

Sept. 15, 1953

R. F. MALLINA ET AL
PERFORATING SYSTEM

2,652,116

Filed March 9, 1948

8 Sheets-Sheet 1

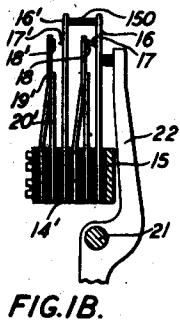


FIG. 1.

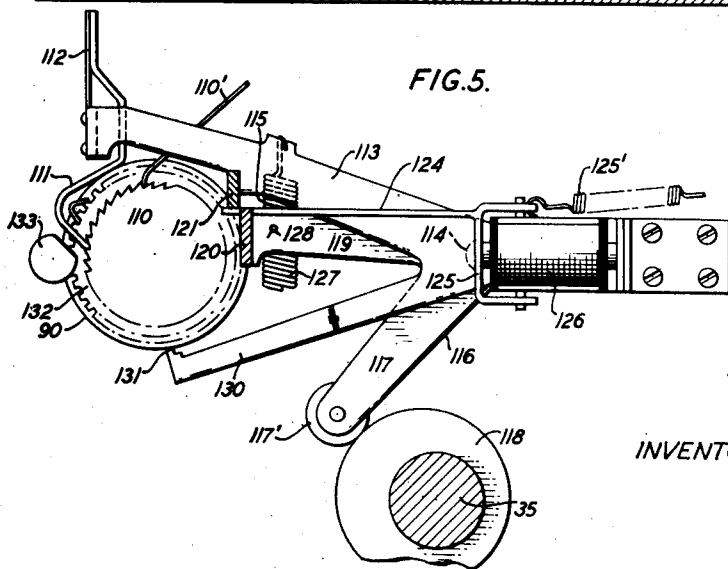
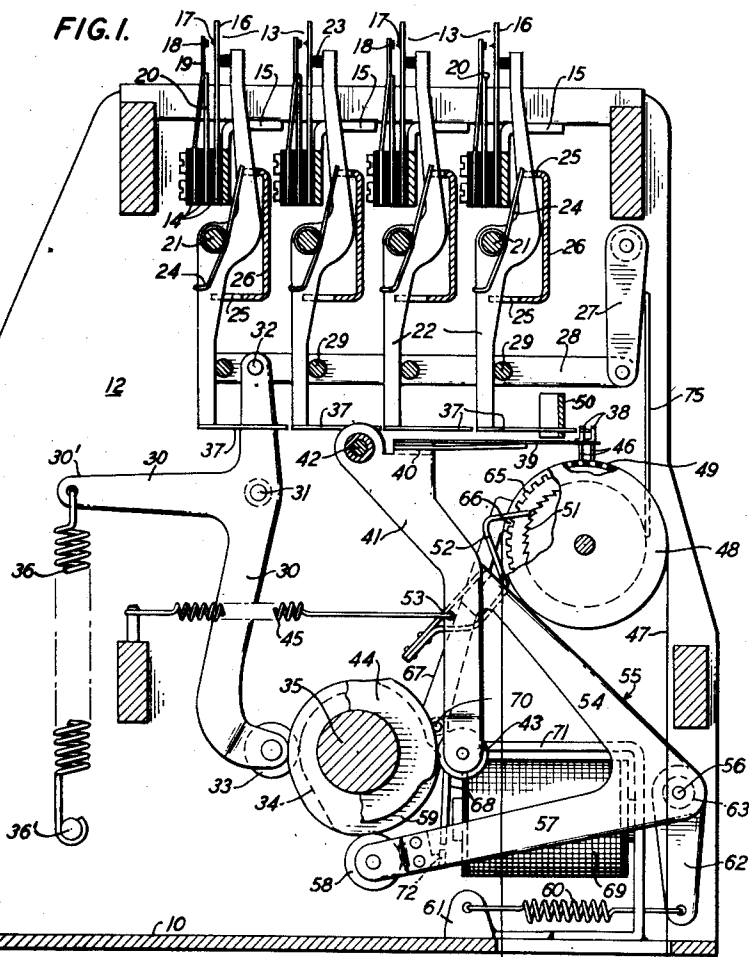


FIG. 5.

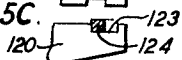
FIG. 5A.



FIG. 5B.



FIG. 5C.



