Sept. 3, 1940. A. W. MILLS ET AL 2,213,567

RECORD PUNCHING MACHINE

Filed Sept. 24, 1938 6 Sheets-Sheet 1

FIG. 1.

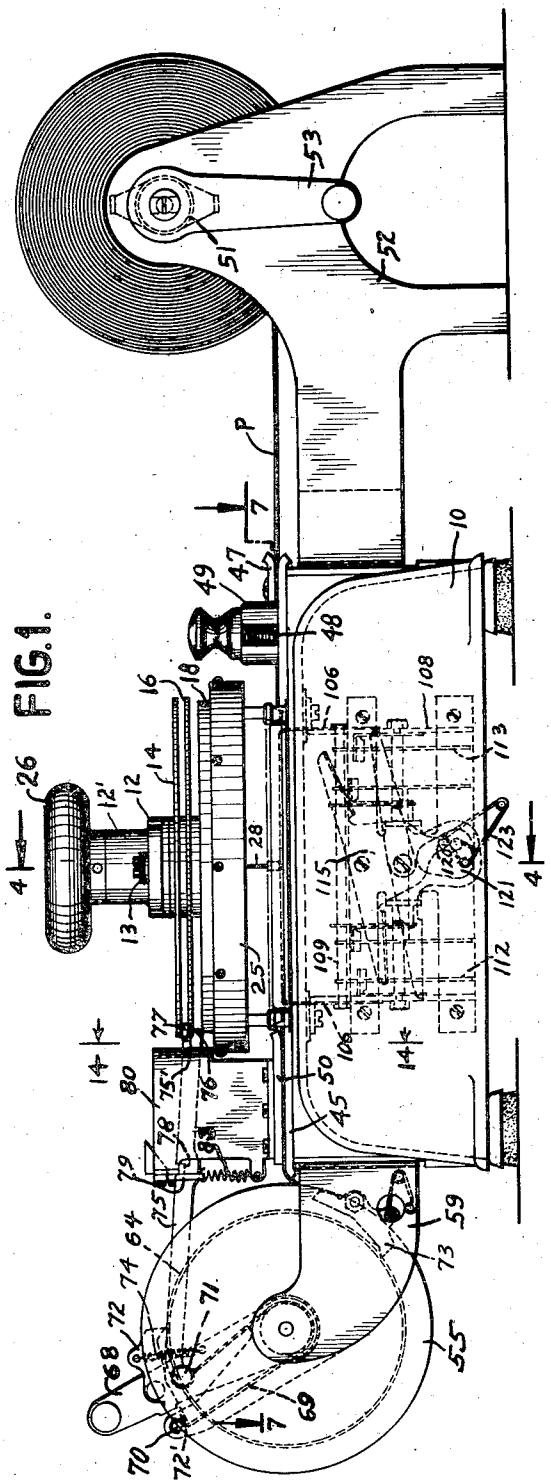


FIG. 2.

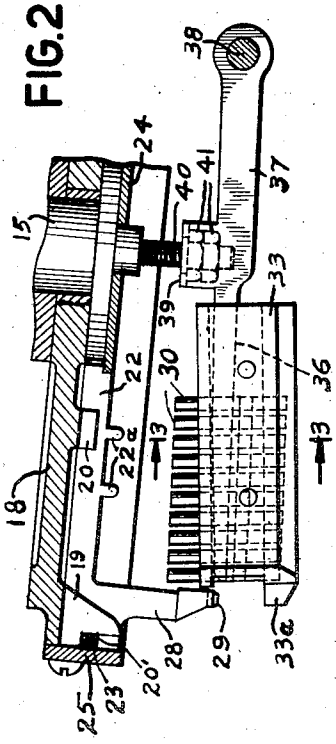
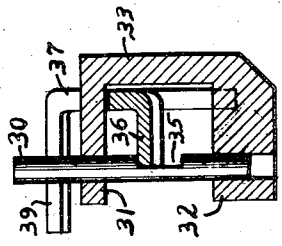


FIG. 3.



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Sept. 3, 1940. A. W. MILLS ET AL 2,213,567

RECORD PUNCHING MACHINE

Filed Sept. 24, 1938 6 Sheets-Sheet 2

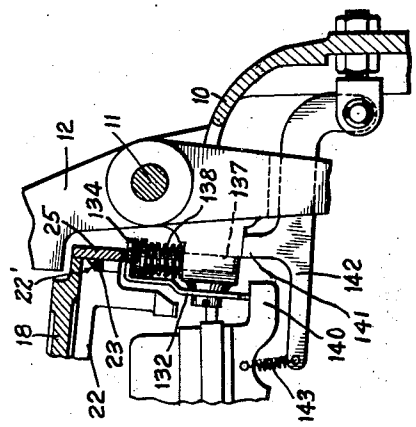


FIG.6.

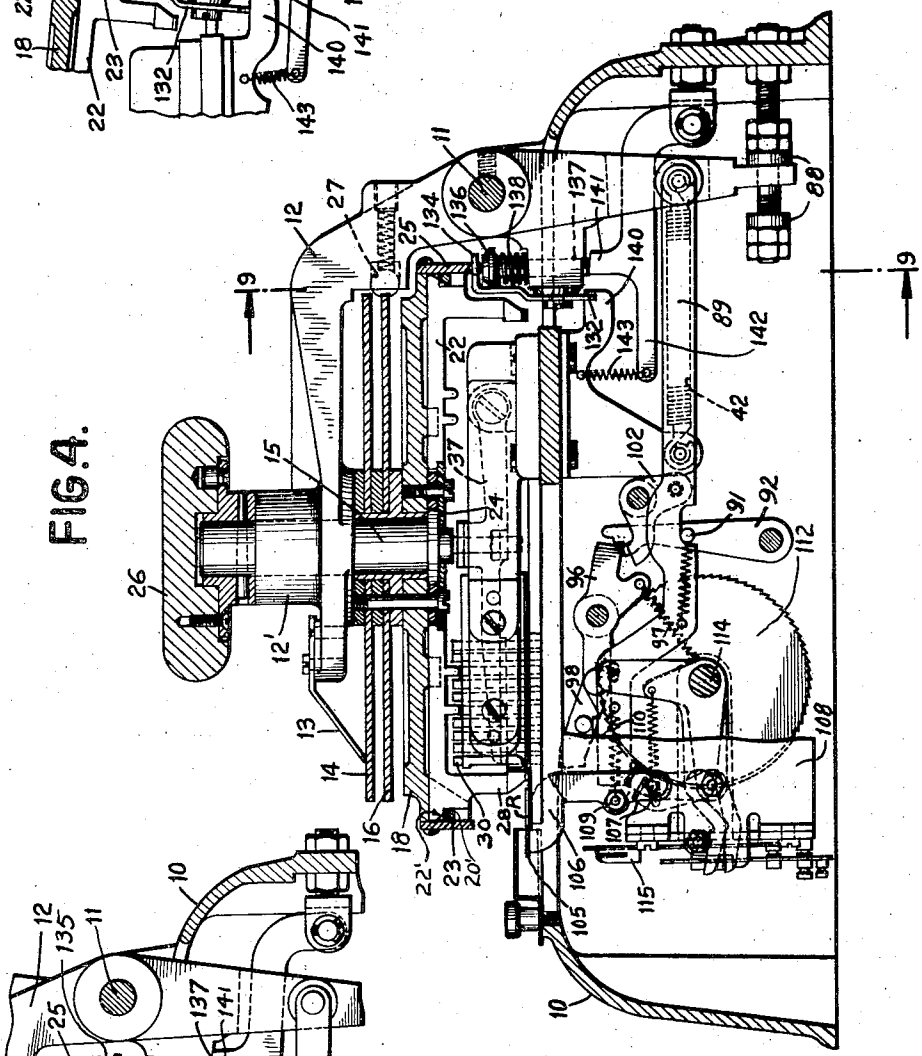


FIG.4.

