriate key signal to be perforated in the tape, preceding the perforation of the character signal. If it is a "figures" key signal, it will return the printer to "figures" case, before the next character is recorded. If it is a "letters" key signal, the "letters" shift means of the printer will operate without effect, because the printer will have been shifted to "letters" case by the "space" signal. The control of the duplicating punch at the receiving station will be different from that of the printer, but the punched record will conform to the printed record. Since the "space" signal will not affect the control relays of the duplicating punch, a "figures" key signal will not alter their condition, which will hold over in "figures" condition, according to the example described. On the other hand, a "letters" key signal, following a "space" signal will transfer the control relays of the duplicating punch to "letters" condition, before the next character is perforated in the duplicate record card.

Control record

Referring now to Fig. 2, the control record is shown to comprise a well known tabulating machine record card, generally designated C, of the type commonly used in the Hollerith electric tabulating systems. Differentially positioned control representations, such as perforations **9**, are used to represent the various characters composing the data. The perforations are differentially positioned in various columns of the record card, and by the differential positioning thereof different significations are imparted thereto. The letters of the alphabet are designated by pairs of perforations, each perforation of a pair being located in one of the twelve index point positions of a column.

The Hollerith character code shown in Fig. 2 is an arbitrary one and different well known codes which have been used in statistical systems may be employed in the present recording system. It will be noted by reference to the said code in Fig. 2 that the alphabet is divided into three groups. The letters of the first group A to I are designated by different combinations of a perforation in the "R" index point position with perforations in the one to nine index point positions. The letters of the second group J to R are designated by perforations in the "X" position in combination with perforations in the one to nine positions, while the letters of the third group S to Z are identified by combinations

of a "0" perforation with perforations in the two to nine index point positions. The individual numerical characters are represented by a single perforation in the corresponding zero to nine index point positions. The record cards may have as many columns for the reception of the data designating perforations as may be desired. The description to be set forth hereinbelow relates to mechanism commonly used in tabulating systems employing the standard eighty column record card.

Record sensing unit

Record card feeding means.—Referring to Fig. 1, the record cards C to be sensed or analyzed are placed in a magazine designated 10, from which they are advanced singly by means of a picker 11 toward the left, to present their first column to a card sensing position above the sensing brushes designated 12 (Fig. 6). In this position, the reciprocable card carriage comprising a pusher 13 and a forward guide 14 engages the card and advances it, step by step, under control of the escapement mechanism to be described later. Pusher 13 and guide 14 are carried by an escapement rack 15 and the picker knife 11 is carried by a rack bar 16. Rack 15 has a gear 17 meshing with its lower edge (see Fig. 6) and bar 16 has a gear 18 meshing with its upper edge, both gears being rigidly mounted on a cross shaft 19 (Fig. 1). Due to this connection between the elements, the movement of picker 11 toward the left, as viewed in Fig. 1, is accompanied by movement to the right of pusher 13 and forward guide 14. At the commencement of operations, the picker and pusher are in the position shown in Fig. 1.

The rack 16 is provided with a finger piece 20 at its right hand extremity by means of which the rack 16 and the picker 11 may be moved toward the left to feed a card from the magazine 10. This movement is accompanied by movement of the pusher 13 in the opposite direction. the parts being so proportioned that, when the card has been advanced to present its first column to the sensing brushes 12, the pusher 13 will have moved toward the right sufficiently to engage the right hand, or trailing edge of the card, and will now control the further advancement thereof in response to the operation of the escapement mechanism.

The operation of card feeding just outlined is more fully explained in Patent 1,772,186 granted to F. L. Lee et al. for a duplicating punching machine. The escapement mechanism referred to is of the same general nature as that disclosed in the Schaaff Patent 1,426,223 and a brief description thereof will now be given.