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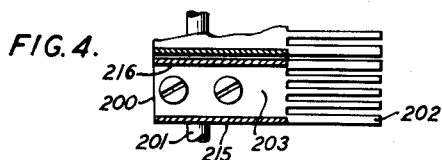
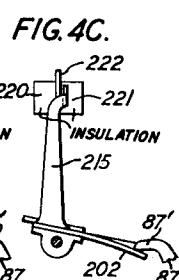
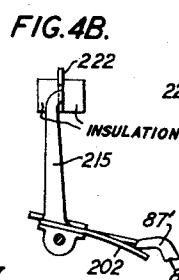
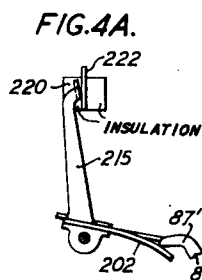
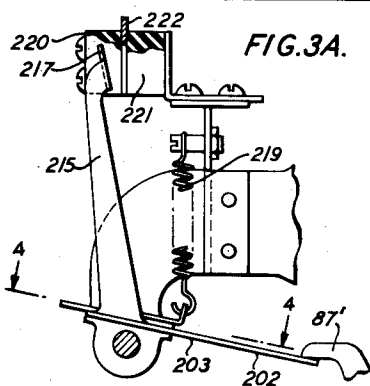
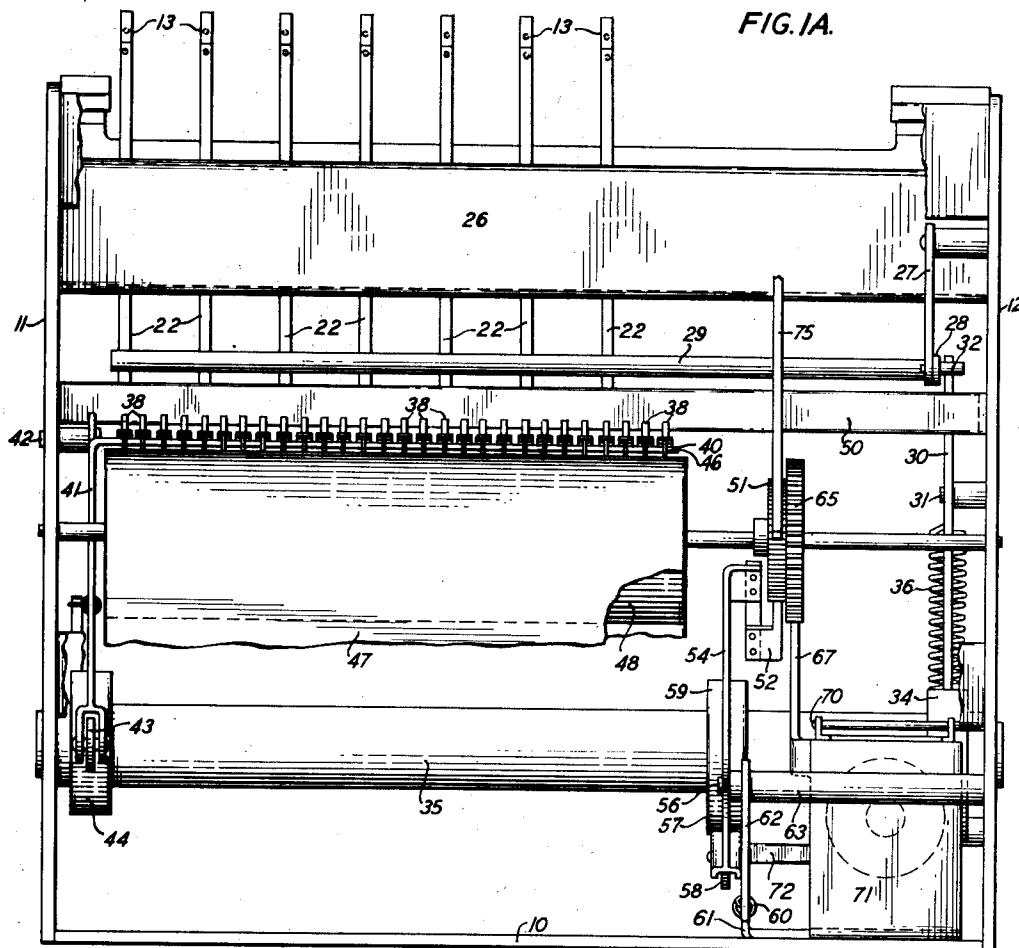
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FIG. 2.

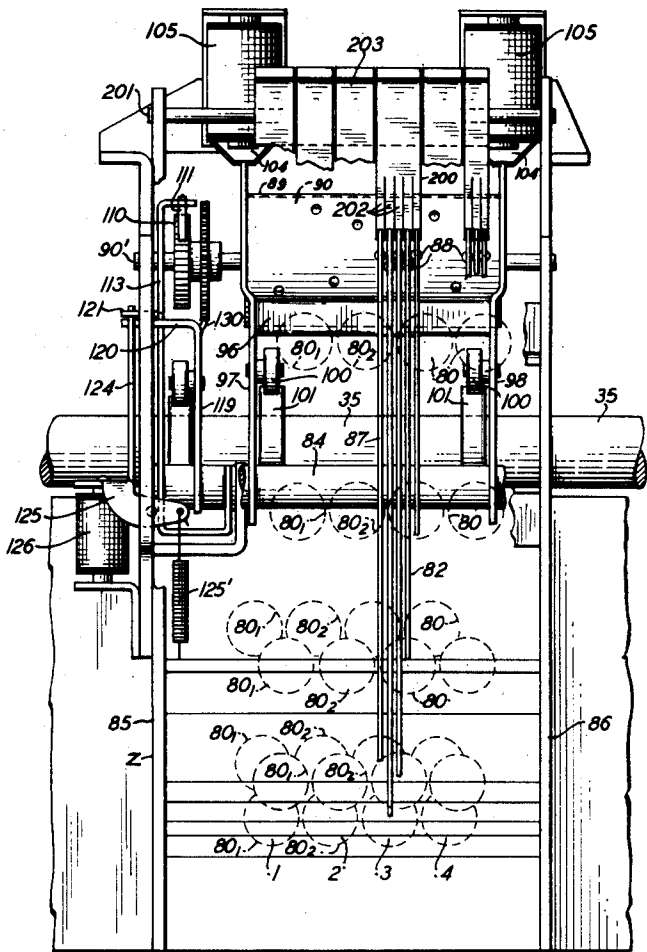
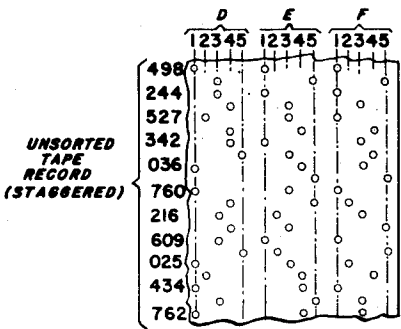


FIG. II.