FIG.5.

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RECORD PUNCHING MACHINE

Filed Sept. 24, 1938 6 Sheets-Sheet 3

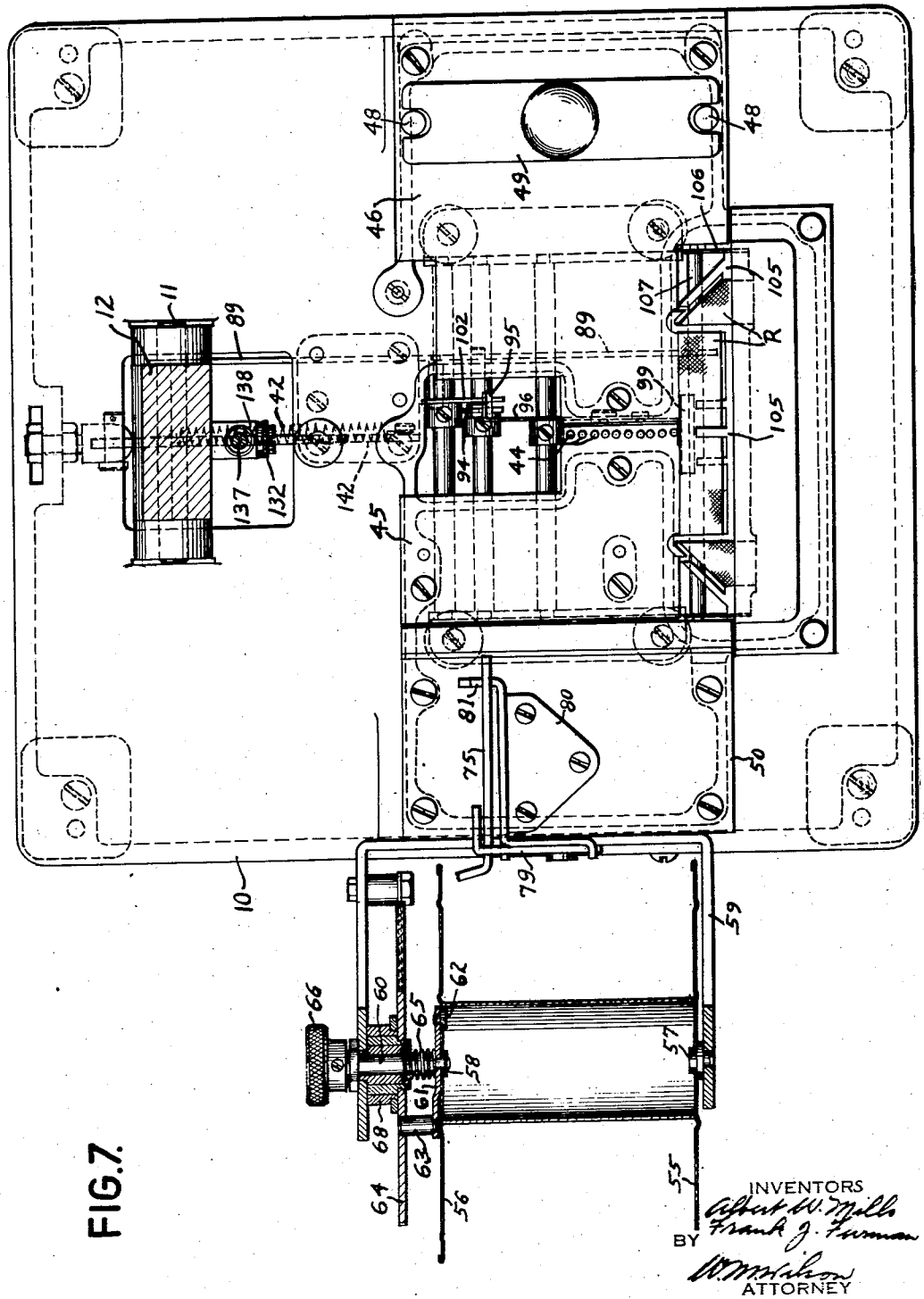


FIG. 7.

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RECORD PUNCHING MACHINE

Filed Sept. 24, 1938 6 Sheets-Sheet 4

FIG.8.

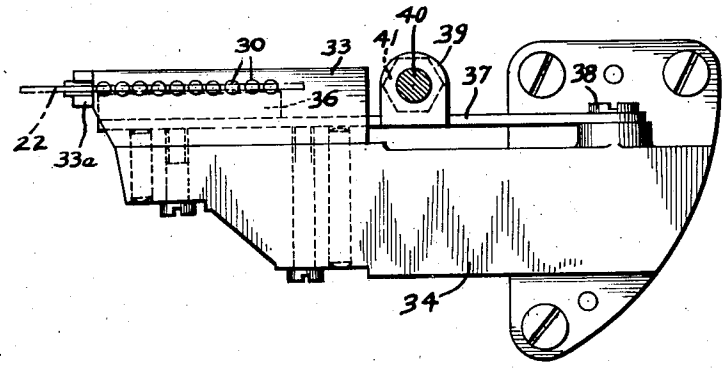


FIG.9.

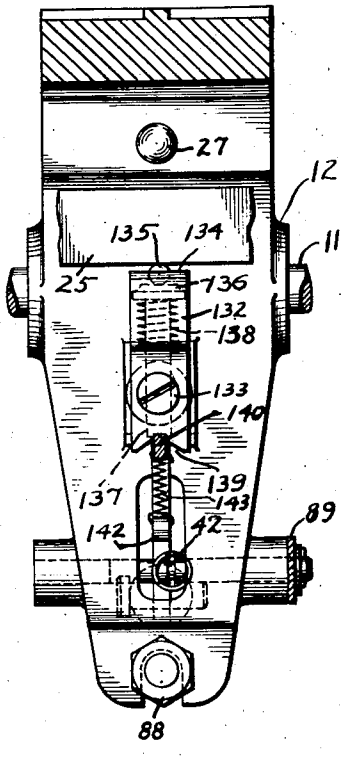
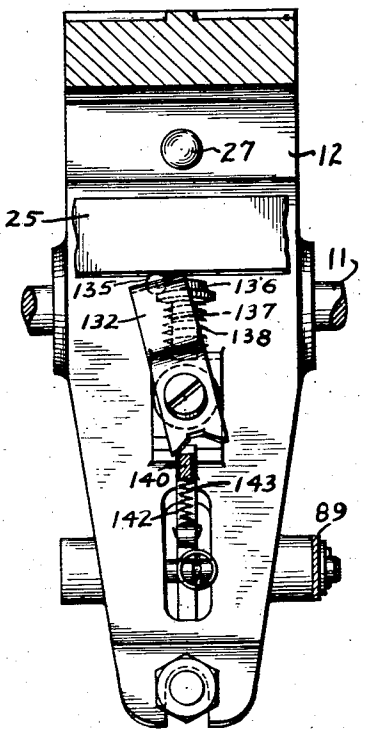


FIG.10.



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Sept. 3, 1940. A. W. MILLS ET AL 2,213,567

RECORD PUNCHING MACHINE

Filed Sept. 24, 1938 6 Sheets-Sheet 5

FIG.11.