Escapement means.—When the card is in position above the sensing brushes 12 (Fig. 6), further advance is controlled by the escapement mechanism which, in turn, is responsive to the energization of escape magnet 40. Upon energization of magnet 40, its armature 41 will be rocked about a pivot in a clockwise direction and through a screw 42 secured to an arm 43*a* projecting from a rockably mounted rod 43, will rock the rod 43 counterclockwise against the tension of a spring 44. The rod 43 is rocked as an incident to each spacing operation and has secured to one end thereof oppositely extending arms 45, 46 (see also Fig. 7). Arm 46 is provided with a laterally extending pin 46*a* for engagement with an enlarged opening in a stepping dog 47, which is loosely pivoted on rod 43. Opposite arm 46 is provided with a pin 45*a* extending into a slot formed in the locking dog 48. When rod 43 is rocked, arm 46 will, through its pin and slot connection with dog 47, lift the latter out of one of the notches of the rack 15 and at the same time arm 45 will depress locking dog 48 into a notch between the rack teeth. At this time a spring 49 advances the loosely pivoted dog 47 a short distance just sufficient to permit this dog to move above the top of the next tooth. When the locking dog is again raised, stepping dog 47, due to the movement of rack 15, will ride down along the next tooth until it strikes the end thereof and the carriage is thereby arrested. The usual spring drum (not shown) is provided to bias the rack 15 toward the right, as viewed in Fig. 7. The detailed structure in this dog and rack arrangement is well known and need not be further described, and it is sufficient to note that for each operation of the escape magnet 40, the rack 15 is advanced one step or tooth, carrying with it the pusher 13 and forward guide 14, so that the card is likewise advanced one step, each step of advancement being coextensive with the spacing of the columns of the card.

Also in Fig. 7 are shown the "floating cam" contacts 149, one blade of which is shifted by an arm 150 which is loosely pivoted on the rod 43 and which has a lateral extension resting upon the upper edge of the stepping dog 47 so that during escapement from one column to another, the incidental raising of the stepping dog 47, through arm 150 will open the contacts 149 during the period that the dog is raised.

Record card sensing means.—The card sensing brushes 12 are shown in Fig. 6. There are provided twelve of these brushes positioned side by side, there being one for each of the usual twelve rows of index point positions of the card. The brushes 12 are mounted in an insulating brush holder 90 so as to contact the card and effect electrical connections through the perforations therein with a common contact roller 91.

Perforated telegraphic tape

Referring now to Fig. 3, a tape 200 is shown provided with successive transverse rows of perforations 201 arranged in accordance with the well known five-unit telegraphic code, usually referred to as the Baudot or Teletype code. In a five-unit code only thirty-two possible combinations are available, and, as mentioned hereinabove, for this reason, it is necessary to employ the same code combinations to represent the alphabetical characters, and the numerical and other characters.

In order to distinguish the alphabetical characters from the other remaining characters, for telegraphic transmission purposes, a sequence of alphabetical signals is always preceded by a "letter shift" signal and a sequence of the other remaining character signals is preceded by a "figure shift" signal.

Whenever a space is to appear in the printed copy, a "space" code signal must be perforated in the tape. For example, in the perforated tape shown in Fig. 5, the indicated code perforations designate 129 921. Accordingly there is a "space" signal (3 hole) immediately after the first "9" signal (4—5 holes). Furthermore, since the "space" signal will unshift the printer, the second "9" signal is preceded by a "figure shift" signal (1—2—4—5 holes). Fig. 4 shows the corresponding designations on the record card. A

blank in column 4 restores the control relays R15–R19 and the associated circuits to their normal condition, therefore the sensing of a numeral designation in column 5 of the record card will cause a "figure shift" signal to be perforated in the tape, preceding the second "9" signal. The way in which these operations are performed will be described in detail later.