UNSORTED
TAPE
RECORD

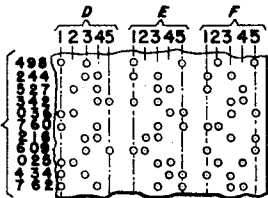


FIG. 12.

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FIG. 3.

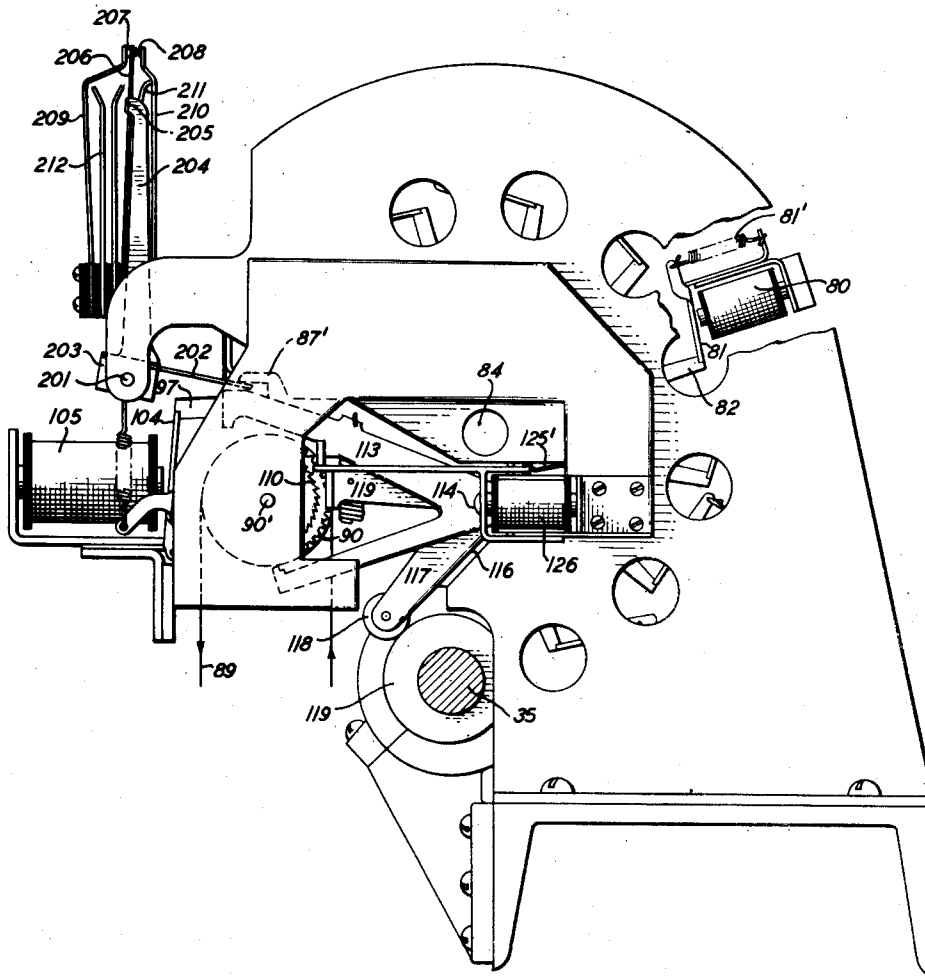
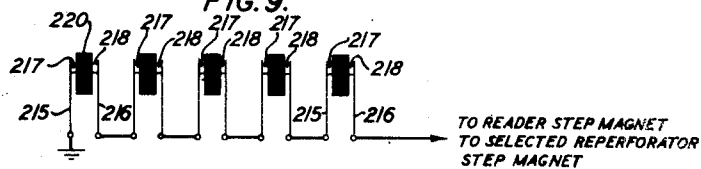


FIG. 9.