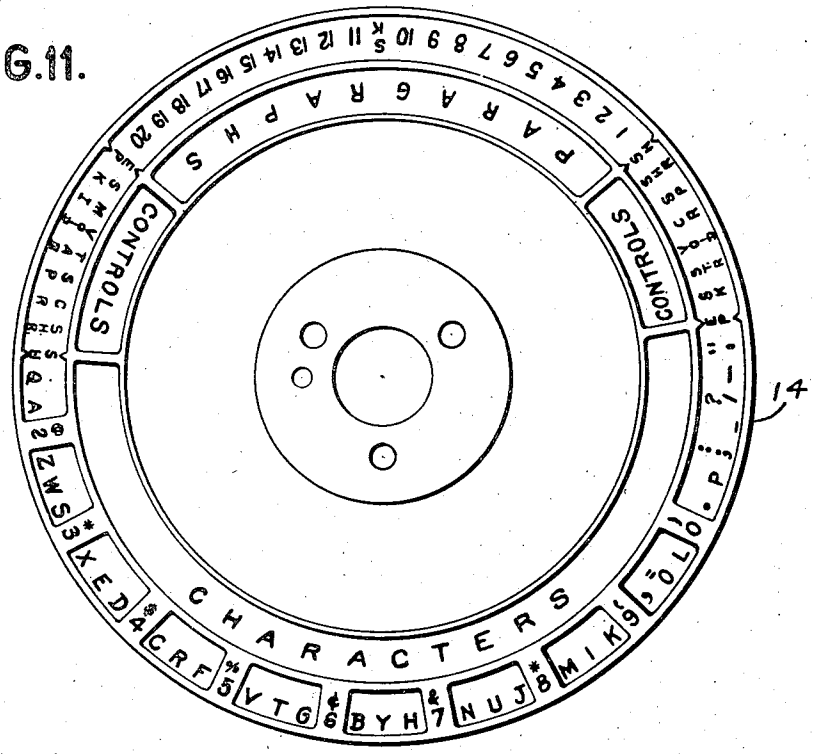
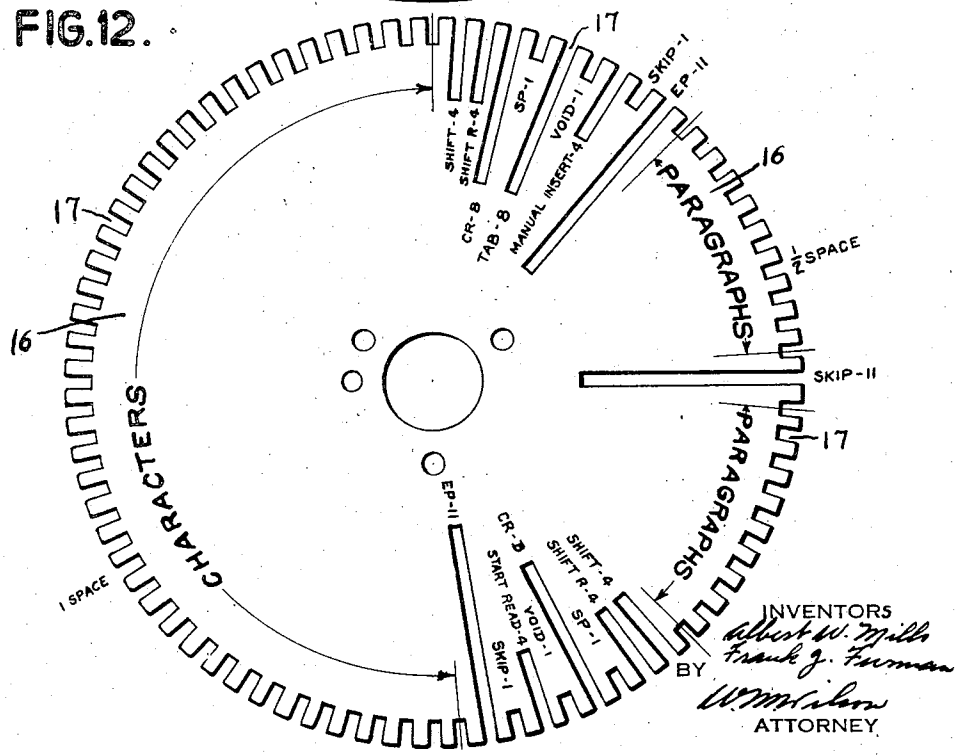


FIG.12.



Sept. 3, 1940. A. W. MILLS ET AL 2,213,567

RECORD PUNCHING MACHINE

Filed Sept. 24, 1938 6 Sheets-Sheet 6

FIG.15

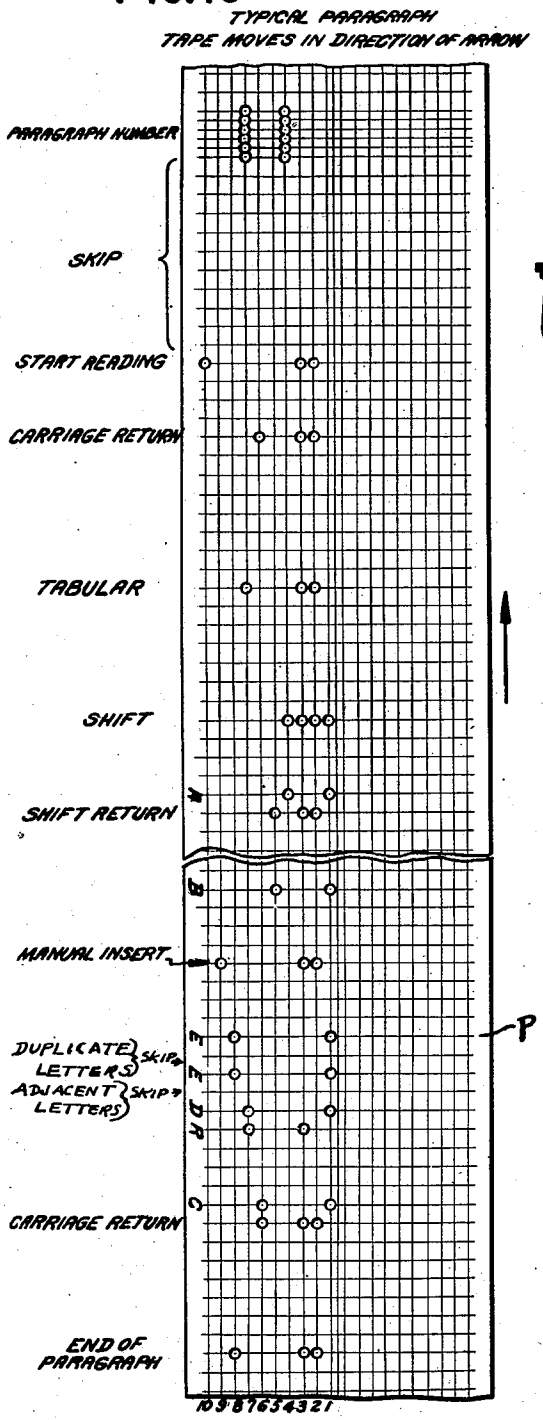


FIG.13.

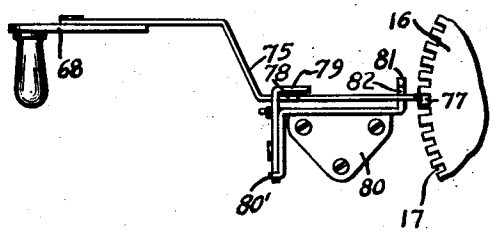
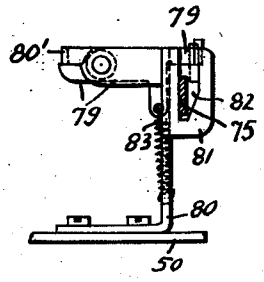


FIG.14.



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UNITED STATES PATENT OFFICE

2,213,567

RECORD PUNCHING MACHINE

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Application September 24, 1938, Serial No. 231,530

13 Claims. (Cl. 164—114)

This case relates to apparatus for punching a record sheet with data or machine controlling codes or designations.

The punching apparatus of the present invention is suitable for punching any record medium with data or control designations or codes, but is particularly adapted for punching a record sheet or tape for use in a correspondence machine such as disclosed in copending application Serial No. 133,762. Certain functions of the correspondence machine take longer than other functions. Thus, the typing of a character requires a shorter interval than a carriage return, case shift, or tabular spacing operation. There are other functions of the above-mentioned correspondence machine, such as paragraph identification, "manual insert" and "end of paragraph" functions which also require more time than the normal typing or writing function. All of these functions are designated by codes punched in the tape which are analyzed or read out in succession during travel of the tape. Since some of the functions take longer than others, the analyses of the various codes require varying lengths of time to be translated or converted into the functions or operations represented by the codes.