Tape perforating unit

Referring now to Fig. 8, the perforating apparatus is shown to include individual punch elements 210, one for each of the five units of the telegraphic code, plus an additional one to punch feed holes. The punch elements coact with a common die block 211 and are slidably arranged in a guide which does not appear in the drawings. They are normally held in raised positions by means of individual springs 213, hung upon a stationary part (not shown). Each punch element 210 is provided with a recess 216, to receive one end of a related actuating lever 217. An individual lever 217 is provided for each punch element 210. An elongated eccentric 219 formed on a shaft 220 is located within the bows of yoke portions 218 of the adjacently arranged levers, to support and oscillate the said levers. Normally, during the rotation of the eccentric, the levers are moved downward and upward by the supporting eccentric, about the pivotal connections formed by the ends of the levers engaging the recesses of the related punch elements. Under these conditions the free right ends of the levers are rocked, first down and then up.

An individual pivoted latch 222 provided for each actuating lever is formed near its lower end with a pair of spaced latching fingers 224, disposed in close proximity to, but normally held out of the path of the normally free ends of the actuating levers, by a spring (not shown).

Whenever it is desired to operate a punch element 210, the related latch arm is rocked in a clockwise direction, so that its latch fingers 224 engage and latch the free end of the related actuating lever. The shaft 220 is normally stationary, being latched by a detent 274 engaging the releasing arm 273 of a one revolution clutch mechanism 270. The detent 274 is operated by the punch magnet 280, momentary energization of which will release the detent from the arm 273 and allow the clutch to couple the shaft 220 to the constantly rotating shaft 278 of a punch motor 281 (Fig. 9*a*). The magnet 280 is deenergized immediately after the arm 273 is released, to allow the detent to return (under the pull of a spring, not shown) to position to engage the arm 273 after one revolution and disengage the clutch. During this revolution of shaft 220 the latched actuating levers 217 drive their punch elements through the tape 200, positioned over the die block 211, while the unlatched actuating levers rock idly about their ends held by the recesses 216. The latches 222 are selectively called into operation by related magnets 290 (only one shown in Fig. 8), the armatures 292 of which are connected by rods 293 to the respective latches.

The tape is fed by a pin wheel 240 on a shaft 241, the pins 243 of the wheel engaging feed holes 202 in the tape formed by a punch element 210 operated, upon each rotation of the eccentric 219 in a manner similar to the code punch elements by an actuating lever 217 constantly latched by a fixed latch 260. The shaft 241 of the pin wheel has fixed to it a ratchet wheel 246, which is fed step by step by a pawl 247 pivoted to a reciprocating bar 248. The bar 248 has a yoke portion engaging over an enlarged portion of the shaft 220 and is reciprocated once for each revolution of the shaft 220 by a cam 249 bearing against a roller 250 journaled on the bar 248.

A cam shaft 296 is driven by a gear 294 on shaft 220, which meshes with a gear 295 fixed to the shaft 296. The cam shaft 296 has mounted on it four cams 297 respectively operating pairs of contacts C1, C2, C3, and C4, the timing of which is shown in Fig. 10.

Operation

Referring now to Figs. 9*a* and 9*b* the operation of the described units will be explained in connection with the circuit diagram.

As mentioned hereinabove, the columns of data designations in the record cards must be sensed to determine the nature of the data designating perforations of each column, that is, to determine whether the punched data are alphabetical or numerical. It also was mentioned that like code combinations are employed for designating alphabetical and numerical characters in the five-unit Baudot or Teletype code, thus, each group of data designating perforations of the same class, in the telegraphic control tape, must be preceded by a key code signal, such as a "letters" or "figures" signal.

In order to simplify the description to follow, assume that the first seven columns of the record card C (Fig. 4) to be sensed are perforated to represent: 129 921; also, that the card sensing unit is conditioned so that the first column of the record card C is under the sensing brushes 12.

Upon closure of the floating cam contacts 149, a circuit is completed from conductor 300 through said contacts 149, contact roll 91, brush 12 sensing the "1" perforation, coils of translating relay R1 and control relays R13 and R14 to conductor 301, thus, energizing the said relays.

At the same time, a circuit is also completed from conductor 300 through contacts 149, coils of the tape punch clutch magnet 280, and cam controlled contacts C1 (closed at this time, see Fig. 10) to conductor 301, thus energizing the said clutch magnet. In this manner, shaft 220 of the tape punch is called into operation to rotate the associated eccentric 219 and cam elements of the related cam controlled contacts C1 to C4.