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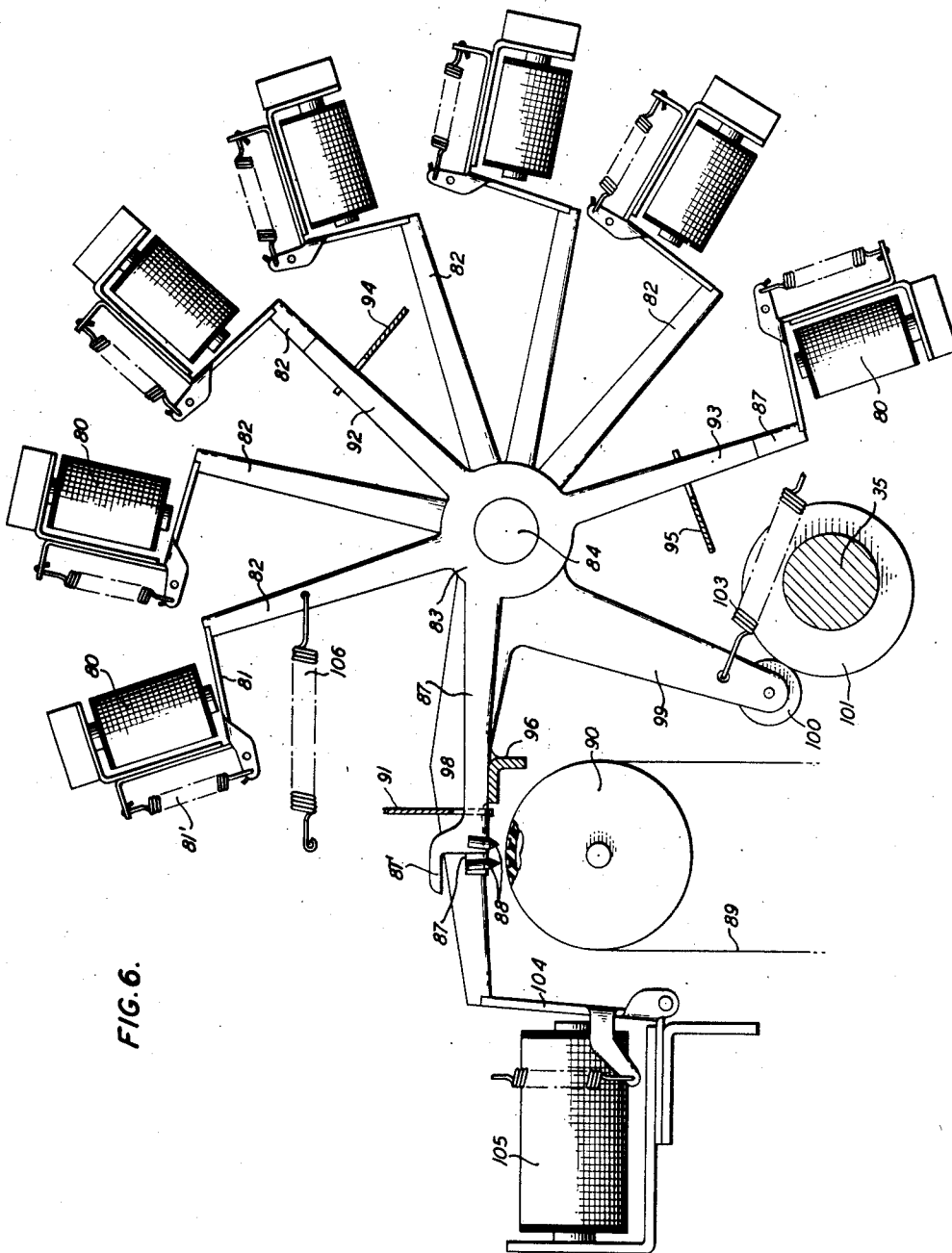


FIG. 6.

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FIG. 7.

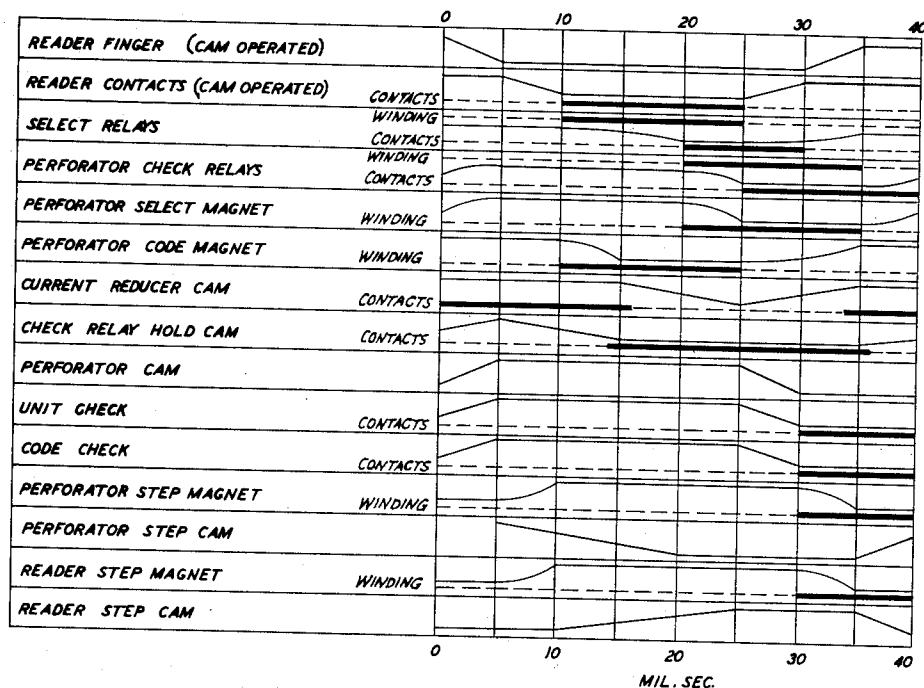
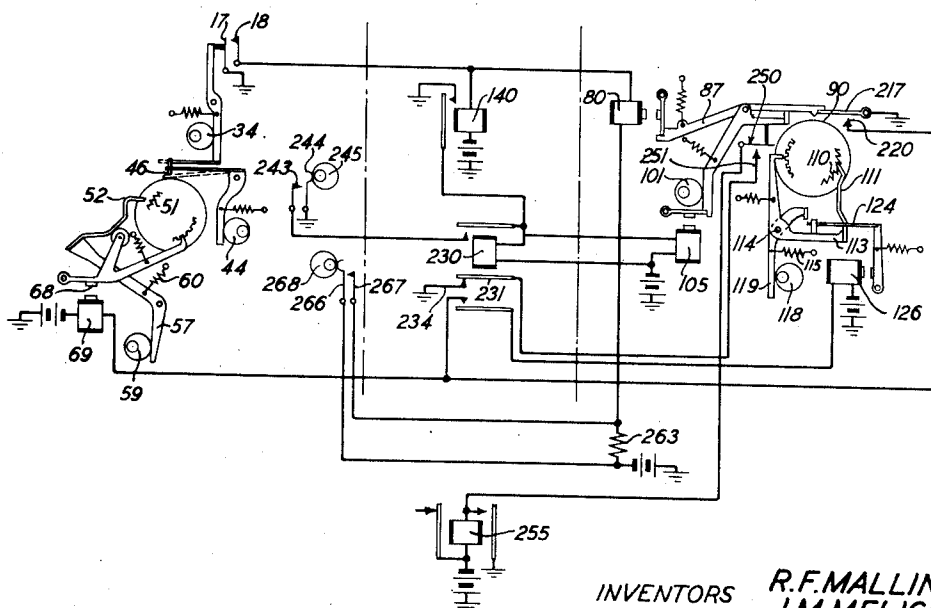


FIG. 7A.