Accordingly, one of the objects of the present invention is to provide improved means for punching the codes in the record sheet at different distances apart depending on the time required to effect the functions denoted by the codes.

In controlling a writing apparatus such as a typewriter, it is desirable in order to prevent locking of adjacent type bars when operated in rapid succession that the codes controlling successive operations of adjacent type bars be spaced apart a greater than normal distance in order to provide more time for the operation of one of such adjacent type bars before the other adjacent type bar is successively operated. Also when two successive codes on a tape are the same for causing operation of the same type bar in succession, it is desirable to delay the second of such operations in order to permit the first type bar operation to be completed, in this manner assuring full and proper repeat operations of the same type bar.

Accordingly, it is still another object to control feed of the tape after the punching of the code representing one character in such a manner that a multiple spacing will be effected before the punching of the last code representing the same character.

This object is, still further, to prevent selection or punching of a code which is either the same as the previously punched code or which corresponds to a type bar adjacent the type bar corresponding to the previously punched code, unless a special feeding operation is effected to provide a greater than normal spacing between such successive codes.

Broadly, the latter object contemplates the automatic locking of the punching apparatus against a repeat operation before an intermediate operation is effected.

It is also one of the objects to provide a novel and simplified machine for punching combinational or single hole codes in a record medium.

Further objects of the instant invention reside in any novel feature of construction or operation or novel combination of parts present in the embodiment of the invention described and shown in the accompanying drawings whether within or without the scope of the appended claims and irrespective of other specific statements as to the scope of the invention contained herein.

In the drawings:

Fig. 1 is a side view of the machine.

Fig. 2 is a detail view of the punching mechanism.

Fig. 3 is a section along lines 3—3 of Fig. 2.

Fig. 4 is a section on lines 4—4 of Fig. 1.

Fig. 5 is a detail view of a locking means for the punch operation with the parts shown in locking position.

Fig. 6 is similar to Fig. 5 but with the parts in release position.

Fig. 7 is a section along lines 7—7 of Fig. 1.

Fig. 8 is a plan view of the punches and upper die block therefor.

Fig. 9 is a detail section along lines 9—9 of Fig. 4.

Fig. 10 is similar to Fig. 9 but with the parts in initial position.

Fig. 11 is a plan view of the code indicating dial.

Fig. 12 is a plan view of the feed regulating dial.

Fig. 13 is a plan, detail view of part of the tape feed control means.

Fig. 14 is a section along lines 14—14 of Fig. 1, and

Fig. 15 shows a portion of a perforated tape.

The machine comprises a base frame and housing 10 to the top of which is hinged, by a pin 11, a bell crank 12 (see Figs. 1 and 4). The lower vertical arm of the lever 12 extends into the interior of the base housing while the upper horizontal arm of the lever lies above the top of

the housing. To the free end of this horizontal arm is fastened a pointer 13 for indexing the indications of a code indicating dial 14 (see Figs. 4 and 11). This indicating dial is part of an assembly rigidly fastened to a vertical shaft 15 which is journaled in a hole provided in the boss 12' near the free end of the horizontal arm of lever 12. Below dial 14, this assembly has a feed regulating dial 16 provided with radial notches 17 in its rim (see Figs. 4 and 12) of lengths dependent on the extent of feed to be imparted to the tape P (see Figs. 1 and 15). Also part of the assembly on shaft 15 is a disk 18, below the dial 16, and from the bottom of which project concentric rows of spaced apart lugs 19 and 20. The spacing between the lugs of each row is such as to provide radial slots for receiving interposers 22 and fixing their location around the disk 18 or in a circumferential direction. The outer lugs 19 of the disk 18 are formed with notches 20' to receive a split spring ring 23. The outer ends of the interposers are formed with upwardly inclined edges 22' so that when the split ring is snapped into position within the notches 20', it wedges against the inclined edges 22' to force the interposers upwardly and inwardly, thus holding the interposers in place. The inner ends of the interposers are notched to receive the rim of a washer 24 (also see Fig. 2) which is part of the assembly fixed to shaft 15. The washer 24 combines with the split ring 23 to fix the positions of the interposers in a radial direction. A circular band 25 secured to the rim of disk 18, and surrounding split ring 23 and the interposers 22, forms part of the means for locking the machine to prevent successive punchings of the same or adjacent character codes unless a special intermediate operation is effected, as will be explained later.

To the upper end of shaft 15 is fixed a hand knob 26 by means of which the operator may rotate the shaft and the assembly carried thereby. For retaining the rotatable assembly in adjusted position, a spring actuated ball 27 is provided on the upper arm of lever 12 for coacting with the feed regulating notches 17 of dial 16. Ball 27 coacts with any of the notches 17 to impositively maintain the shaft assembly in its position of adjustment.

Referring to Fig. 11, the indicating dial 14 is inscribed at equal distances or equal indicating steps or spaces with the characters and functions to be represented by code punchings in the record tape P. As stated before, the tape is to be punched for controlling a correspondence machine including a typewriter which may be of the kind disclosed in Patent No. 1,777,055. In order to enable the punch operator to distinguish the characters that are on adjacent type bars of the typewriter keyboard, these adjacent characters are placed on dial 14 next to each other. In addition to the character codes, the tape is to be punched with control codes and paragraph identifying codes. There are two sets of control indications marked on dial 14, some being duplicate indications, and adjustment of the dial to bring a duplicate indication of either set of controls to the index position defined by pointer 13 will result in the punching of the same code. Paragraph identifying indications are marked on the dial within the segment designated as "Paragraphs."

When successively punching adjacent type bar characters or repeating the same character punching, it is desirable to provide a greater than normal spacing between such successive punchings for reasons previously explained. As will be brought out later, the machine is locked against successive punching of the same or adjacent characters until an intervening operation has been effected. This intervening operation is intended to be accompanied by a skip feed of the tape. To cause the skip feed to take place, the operator adjusts dial 14 to bring the indication SK within either control group to the pointer 13. The purpose of providing such duplicate skip indications as well as other duplicate control indications is to enable the operator to turn dial 14 through the shortest possible distance to bring a desired control or skip indication to the pointer 13. The control indications are abbreviated, for convenience, and the various abbreviations designate the controls as follows: MI represents a manual insert code, SK a tape skip feed operation, EP an end of paragraph code, TAB a tabular spacing code, SP a space bar code, CR a carriage return code, SHR a lower case shift code, SH an upper case shift code, and STR a start read code.

Corresponding to each indication on dial 14 is a notch 17 in the feed regulating dial 16 (see Fig. 12). Thus, when an indication on dial 14 is brought opposite pointer 13, the corresponding notch 17 of dial 16 is brought to a feed controlling position. The length of each notch 17 is determined by the extent of feed to be imparted to the tape P following the punching of the code representing the indication corresponding to the notch.

As indicated in Fig. 15, the successive character representing codes on the tape are spaced apart one step or a normal space, and therefore, the character-corresponding notches 17 are marked in Fig. 12 as "1 space." In Fig. 12, the space value of every other notch 17 is indicated, as by appending the value to the indication of the code to which the notch corresponds. Thus, after an end of paragraph code punching, the tape is fed 11 steps or spaces. It may be noted that the skip notch within the control groups has a "1 space" value while the skip notch within the paragraph group has an "11" space value. This latter skip notch is used after the punching of a paragraph code. The paragraph notches 17 have only a "½ space" value, which is not sufficient to completely separate the successive perforations. Thus, in punching a paragraph code, the operator successively effects a plurality of repeat operations, each followed by a ½ space, causing the series of paragraph designating holes in one row to overlap and intersect, thereby forming in effect a single elongated hole at each index position of the paragraph code. This is done in order to provide sufficient time for the paragraph code to be sensed and read out from the tape.