The transferred contacts R13*a* to R13*c* (Fig. 9*a*) exercise no controlling effects during numerical sensing operations; however, closure of contacts R13*d* completes a circuit from conductor 300 through normally closed contacts R10*b*, R11*b*, and R12*b*, said contacts R13*d*, normally closed contacts R18*a*, and coil of relay R16 to conductor 301, thus energizing the said relay.

Contacts R16*a* are opened to insure an open circuit to the escape magnet 40 of the sensing unit; contacts R16*b* are opened to insure an open circuit to coil of relay R17; contacts R16*d* are closed to complete a circuit from conductor 300 through said contacts R16*d*, coil of relay R19 to conductor 301, thus, energizing the said relay and causing contacts R19*a* to R19*e* to be transferred.

The said transferred contacts connect the "1," "2," "4" and "5" punch magnets 290 directly to cam controlled contacts C4. The "3" punch magnet 290 is connected to contacts R16*e*, which are opened at this time during numerical sensing operations.

Upon closure of the said contacts C4, near the beginning of the punch cycle (see Fig. 10), the "1," "2," "4" and "5" punch magnets 290 are connected to conductors 300 and 301 to energize the said magnets, thereby causing the "figures" key signal perforations to be punched in the first transverse row of the telegraphic tape 200, as shown in Fig. 5.

Upon completion of punching the "figures" perforations, the cam controlled contacts C2 are closed, as indicated in Fig. 10, tending to establish a circuit to the escape magnet 40 to advance the next column of the card to the sensing brushes 12; however, due to the said open contacts R16*a*, a circuit cannot be completed to the said magnet, consequently, the first column of the card remains under the said sensing brushes during a subsequent punch cycle, maintaining the said relays R1, R13 and R14 energized.

Shortly before the cam controlled contacts C2 are opened, the cam controlled contacts C3 are closed to establish a circuit from conductor 300 through the said cam contacts C3, the said closed contacts R16*c*, coil of relay R18, contacts R15*c* to conductor 301, thus, energizing the said relay. A holding circuit for relay R18 is immediately established from conductor 300 through normally closed contacts R25*a* and contacts R18*b*.

Opening of contacts R18*a* causes relay R16 to be deenergized and the related contacts R16*d* to be opened, the latter contacts, in turn, causing relay R19 to be deenergized and restoring the said transferred contacts R19*a* to R19*e* to their normal positions, as indicated in the circuit diagram.

As described hereinabove, near the end of each punch cycle, the tape feeding mechanism of the punch unit is operated to advance the tape 200 one step, thus presenting the next portion of the tape to be punched to the punch elements.

Upon completion of the punch cycle, cam controlled contacts C1 are closed, as indicated in Fig. 10, to again cause the tape punch clutch magnet 280 to be energized, thereby releasing the said punch shaft 220 and initiating a second punch cycle. During this second punch cycle the tape is punched in accordance with the code combination for the sensed numerical data "1." It should be noted that relays R16 and R19 cannot be energized during this second punch cycle, due to the said opened contacts R18*a*, thus the contacts R19*a*–R19*e* remain in their untransferred positions during the remainder of the said second cycle. The said contacts R19*a*–R19*e* now connect the individual punch magnets 290, by means of the related conductors 306–310, to the individual conductors 311–315 (Fib. 9*b*), respectively, the latter being connected to groups of translating contacts of the translating relays RR, RX, R0, and R1–R9, which groups of translating contacts are connected together in a cascaded relationship. Fig. 9*b* shows only a portion of the translating relay contacts and associated circuits sufficient to illustrate the principle of the present invention. The full diagram is given in the above mentioned Doty application Ser. No. 446,877.