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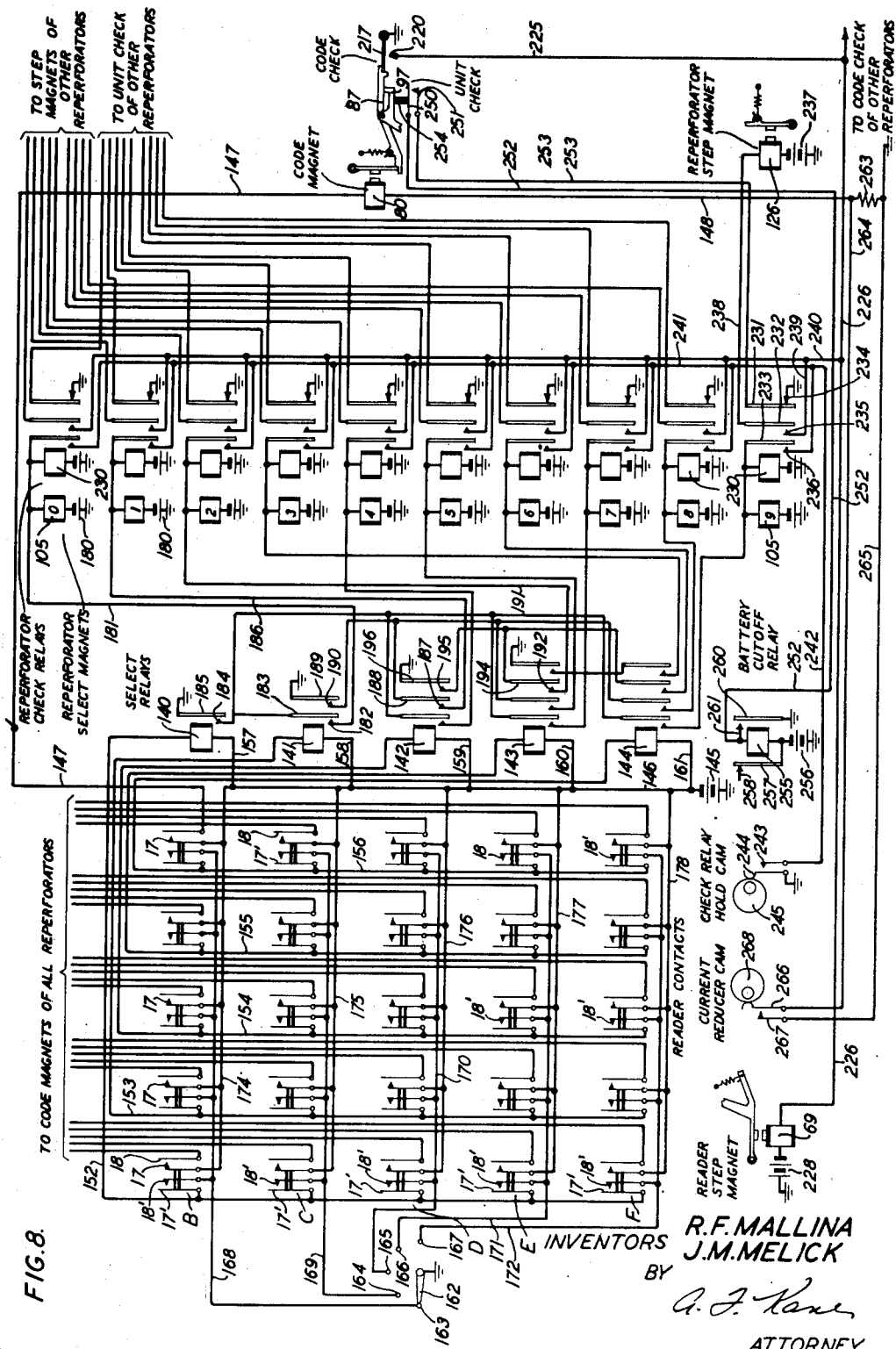
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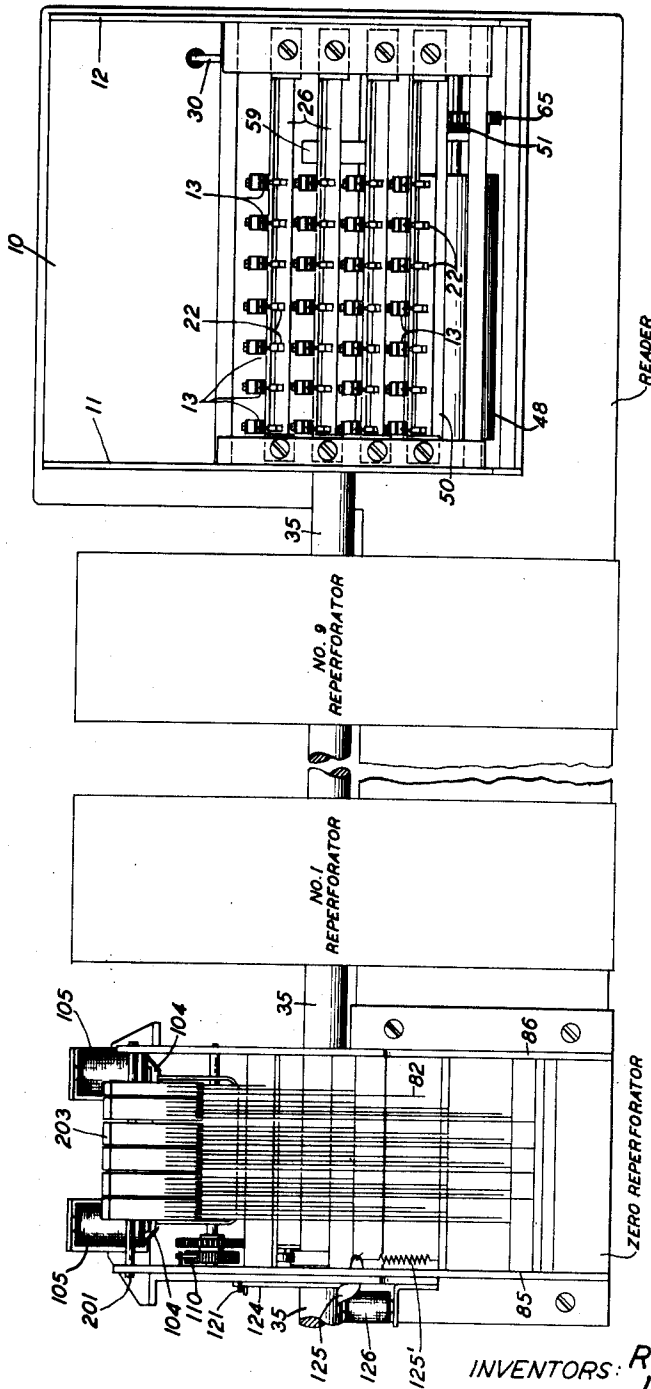
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FIG. 10