There is one interposer 22 for each indication on dial 14 and each notch 17 on the dial 16. The interposers are provided at their outer ends with long dependent teeth 28, and those teeth on the interposers corresponding to character indications are provided on their lower face with types 29 (see, particularly, Fig. 2) to print the conventional character indication on the tape at the bottom of the column in which the code for the character is punched (see Fig. 15). Successive characters are represented on the tape by their codes and the conventional interpretation thereof printed in successive columns. Thus, the subject matter punched on the tape may be read from

the interpretation of the codes along one edge of the tape, as indicated in Fig. 15.

Located along a radial line with respect to shaft 15 is a column of ten punches 30 (Figs. 2, 4, and 8), one for each of the ten index positions or perforation receiving positions in a tape column. The various codes are designated by single or combinational perforations in the ten index positions. Thus, one or a combination of the punches 30 is operated to punch a column of the tape with a code.

In adjusting the machine to punch a desired ode the operator turns knob 26 until the indication of the code on dial 14 registers with pointer 13. This positions the interposer 22 corresponding to the code vertically above the column of punches 30.

Each interposer is formed with interposer or punch-operating lugs 22*a* differentially arranged along the length of the interposer in accordance with the punches to be operated and the index positions to be perforated for the corresponding code. When an interposer is aligned with the column of punches, the interposer lugs of the interposer will be located directly above the punches in the corresponding index positions.

The punches are guided for vertically slidable movemen. by guiding holes in the horizontal flanges 31 and 32 of a U-shaped bar 33 (see Figs. 3 and 8), the base or vertical side of which is rigidly attached to a block 34 secured to the top of base frame 10. Each punch 30 is formed, intermediate its length, with a vertically elongated notch 35 through which a punch restoring bar 36 passes. Bar 36 is part of a lever 37 pivoted by means of a pin 38 to the side of block 34. Intermediate its length, lever 37 is provided with a horizontal tab 39 having a hole through which freely extends a screw 40 rigidly dependent from the bottom of washer 24 of the rotatable assembly fastened to vertical shaft 15. Carried by screw 40 below tab 39 are nuts 41.

The entire assembly rigidly carried by shaft 15 is rotatable with respect to lever 12, but the shaft and its assembly are mounted on the lever for rocking movement therewith about hinge pin 11. The lever 12 and the assembly carried thereby are normally held at the clockwise limit (as viewed in Fig. 4) by a coil spring 42 connecting the lower vertical lever arm to the frame. In this normal position of lever 12, the nuts 41 on screw 40 are abutting tab 39 of lever 37 to maintain the latter in upper position. With lever 37 in its elevated position, restoring bar 36 is acting on the upper shoulders of notches 35 in punches 30 to hold the punches in upper restored position (see Fig. 3). Upon depression of lever 12 and the rotatable assembly carried therewith by downward pressure on hand knob 26, the nuts 41 on screw 40 move downwardly, away from tab 39, permitting lever 35 and restoring bar 36 to drop and the punches to fall lightly on the surface of the tape and rest thereon until the interposer lugs 22*a* on the aligned interposer 22 strike the upper ends of one or more of the punches and force them through the tape. As the interposer in punch operating position moves down, the lower beveled end of its long tooth 28 moves between a pair of prongs 33*a* (Figs. 2 and 8) and positively alines the interposer and locks it in alined position with respect to the punch column. This happens before the interposer lugs 22*a* strike the punches. As the punches penetrate the tape, the type 29 of the interposer, if corresponding to a character code, prints the interpretation of the code on the tape. The punches pass through the tape and into alined die holes 44 of a lower punch die block 45 fastened to the top of base frame 10 (see Fig. 7). Upon the return stroke of lever 12, shaft 15 and the assembly thereon rise, causing nuts 41 to engage tab 39 and restore lever 37 and bar 36 thus stripping the punches from the tape and returning the punches to normal elevated positions. The upper surface of die plate 45 forms part of the supporting surface for the tape P. To the right of die plate 45 (as viewed in Fig. 7) is a plate 46 also fastened to the top of base frame 10 and forming a supporting surface for the tape as it is fed to the punches. Fastened to the right end of plate 46 is an upper guide plate 47 for the tape. To the left of the guide plate 47, the plate 46 has two upright pins 48 for locating a removable bar 49 for pressing on the surface of the tape to maintain it taut during feeding. To die plate 45 is fastened an upper guide plate 50 for the tape.

Record sheet or tape P is supplied in the form of a roll carried by a spool 51 mounted between the sides of a frame 52 secured to the right hand end of base frame 10 (as viewed in Fig. 1). A handle 53 is provided on the spool shaft for turning the spool when it is desired to rewind the tape onto the spool. The tape is fed from spool 51 through the passage between plates 46 and 47, underneath the weight bar 49, between the punches and dies, over the die plate 45, and through the passage formed between the die plate and upper guide plate 50. After being led past the latter passage, the tape is wound on a take-up spool comprising the usual side flanges 55 and 56 (see Figs. 1 and 7). The spool is journaled on studs 57 and 58. Stud 57 is carried by one side of a U-shaped frame 59 secured to the left hand end of base frame 10 while stud 58 is at the front end of a shaft 60 which is rotatably carried by the other side of frame 59. Secured to the inner end of shaft 60 is a driving lever 61 provided at one end with a stud 62 and at the other end with an oppositely extending stud 63. Stud 62 fits into a hole in spool flange 56 while stud 63 projects into a hole in a ratchet disc 64 which is mounted for movement about the same coincident axis as the take-up spool and shaft 60. A spring 65 between crank lever 61 and the bearing collar for shaft 60 normally urges shaft 60 and its crank lever 61 towards the flange 56 of the take-up spool, thus maintaining stud 62 engaged with flange 56. The outer end of shaft 60 is provided with a hand knob 66. By pulling outwardly on knob 66, shaft 60 and lever 61 carried thereby may be retracted against resistance of spring 65, thereby withdrawing stud 62 and bearing stud 58 from flange 56, leaving the spool free to be removed from the machine. In a similar manner, when inserting the spool, shaft 60 is retracted to allow the spool to be positioned between studs 57 and 58, after which the shaft 60 is brought forward by spring 65 to normal position for engaging stud 58 and stud 62 with the flange 56 of the spool. Referring to Figs. 1 and 7, a crank handle 68 is mounted for rotation concentrically with shaft 60 and the take-up spool. A hair pin spring 69 secured at one end to stud 70 on frame 58 and at the other end to a stud 71 on the crank handle 68 normally urges the crank handle clockwise (Fig. 1). Handle 68 pivotally carries a feed pawl 72, the nose of which is adapted to coact with the teeth of ratchet disc 64.