Now, upon closure of cam controlled contacts C4, during the said second punch cycle, a circuit is completed from conductor 300 through the said cam contacts C4, conductor 305, contacts R1*b* and R1*c*, and normally closed contacts RR*e*, RX*d* to contacts R1*d* and R1*e*, conductors 311, 312, 313, 315, respectively, conductors 306, 307, 308, 310, respectively, contacts R19*a*, R19*b*, R19*c*, R19*e*, respectively, and the "1," "2," "3," "5" magnets 290 respectively, to conductor 301; thus, energizing the said magnets and causing the code designating perforations representing the numeral "1" to be punched in the second transverse row of the telegraphic tape 200, as indicated in Fig. 5.

After the said punching operation is completed, during this second punch cycle, the cam controlled contacts C2 are closed to energize the escape magnet 40, causing the next, or second, column of the card to be fed to the sensing brushes, by means of a circuit completed from conductor 300 through normally closed contacts R15*a* and R16*a*, said cam contacts C2 to escape magnet 40 and conductor 301.

It will be recalled, that upon energization of the escape magnet 40 and operation of the described escapement mechanism of the sensing unit, the floating cam contacts 149 are opened, until the next column of the card is presented to the sensing brushes. Opening of contacts 149 causes the translating relay R1 and control relays R13 and R14 to be deenergized.

Upon closure of the said floating cam contacts another punch cycle (third) is initiated, due to the completion of the previously traced circuit to the punch clutch magnet 280 through the contacts 149 and C1. At the same time, a circuit is completed from conductor 300 through contacts 149, contact roll 91, brush 12 sensing the "2" perforation, coils of translating relay R2 and control relays R13 and R14 to conductor 301, thus energizing the said relays.

Since the said second column of the record card C has numerical data punched therein, namely, the numeral "2" as assumed in the present example, it is not necessary to punch again the "figures" key signal in the tape preceding the signal for the said numeral "2." As mentioned hereinabove, whenever a group of data designations, representing all numerical or all alphabetical data, are arranged in successive columns on a record card, it is only necessary to provide one key signal preceding each group of numerical or alphabetical data designations on the telegraphic tape. In the chosen example, the first three columns of data on the record card are numerical, therefore, in translating and punching this data on the telegraphic tape, it is merely necessary to provide a single key signal, namely, the "figures" key, preceding the three transverse rows of perforations in the tape representing the numerical data sensed in the said three successive columns on the card.

The suppression of repeated key signals is accomplished by maintaining the control relay R18 energized at all times during the sensing of a group of data designations of the same class. The holding circuit for relay R18 is maintained through contacts R18*b* until either of relays R15 or R25 is energized to open the contacts R15*c* or R25*a*, in the previously traced holding circuit. As mentioned previously, contacts R18*a* are held open, as long as relay R18 is energized, to prevent energization of relay R16 and in turn R19, thus maintaining the R19*a*–R19*e* contacts in their normal indicated positions, whereby the tape punch magnets 290 are connected directly to the variously connected groups of contacts of the translating relays.

Thus, upon closure of the cam controlled contacts C5, during the third punch cycle, the following punch magnet circuits are established: from conductor 300 through the said cam contacts C5, conductor 305, contacts R2*b*, normally

closed contacts R0*d*, RR*f* and contacts R2*c*, normally closed contacts RX*e* and contacts R2*d*, conductors 311, 312 and 315, respectively, conductors 306, 307 and 310 respectively, normally closed contacts R19*a*, R19*b*, and R19*e*, respectively, and the "1," "2," and "5" punch magnets 290, respectively, to conductor 301; thus, energizing the said magnets and causing the code signal perforations representing the numeral "2" to be punched in the third transverse row of the telegraphic tape 200, as indicated in Fig. 5.

After the said punching operation is completed, during this third punch cycle, the cam controlled contacts C2 are closed and cause energization of the escape magnet 40, as previously described, to present the next or third column of the card to the sensing brushes.

Upon closure of the floating cam contacts 149 and cam contacts C1, the punch clutch magnet 280 is energized to initiate a fourth punch cycle as described hereinabove; also, as described, a circuit is completed to the brush 12 sensing the "9" perforation to effect energization of the translating relay R9 and control relays R13 and R14.