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UNITED STATES PATENT OFFICE

2,652,116

PERFORATING SYSTEM

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Application March 9, 1948, Serial No. 13,898

48 Claims. (Cl. 164—115)

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This invention relates to code perforating and sensing mechanisms of the type employed, for example, in automatic computing and billing systems wherein a primary recording medium, such as a code tape, is employed to record, in code, data relating to a multiplicity of individual items and in which data relating to any one specific item may be interspersed between data relating to other specific items. More particularly, the invention relates to means for sorting code entries recorded in mixed-up fashion on a primary tape and causing them to be reproduced, in code, in a numerical sequence.

In such systems, data or entries of transactions or events relating to one specific item, are recorded, in code, on a continuous strip of code tape and are interspersed thereon between other data, or entries relating to other specific items. This tape, herein referred to as the primary record or tape, therefore contains a multiplicity of random, or unsorted code entries relating to a plurality of separate items. For example, and as shown and described in the W. W. Carpenter et al. Patent 2,204,957, issued June 18, 1940, a primary record, or tape, may contain all the necessary entries for telephone call charging purposes such as the calling and called line numbers and the start and finish times of conversation, all of which are entered on the primary record at particular times during the origination, completion and termination of the telephone connections to which the entries pertain. The purpose of such a record is to provide means whereby an individual record for each telephone line may be produced and subsequently utilized to produce a translated and computed charge record for each telephone line in a manner fully disclosed and described in the W. W. Carpenter et al. Patent 2,112,951, issued April 5, 1938. See, also, patent to W. W. Carpenter et al. 2,268,203, issued December 30, 1941.

The present invention, while relating to apparatus particularly suitable for use in such a system as is disclosed in any of the above-identified patents, deals primarily with means for enabling code entries recorded indiscriminately and in mixed-up fashion on a primary record, or tape, to be reproduced or repeated in an orderly sequence in accordance with numerical codes which correspond to specific items and, obviously, is applicable to other than the automatic telephone message accounting systems disclosed in the above-mentioned patents.

By way of illustration, the code entries recorded on the primary tape are illustrated as

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corresponding to multidigit numbers which may, but need not necessarily, correspond to telephone numbers. These entries which have been recorded indiscriminately on the primary tape may, through the organization of apparatus comprising a plurality of reperforators and a code reading or sensing device, be sorted in accordance with their numerical values and reproduced on, or transferred to, a plurality of individual tapes in numerical sequence in the respective tapes.

It is the object of this invention to simplify and otherwise improve code tape reperforators and readers, or sensing devices, which cooperate in effecting the selective transfer or reproduction, in numerical sequence, of code entries recorded indiscriminately, or in random fashion to or on a plurality of individual records or tapes.

In accordance with the present invention a plurality of reperforators are controlled directly and selectively by a single code tape reader, or sensing device, through means which function under control of the reader and in accordance with the digital patterns of the code tape entries encountered by the sensing fingers of the reader, to operate corresponding combinations of perforating levers of a selected reperforator for reproducing on its individual tape recording medium the code pattern of the reader tape. A feature of the invention resides in placing the feed stepping mechanism of the reader tape under control of the reperforator selecting mechanism.

More particularly, the invention provides for controlling the reader and the reperforator tape stepping mechanisms so that both stepping mechanisms are maintained inoperative unless the reperforator selecting mechanism performs its function properly.

Another feature of the invention comprises the preventing of operation of the reader and reperforator tape stepping mechanisms unless the proper number of reperforator levers are operated in the various code channels. The invention provides for maintaining said feed mechanisms inoperative if either more or less than the proper number of reperforator levers are actuated in any code channel of the selected reperforator.

In addition, the invention provides a novel electrical system for selecting a reperforator unit and conveying the code information from the reader tape thereto.