Also cooperating with the ratchet disc is a holding pawl 73 for preventing reverse movement of the ratchet disc. When the handle 68 is in its rearmost position, the tail 72' of pawl 72 is against the stud 70 which thereby holds the pawl in a counterclockwise position (Fig. 1) against the resistance of a spring 74 which is urging the pawl nose against the ratchet teeth. Pivotally connected to handle 68 is one end of a feed control link 75 (Figs. 1, 13, and 14), the other, forward end of which is formed with a lower projection 76 (Fig. 1) resting on top of the interposer carrying disc 18. The forward end of link 75 is also formed with an upper horizontally projecting tab 77 which rests on top of the notched feed regulating dial 16. Thus, link 75 is constrained by engagement of tab 77 and projection 76 with dial 16 and disc 18, respectively, to move up or down, at the front end, with the rotatable assembly on shaft 15 during the vertical movements of the assembly. Between projection 76 and tab 77, link 75 has a vertical, intermediate straight tooth portion 75' adapted to enter any of the notches 17 of dial 16. When the bell crank lever 12 is in normal clockwise position, the portions of dial 16 and disc 18 engaged with the forward end of link 75 are in elevated position and have correspondingly raised the forward end of the link. The angle of the dial 16 is then such that a portion thereof between consecutive notches 17 is straddled by projection 76 and tab 77 of link 75 and the tooth 75' thereof is between two notches 17 and against an uncut rim portion of dial 16. Link 75 is provided with a recess or notch 78 into which a latch plate 79 is adapted to move. The latch plate 79 is pivotally carried by a bracket 80 secured to the top of tape guiding plate 50. Bracket 80 is provided with a vertical extension 81 (Figs. 7, 13, and 14) formed with a slot 82 open at its upper end and through which the link 75 passes. Slot 82 serves as a guide for limiting lateral movement of link 75. A spring 83 between the bracket 80 and latch plate 79 normally urges the latter clockwise to a limit determined by engagement of the tail of plate 79 with lug 80' of bracket 80 (see Fig. 14). When link 75 is in rearmost, normally raised position, the latching end of latch plate 79 intrudes into notch 78 of the link and prevents forward movement thereof. With link 75 in this retracted and latched position, crank handle 68 is also at its rearmost limit and the tail 72' of pawl 72 is against stud 70 so that the nose of the pawl is disengaged from the teeth of ratchet disc 64.

Upon depression of the horizontal arm of lever 12 to effect punching, dials 14 and 16 and disc 18 are lowered and by coaction with portions 76 and 77 of link 75 force the forward end of the link down, bringing the notch 78 of the link out of engagement with latch plate 79. This permits the link 75 and connected crank handle 68 to move forward under the influence of hair pin spring 69. As a result, notch 78 of the link moves to the right (Fig. 13) of latch plate 79 so that a high, uncut portion of the link underlies the latch plate, which, therefore, is now unable to latch the link until the latter is returned to the left. Also, as handle 68 moved slightly forward, the tail of pawl 72 withdrew from stud 70, enabling spring 74 to rock the pawl nose into engagement with the teeth of ratchet disc 64. The force required to rotate disc 64 and the takeup spool for feeding tape P is greater than the force supplied to the ratchet pawl 72 by hair pin spring 69. As a result, when pawl 72 engages ratchet disc 64 the latter stops further forward, clockwise movement of crank handle 68 and link 75. As dial 16 is depressed, its portion engaged with projections 76 and 77 of link 75 moves angularly and by so doing, slides relatively to the forward end of link 75 to bring the notch 17 initially behind the tooth portion 75', into alinement with the latter. As this downward movement of the dial 16 has also resulted in releasing link 75 from latch 79 to enable spring 69 to move the link slightly to the right, the tooth portion 75' will enter the notch 17 as the latter is alined therewith. Link 75 is now in position where it may be moved into the alined notch 17 to the closed end thereof, but this movement is not effected until after the punch operation. As explained before, as notch 17 corresponds to one of the interposers 22, and therefore to one of the codes to be punched, when the assembly on shaft 15 was turned to bring a selected interposer into punch operating position, the corresponding notch 17 was brought into position for coaction with link 75 upon depression of the assembly. As lever 12 is fully operated to effect punching, the forward end or tooth 75' of link 75 enters the alined notch 17 ready to be moved to the closed end of the notch. As a result of tooth 75' moving into the notch 17, the assembly on shaft 15 is locked against further rotation and may not be shifted from its punch selecting position until the tooth 75' is withdrawn from the notch 17 corresponding to the punch selection, and this is not done until after a paper feed is effected following the completion of the punching operation.

After the punching operation, lever 12 is restored by spring 42 (Fig. 4), causing dial 16 and disk 18 to rise. Disk 18 through engagement with link projection 76 also raises the front end of the link, but the link having moved forwardly, its notch 78 is not in position to be latched by plate 79. As dial 16 rises, it returns angularly to its previous position and in so doing forces the tooth portion 75' of the link, now within the notch, to move laterally. In the raised position of the forward end of the link, the lateral movement thereof is permitted by the widened upper portion of guide slot 82 in portion 81 of bracket 80 (see Fig. 14). Since notch 78 is now ahead of latch 79, link 75 is free to move forwardly. Now, with the assembly on dial 15 returned to normal after the punching operation, crank handle 68 is rocked clockwise (Fig. 1) by the operator to move link 75 forwardly to the limit determined by the depth of the alined notch 17. During this movement of handle 68, its pawl 72 acts on ratchet disk 64 to move driving lever 61 and through the latter to rotate the takeup spool, thereby feeding the tape P to an extent determined by the depth of the notch 17 into which the link 75 is moved. In this manner, the extent of feed of tape P is determined by the depth of the notch 17 corresponding to the code which has just been punched into the tape.

After the handle 68 has been moved forwardly to the limit determined by the notch 17 in control position, the handle is retracted to its rearmost, initial position, in which pawl 72 is disengaged from ratchet disk 64. Link 75, retracted by handle 68, is latched by latch plate 79 in initial position, thereby also latching handle 68 in initial position. In the rear, latched position of link 75, its front tooth end 75' is completely out of the notch 17. As soon as the tooth end

75' leaves the notch, link 75 springs back laterally to its initial plane on which the tooth end is out of line with any of notches 17 of dial 16. It may be noted that the take-up spool may be rotated clockwise (Fig. 1) by turning knob 66 of shaft 60, which through drive 61 will turn the spool and the ratchet 64 independently of crank handle 68 and pawl 72.

The lower vertical arm of bell crank 12 extends into base frame 10 and its lower end is located between adjustable stops 88 (Figs. 4 and 9) which limit the forward and return strokes of the assembly carried by lever 12. Pivotally connected to the lower arm of lever 12 is one end of a link 89 which engages a pin 91 of a lever 92 by which a lever 96 is latched. Lever 96 pivotally carries an arm 98 provided with a platen disk 99 (Fig. 7). When hand lever 12 is rocked anti-clockwise, link 89 moves to the right (Fig. 4), rocking lever 92 clockwise to release lever 96 for clockwise operation by a spring 97. Lever 96 moves arm 98 upwardly to impel platen disk 99 towards the type 29 of the interposer in punching position. When lever 12 is returned, link 89 is restored to the left, rocking a pivotally connected lever 102 clockwise to replace lever 96 into latching engagement with lever 92.

The imprint is effected through a length of ink ribbon R threaded through a guide comb 105 (see Fig. 7) provided at the upper end of a bail 106 pivoted at 107 to a bracket 108 (see Fig. 4). A rod 109 extends between the sides of bail 106 to stiffen the bail. One end of a spring 110 is connected to rod 109 and the opposite end to link 89. In the initial position of the link, its left end abuts rod 109, thereby keeping bail 106 in counterclockwise position with the ribbon guide comb 105 retracted to hold and locate the ribbon length threaded therethrough externally of and to one side of the tape P. Thus, during feed of the tape, the ribbon is remote therefrom so as to expose the edge of the tape on which the interpretation of the punched codes is printed, enabling the operator to read the printing interpretation so as to check the accuracy of the tape punching. Incidentally, the ribbon being remote from the tape during feeding of the latter does not tend to interfere with the tape feed or to smudge the tape. Upon the forward stroke of lever 12, link 89 moves to the right (Fig. 4) and spring 110 causes bail 106 to rock clockwise, bringing the comb 105 and the ribbon length to the right (Fig. 4) and above one edge of the tape P. The ribbon length moves above tape P and between platen wheel 99 and the type 29 of the interposer in punching position before this interposer completes its downward movement. As the lever 12 completes its forward stroke and the interposer lugs 22a are driving punches 30 through the tape, link 89 trips latch lever 92 from lever 96 causing the platen wheel 99 to strike the ribbon length now between the platen wheel and the type 29 on the active interposer, thus causing printing of the character corresponding to the code which is punched under control of this interposer on the tape. On the return stroke of lever 12, the left hand end of link 89 engages rod 109 to return the ribbon bail to its normal, retracted position.