Upon closure of the cam contacts C4, a circuit is completed through the normally closed contacts RR*n*, R0*n*, and contacts R9*b*, and through normally closed contacts RX*q* and contacts R9*d*, conductors 314, 315, conductors 309, 310, normally closed contacts R19*d*, R19*e* and the "4" and "5" punch magnets 290, just as previously traced, to energize the said magnets to cause the code designation representing the numeral "9" to be punched in the fourth row of the telegraphic tape 200, as indicated in Fig. 5. Whereupon, the escape magnet 40 is energized, upon closure of cam contacts C2, to present the next, or fourth, column of the card to the sensing brushes.

Blank columns.—To continue with the chosen example, it will be remembered that the fourth column of the record card is a blank column. Upon feeding the blank fourth column to the sensing brushes, and upon closure of the floating cam contacts 149, no circuits can be completed to the translating and control relays, however, the circuit to the punch clutch magnet 280 is completed to initiate another (the fifth) punch cycle, as previously described.

Since contacts R14*a* remain closed during this fifth punch cycle, a circuit is completed as follows, upon closure of cam contacts C4: from conductor 300 through said cam contacts C4, said contacts R14*a*, relay R25, the "3" punch magnet 290 to conductor 301, energizing said relay and said punch magnet. The said punch magnet causes a single perforation to be punched, in the "3" position, in the telegraphic tape 200, in the fifth row, as indicated in Fig. 5, which is a space signal.

The energized relay R25 opens its contacts R25*a*, breaking the circuit of relay R18 and thus restoring the control circuits to the normal condition shown in Fig. 9*a*, with contacts R18*a* closed and contacts R18*b* open. Whichever class of character designation is next sensed on the record card will condition the control circuits to insert a key signal perforation of the tape, before the character signal itself is punched. In the chosen example, upon arrival of column 5 of the record card at the sensing brushes 12, and closure of the floating cam contacts 149, the tape clutch magnet 280 will be energized to start the sixth punch cycle and the translating relay R9 and control relays R13 and R14 will be energized by a circuit completed through the "9" hole in column 5 of the record card. The closure of contacts R13*d* will cause relay R16 to be energized and the same sequence will then be repeated as in the first and second punch cycles, except that in the seventh punch cycle the "4" and "5" punch magnets, designating a "9," will be operated. The insertion of the "figures" key signal in the tape, before the "9" character signal, will cause the teleprinter to shift back to "figures" case, after being unshifted to "letters" case by the preceding "space" signal. The sensing of the "2" and "1" data designations in columns 6 and 7 of the record card will cause the punch to perforate the tape with "2" and "1" character signals, in the manner previously described, without any further "figures" key signals.

The behavior of the apparatus upon sensing alphabetical character designations will not be described in detail, because the present invention is not concerned therewith; a description thereof will be found in the previously mentioned Doty application, Serial No. 446,877.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a single modification, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art, without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the following claim.

What is claimed is:

In an apparatus controlled by records having two different types of characters, such as numerical and alphabetical, represented thereon by positioned code points which are distinctively positioned for each character; record reading means including means to sense the code representations of the characters successively; means including a group of code elements operable singly and in various combinations to manifest code signals; translating means controlled by said reading means selectively to operate said code elements, to manifest code signals of a second code in which each of certain signals representing different characters of one of said types also represents a single character of the other type; supervisory means controlled by said sensing means and differently responsive to the record code representations of the two different types of characters; designating means controlled by said supervisory means to operate said code elements to manifest either of two different key signals designating, respectively, the two different types of characters; normally inoperative disabling means conditioned by said designating means to prevent a second operation of the latter to operate said code elements to manifest the same key signal twice in succession; means responsive to the sensing of a blank on the record to operate said code elements to manifest a particular signal; and means operated in conjunction with said last mentioned means to restore said disabling means to its normal inoperative condition.

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