Other features of the invention will be herein after described and claimed.

In the accompanying drawings:

Fig. 1 is a side elevational view, with parts in vertical section, of a reader mechanism constructed in accordance with the invention.

Fig. 1A is a front elevational view of the reader mechanism of Fig. 1.

Fig. 1B is a detail view of a modified arrangement of reader contacts.

Fig. 2 is a plan view illustrating a reperforator unit constructed in accordance with the invention, certain parts being omitted for clarity.

Fig. 3 is a side elevational view of the reperforator unit of Fig. 2, including a code-checking mechanism.

Fig. 3A is a detail view showing a modification of the code-checking mechanism which may be employed in the reperforator.

Fig. 4 is a detail view, taken on line 4—4 of Fig. 3A and showing a reed-bank arrangement which may be employed in the code-checking mechanism of Fig. 3 or Fig. 3A.

Figs. 4A, 4B, and 4C, show different positions of the code-checking contact mechanism of Fig. 3A.

Fig. 5 is a view in side elevation, with parts in vertical section, showing the tape-stepping mechanism of a reperforator unit.

Figs. 5A, 5B, and 5C are detail views showing different positions of a portion of the reperforator tape-stepping mechanism.

Fig. 6 is a diagrammatic side elevational view showing a portion of the perforating levers and associated parts in a reperforator unit.

Fig. 7 is a diagram showing graphically the sequence of operations of the various elements of the reperforator and reader units.

Fig. 7A is a diagram showing portions of a reader and a reperforator unit, and including electrical connections therebetween.

Fig. 8 is a more detailed wiring diagram.

Fig. 9 is a diagram showing five code-checking contacts of a reperforator, connected in series for controlling the reader and reperforator tape-stepping mechanisms.

Fig. 10 is a diagrammatic representation of a plurality of reperforators and their controlling reader.

Figs. 11 and 12 show fragmentary sections of a primary tape bearing typical code perforations; Fig. 11 illustrates the single straight line arrangement of code perforations and Fig. 12 illustrates the two-line staggered arrangement of code perforations.

The reader or sensing device

Referring to Figs. 1 and 1A of the drawings, the reader unit is shown mounted in a suitable supporting frame comprising a base 10 and side walls 11, 12. Banks of contact assemblies 13 are mounted on suitable insulating units 14 carried by brackets 15 which extend between said side walls. In the embodiment illustrated there are shown four of said brackets 15 (Fig. 1), each of which brackets carries seven contact assemblies 13 (Fig. 1A). Thus there are twenty-eight contact assemblies 13 in the embodiment referred to.

Each contact assembly 13 may (as shown in Fig. 1) comprise a leaf spring 16 having a contact projection 17 thereon, adapted to cooperate with a contact projection 18 on an adjacent leaf spring 19. The leaf spring 19 is tensioned against an arm 20 in the position shown in Fig. 1, so that the contact projection 18 is normally out of engagement with projection 17. The elements 16—20 of the contact assemblies may, as shown,

be mounted in the insulating units 14, whereby the contacts 17 and 18 of each assembly are insulated from each other, as well as from the supporting bracket 15.

Mounted in the side walls 11, 12, below the respective brackets 15 are rods 21, each of which has pivotally mounted thereon a plurality of levers 22, one for each of the contact leaf springs 16. Each lever 22 has at its upper end a projection 23 of insulating material which engages a corresponding leaf spring 16. Also, each of the levers 22 is engaged below its pivot rod by a spring 24 wound around said rod, as shown, and tending to rotate the lever counter-clockwise as viewed in Fig. 1. The levers of each bank are movable in slots 25 of suitable guide frames 26 which extend between the side walls 11 and 12.

Swingably supported from the side wall 12 by one or more links 27 is an arm 28 carrying four bars 29, each of which extends along a corresponding bank of the levers 22. A lever 30, pivoted at 31 on the wall 12, has its upper end pivotally connected to the arm 28 by a pin 32. The lower end of said lever 30 carries a roller 33 which engages a cam 34 on the main drive shaft 35 of the reader mechanism. Said roller 33 is maintained continually in contact with said cam 34 by a spring 36 which is connected at one end to an arm 36' of the lever 30 and at its other end to a rod 36'' fastened to the side wall 12.

In the normal position of the parts, as shown in Fig. 1, the roller 33 engages a depressed portion of the cam 34 so that the spring 36 and lever 30 maintain the arm 28 and bars 29 drawn rearwardly; whereby the levers 22 are prevented from actuating the contacts 17 into engagement with the associated contacts 18. In this position of the parts, the bars 29 hold the levers 22 in inactive position, against the action of the lever springs 24 which constantly urge the levers in a counter-clockwise direction. The lever springs 24, because of the functions performed thereby are stronger than the leaf springs 16.

At the lowermost end, each lever 22 carries a wire 37 which extends into contact with an interference pin 38. In the embodiment illustrated, twenty-eight of said interference pins are provided, one for each lever 22 and wire 37. Said interference pins 38 extend upwardly from leaf spring fingers 39 which are carried by arm 40. Said arm 40 projects laterally from a vertical lever 41. The latter is pivotally mounted at its upper end on a pin 42 on the side wall 11, and carries at its lower end a roller 43 which engages a cam 44 on the drive shaft 35. A spring 45, connected to the lever 41, continually maintains the roller 43 in contact with said cam 44.

Projecting downwardly from the respective leaf springs 39 are reader or sensing fingers 46, each in alignment with a corresponding one of the interference pins 38. The twenty-eight reader fingers 46 overlie the reader tape 47 which passes over a rotatable drum 48, which may be provided with perforations 49 as shown in Fig. 1.