The ribbon is carried by a pair of spools 112, 113 (see Figs. 1 and 4) journaled on a shaft 114 rotatably carried by bracket 108. The ribbon extends from one spool through a guide slot formed in one arm of a lever 115, then over a suitable guide means and through guide comb 105, across the guide comb and then downwardly and through a slot in the other arm of lever 115 and back to the other ribbon spool. Suitable connections are provided between link 89 and the ribbon spools for causing feed of the ribbon in one direction upon each operation of hand lever 12. Suitable means are also provided to reverse the direction of ribbon feed.

To prevent a repeat depression of lever 12 unless the rotatable assembly on shaft 15 has been rotated at least two indicating steps, means are provided to lock lever 12 against a second depression before such rotation of the assembly is effected. The locking means comprises a vertically disposed lever 132 (see Figs. 4, 5, 6, 9, and 10) pivotally carried by the vertical arm of lever 12 by means of a pivot pin 133. The upper end of lever 132 is bent forwardly and horizontally to provide a tab 134 formed with a hole seating a ball 135 which is confined between the lower edge of band 25 of the rotatable assembly and the top 136 of a plunger pin 137. The plunger pin is slidably guided for vertical movement in the lower arm of lever 12 and is urged upwardly by a coil spring 138 surrounding the pin. The lower end of lever 132 is formed with a V notch 139 for coacting with a frame projection 140. The parts 132 to 138 are mounted on and move with the lever 12. Thus, in a normal clockwise position of lever 12, the lever 132 and the pin 137 will be in raised positions and the V notch 139 in the lower end of lever 132 will be substantially clear of the frame projection 140. Prior to a depression of lever 12 and with the parts in normal position, lever 132 will be inclined about its pivot 133 with one side of its V notch 139 just engaged with the side of frame projection 140 as indicated in Fig. 10. As the lever 132 is in inclined position, its upper tab 134 is holding ball 135 along a line inclined with respect to the axis of pin 137, and in this position of ball 135, it is to one side of the central high portion of the head 136 of plunger 137 and above the depressed beveled, annular rim of the head 136. As the ball 135 moved to this inclined position, spring 138 was permitted to raise the pin 137 until the beveled rim of the head 136 of the pin engaged the ball and forced it against the lower edge of band 125. As pin 137 is thus in elevated position under the influence of spring 138, as permitted by the off center position of ball 135, the lower end of the pin is above the inclined top of the projection 141 of a lever 142 which is urged upwardly by a spring 143. Now with the parts in this position, lever 12 is free to rock counterclockwise (as viewed in Fig. 4) to effect the punching and printing operation. During this movement of lever 12, the lever 132 moves downwardly and an inclined edge of its lower V notch 139 cams against the frame projection 140 to bring the lever 132 to a central and vertical position (as indicated in Fig. 9). Not only does the lever 132 move downwardly during counterclockwise action of lever 12 but also rearwardly, or to the right, and similarly the lower end of plunger pin 137 also moves downwardly and to the right, thus disposing its lower end directly above the top of projection 141 of lever 142, as indicated in Fig. 4. As lever 132 moved to its central vertical position, its upper tab 134 brought wall 135 into alinement with the vertical axis of the plunger pin 137, and the ball during this movement rode up on the beveled rim of the head 136 of pin 137 until it was centered on top of the high portion of head 136. Because of this action of ball 135, aided by the

fact that the lower edge of band 25 engaged with the ball also has moved downwardly, the plunger pin 137 is depressed against resistance of spring 138 and the lower end of the plunger pin acts on the top of projection 141 of lever 142 to lower the lever against resistance of spring 143.

Having operated the lever 12 counterclockwise (Fig. 4) to effect the punching and printing operation and as a consequence of which the plunger pin 137 is now on top of projection 141 of lever 142 and the vertical lever 132 is now in central vertical position, the operator permits spring 42 to return lever 12 clockwise to its initial position. During this movement of lever 12, plunger pin 138 moves clockwise so that its lower end moves towards the left while lever 132 remains in its vertical, centered position keeping the ball 135 on the high central part of plunger head 136. As the lower end of pin 137 moves to the left, it moves along the inclined top of projection 141 of lever 142 until it passes the left edge of the projection whereupon spring 143, which had been previously stretched by the action of pin 137 in depressing lever 142, is permitted to return lever 142 to its normal clockwise position. This brings the left end of projection 141 behind and to the right of the lower end of pin 137 which is prevented from rising by the ball 135 now sitting on top of the plunger head 136. Lever 141 of lever 142 is now behind the lower end of pin 137 and the upper edge of the projection is higher than the lower edge of the pin (see Fig. 5).

Lever 12 is now locked against a second successive depression because any attempt to move lever 12 counterclockwise to effect the punching and printing operation is prevented by the lower end of pin 137 abutting the front edge of projection 141 of lever 142. Since the counterclockwise action of lever 12 must result in movement of the lower end of pin 137 towards the right (Fig. 5) and since such movement of the lower end of pin 137 is now prevented by engagement with projection 141 of lever 142, it is clear that the lever 12 cannot be now rocked counterclockwise to effect the punching and/or printing operation. In order to unlock lever 12 for a second operation, ball 135 must be first brought off the central high portion of plunger head 136 and to an inclined position above the beveled rim of the plunger head. In this latter position of the ball, spring 138 is free to raise the plunger pin 137 to an extent sufficient to bring the lower end of the plunger pin above the top of projection 141 of lever 142, so that the projection 141 will no longer be in the path of movement to the right of the lower end of the pin 137, as indicated in Fig. 6. To bring the ball 135 to this off center, release position, the rotatable assembly on shaft 15 must be rotated at least two indicating steps. Upon rotation of the assembly by turning hand knob 26, the lower edge of band 25 acts on ball 135 and through friction moves the ball in the same direction as the direction of rotation of the band. If band 25 is given only one indicating step of rotation, the ball 135 will still remain on top of the central high portion of plunger head 136. It requires at least two indicating steps of rotation of band 25 to bring ball 135 off the high portion of the head 136 and above and in inclined position with respect to the beveled depressed rim of the plunger head. As ball 135 is moved to an off center release position by frictional engagement with the band 25, the ball through its seat in the tab 134 of lever 132 rocks the lever to an inclined position. Lever 132 is limited in its rocking motion by engagement of one of the inclined sides of its V notch 139 with the frame projection 140, and accordingly the extent of movement of ball 135 by band 25 is also limited in accordance with the extent of movement permitted to lever 132.

In above manner, rotation of the assembly carried by shaft 15 through a distance equal to at least two indicating steps of dial 14 has released the locking means to enable lever 12 to be rocked counterclockwise for effecting punching and/or printing. It is clear now that the same character code or character codes having adjacent indications on dial 14 cannot be successively punched in the tape by successive operations of lever 12 unless an intermediate operation is effected. The locking of the lever 12 against a second operation after a character code has been punched indicates to the operator that he is attempting to repeat the punching of the same character code or the punching of a character code corresponding to a character on a type bar adjacent the type bar to which the previously punched character code corresponds. The operator will then rotate dial 14 to bring either skip indication SK, within either set of controls, to pointer 13. In so doing, the dial is rotated at least two indicating steps since the closest distance between an SK indication and the nearest character indication is two indicating steps. This will therefore release the lever 12 for a second operation. The interposer corresponding to the SK indications has no punch actuating lugs nor any type, and depression of the assembly on shaft 15 with an SK indication in index position will not result in punching or printing. However, with the SK indication in index position, a notch 17 of feed regulating dial 16 will be in position for coaction with feed control link 75 (see Figs. 1, 13, and 14) and the reciprocation of crank handle 68 will cause a feed of the tape determined by the length of the latter notch 17. The length of the aforementioned SK indications corresponds to one space (see Fig. 12). In above manner, after the punching of a character code the lever 12 is locked against operation until the rotatable assembly has been moved at least two steps. In accordance with this plan of operation the operator will operate the machine to effect an intermediate tape feed equal to one space (see Fig. 15) before the successive punching of the same character code or an adjacent character code.

In perforating the tape with paragraph identification codes, an intermediate skip between the repeat punchings of the paragraph perforations is not desired as these perforations at each index position of the code must overlap to form, in effect, one continuous long perforation. Accordingly, after each operation of lever 12 to punch a paragraph identifying code, the operator will turn the assembly on dial 15 two steps in either direction and then return the assembly to the same paragraph indication and repeat the punching. This is done until the paragraph code has been punched in succession about six times to form one long perforation at each index position of the paragraph code. The operator will then move the assembly to bring the SK indication within the paragraph segment to the pointer 13. Depression of the assembly will not result in printing or punching, but will bring a long notch 17 of dial 16 to feed controlling position, and operation of crank handle 68 will cause a

long feed of the tape following the punching of a paragraph designation.

It may be understood from Figs. 4, 7, and 15, that one half the width of the tape is punched during one run of the tape through the machine. The other half of the tape may also be punched to provide desired control and character codes by reversing the tape and sending it through the machine with its reverse surface facing upwardly. The interpretation of the codes on this reverse surface will be on the opposite surface of the interpretation of the codes on the other half of the tape.

While there has 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 claims.

What is claimed is:

1. In combination, means to punch record material with various indications, means automatically effective after a punching operation to prevent repeat punching, means to feed the material variable amounts past the punching means, feed regulating means having different feed regulating positions, in each of which the feed regulating means coacts with a part of the feeding means to determine an amount of feed to be given to the material by the feeding means, and means operative upon shifting of the feed regulating means from one of the feed regulating positions to another, suitable feed regulating position for rendering the repeat preventing means ineffective.

2. In combination; punching means to punch coded designations in record material, a reciprocatable carrier, a shaft mounted thereon for rotation and for common reciprocation therewith, a feed regulating device fixed to the shaft, punch interponent means fixed to the shaft, rotative adjustment of the shaft adjusting the punch interponent means for selective coaction with the punching means and jointly adjusting the feed regulating device, material feeding means controlled by the feed regulating device for variously feeding the material in accordance with the adjustment of the feed regulating device, reciprocation of the carrier causing the interponent means to operate the punching means in accordance with adjustment of the interponent means, and means for preventing a successive operation of the punching means before a predetermined rotation of the shaft has been effected following a punching operation.

3. In a punching machine; punching means to perforate a record sheet with designations, designation selecting means, operating means to effect operation of the punching means under control of the selecting means to punch the sheet with selected designations, feeding mechanism for the sheet, a manual actuator for the feeding mechanism operable separately from the aforesaid operating means, means detaining operation of the actuator prior to a punching operation, and means operable as an incident to the punching means for releasing the detaining means to enable the actuator to be operated for feeding the sheet after a punching operation.

4. In a punching machine, punching means to perforate a record sheet with designations, mechanism to feed the sheet after a punching operation, a manual actuator for the feed mechanism, variable feed regulating means settable in accordance with the extent of feed to be effected following the punching operation and normally out of correlation with the actuator, operating means operated separately and apart from the aforesaid actuator for effecting operation of the punching means to punch the sheet with a designation and, as an incident to the punching operation, bringing the feed regulating means into correlation with the actuator for governing the extent of feed effected by the actuator after the punching operation.

5. In a punching machine; means to punch a record sheet with designations, designation selecting elements selectively settable in punching control position, a feed regulating element rigidly paired with each selecting element to be set in a feed control position coincidentally with the setting of the paired selecting element in punching control position, feed means for the sheet including a part adapted to interfit and coact with the feed regulating element in feed control position for determining the extent of feed to be imparted to the sheet following a punching operation, and operating means effective at the beginning of its operation to cause the said part to interfit with the feed regulating element in feed control position so as to aline the paired selecting element in punching control position and prevent the paired elements from being displaced out of their respective control positions, and effective during continued operation to effect operation of the punching means under control of the selecting means in punching control position.

6. In a punching machine; means to punch a record sheet with designations, feed means for feeding the sheet after a punching operation and including a feed control part, feed regulating means including a feed regulating element adapted for coaction with said part to determine the extent of feed imparted to the sheet by the feed means, said element being transversely displaced from said feed control part prior to a punching operation, and means to operate the punching means to punch the sheet and, as an incident to the punching operation, transversely moving the feed regulating element into coacting position with respect to said feed control part.

7. In a punching machine; means to punch a record sheet with designations, feed means to feed the sheet after a punching operation, feed regulating means comprising a rotatable disk having feed regulating notches of different depths in the rim and selectively settable by rotation of the disk into a feed regulating position, said feed means having a part adapted to move into the selected notch to determine feeding operation to the extent depending on the depth of the notch, said selected notch being normally out of line with the said part, means for mounting the disk for bodily rockable movement, and operating means for operatig the punching means and, as an incident to the punching operation, rocking the disk to bring the selected notch into line with the said part so as to enable movement of the part into the notch.

8. In a punching machine, means to punch a record sheet with designations, a plurality of designation selecting elements, each reciprocatable from and back to a home position to cause operation of the punching means to punch a different designation, means automatically operating caused by reciprocation of any said se-

lecting element as an incident to the punching operation and effective after the latter selecting element has been restored to home position for releasably preventing a repeat reciprocation of the said active selecting element, and means to render the preventing means ineffective.

9. In a punching machine, means to punch a record sheet with designations, a plurality of designation selecting elements, a common operating device to operate the punching means under control of any selected one of the said elements, a latch engageable with the common operating device and operable as an incident to the punching operation for releasably preventing repeat punching under control of the same or an adjacent selecting element, and means for releasing the latch from restraining effect on the common operating device.

10. In a punching machine, means to punch a record with indications, selecting means movable across the punching means to select different indications to be punched, reciprocatable means to effect punching of the selected indications, a latching device to latch the reciprocatable means against repeat operation after one reciprocation thereof, and means operated by movement of the selecting means across the punching means for releasing said latching device from the reciprocatable means to enable the latter to perform a successive reciprocation.

11. In a punching machine, means to punch a record sheet with indications, a rotatable interposer contrivance including a plurality of spaced punch interponents, each for causing the punching of a different indication, a latching device including a pair of interengageable elements normally disengaged from each other, means to reciprocate the interposer contrivance to effect punching of a selected indication, means operated by reciprocation of the interposer contrivance for causing the aforesaid elements to interengage and thereby to latch said contrivance against a repeat reciprocation, and means connected to the contrivance and operating, as an incident to rotation of the contrivance in making a new selection, to release the elements from latching interengagement.

12. In a punching machine, means to punch a record sheet with indications, means to select different indications to be punched, a common manual device operable to effect punching operation after selection of any indication, means to prevent a repeat operation of the manual device, and means to release the preventing means as an automatic incident to a new selection being effected by the selecting means.

13. In a punching machine, means to punch a record sheet with designations, a plurality of designation selecting elements, each reciprocatable to cause punching of a different designation, means to feed the sheet a variable extent after a punching operation, feed control means variably settable prior to and independently of operation of the feed means for coacting, according to its setting, with a part of the feed means, during operation of the latter, to determine the extent of feed to be imparted to the sheet by the feeding means, means automatically preventing repeat punching after restoration of the active selecting element, and means operable as an automatic incident to the making of a change in the setting of the feed regulating means for releasing the preventing means.

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CERTIFICATE OF CORRECTION.

Patent No. 2,213,567. September 3, 1940.

ALBERT W. MILLS, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 7, second column, line 64, claim 7, for "operatig" read --operating--; page 8, first column, lines 1 and 2, claim 8, strike out "as an incident to the punching operation" and insert the same before "caused", page 7, second column, line 75; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 8th day of October, A. D. 1940.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.