The wires 37 extending from the lower ends of the levers 22 may be guided into proper alignment with the respective interference pins 38 by passing through openings in a bar 50 which is fastened to the side walls 11, 12. The pins 38 and their corresponding reader fingers 46 may be staggered alternately, as shown in Fig. 1, to provide two rows each having fourteen pins 38 and fourteen fingers 46. However, it will be apparent that, if desired, the pins and fingers may be arranged in a single row of twenty-eight.

As long as an interference pin 38 is in the path of a wire 37, the corresponding lever 22 cannot be turned counter-clockwise by its spring 24, even though the arm 28 and cross bars 29 be operated by cam 34 to remove said cross bars from the paths of the levers.

The normal positions of the above-described reader elements at the end of a cycle of operation, are shown in Fig. 1.

During a cycle of operation of the reader drive shaft 35, said shaft is turned counter-clockwise as viewed in Fig. 1, under power supplied by any suitable motor (not shown). At the outset of the cycle, the high point of the cam 44 moves away from the roller 43, so that the spring 45 rocks the lever 41 clockwise. Thereupon all of the leaf spring elements 39 are moved downwardly, bringing the reader fingers against the tape 47. Those fingers 46 which are opposite perforations in the tape 47 pass through said perforations, removing the corresponding interference pins 38 from the paths of the corresponding lever wires 37. Those fingers 46 which overlie unperforated portions of the tape 47 remain in contact with the surface of the tape, while the spring elements 39 which carry them are flexed as the lever 41 continues its clockwise swing; and the corresponding interference pins 38 remain in the paths of the corresponding lever wires 37.

When the lever 40 and reader fingers are actuated as above described, and while they remain in their actuated positions, the cam 34 actuates the lever 30 and shifts the frame 28 to the right in Fig. 1, withdrawing the cross rods 29 from the paths of movement of the levers 22. Thereupon, those of said levers 22 whose wires 37 are not obstructed by interference pins 38 are free to turn counter-clockwise under the influence of their springs 24, with consequent operation of the corresponding contacts 17 into engagement with the contacts 18 in the corresponding contact assemblies. In short, upon operation of the reader fingers and of the cross rods 29, those levers 22 corresponding to reader fingers which enter perforations in the tape 47 are operated to close the corresponding contacts 17—18. Thus the contacts 17—18 are closed in those contact assemblies which correspond to the reader fingers which enter the tape perforations.

As previously noted, the drum 48 may have perforations 49 into which the reader fingers may enter after passing through perforations in the tape. Specifically, the surface of the drum may be perforated to provide, in each position to which the drum is turned, as many perforations as there are reader fingers, i. e., twenty-eight in the present instance.

The code system employed may be substantially the same as that illustrated in the application of R. F. Mallina, Serial No. 635,355, filed December 15, 1945, now Patent 2,576,844 granted November 27, 1951, in which each digital pattern of a code entry on the record tape is made up of two perforations out of a fixed pattern of five. Assuming a code number to consist of five digits, the entry on the tape is considered to consist of five channels each allocated to one digit of the five-digit number. Each digit, as previously noted, is characterized by two perforations out of a fixed pattern of five so that each of the possible digits, 1 to 9 and zero, can be represented by two perforations spaced differently across the channel allocated to a digit, as shown in Fig. 11. Thus, in the present embodiment, twenty-five of the fingers 46 and levers 22 may be considered as

divided into five groups of five each, said groups corresponding to units, tens, hundreds, etc. of the digital channels or orders. The remaining three fingers 46 and levers 22 may be used for certain control purposes, as is well understood in the art, and need not be further discussed.

When the reader fingers 46 are alternately staggered as shown in Fig. 1, the perforations in the drum 48 for each position of the latter are correspondingly staggered to lie directly opposite said fingers. The code pattern is then the same as illustrated in the above-mentioned Mallina application, except that alternate holes are staggered, as shown in Fig. 12. For instance the fixed code pattern for each digital channel may then comprise five perforations, with the first, third, and fifth in one row, and the second and fourth in another row. When, on the other hand, all of the reader fingers 46 are in a single row, the code pattern perforations for each channel will also be in a single row as shown in said Mallina application.

When the reader fingers corresponding to tape perforations for a given code entry have passed into said perforations, the corresponding levers 22 are operated and contacts 17—18 are closed in the corresponding contact assemblies as above set forth. Thereupon certain operations take place in the reperforator units which will be presently pointed out.

The reader tape drum 48 is rotatably stepped to successive positions by mechanism which may comprise a ratchet wheel 51, secured to the drum 48, the teeth of which wheel are adapted to be engaged by a pawl 52. Said pawl is carried by a leaf spring 53 fastened to an end of an arm 54 of a bell crank lever 55, pivoted on a pin 56 on the side wall 12. The lower arm 57 of said lever carries a roller 58 engaging a cam 59 on the drive shaft 35. A spring 60 maintains the roller 58 in contact with said cam 59, for which purpose said spring may be connected at one end to a stationary lug 61 projecting from a bracket 71 and at its opposite end to an arm 62 rotatable with the lever 55. Said arm 62 may conveniently be fastened to a sleeve 63, secured to the lever 55 and rotatable therewith on the pin 56.

Secured to the drum 48 adjacent the ratchet wheel 51 is a toothed wheel 65, normally engaged by a tooth 66 on an arm 67 integral with or secured to an armature 68 of an electromagnet 69. Said arm and armature assembly is pivotally mounted in any suitable manner, as for instance through pivot 70 on a frame or bracket 71 of the electromagnet 69. Said arm 67 may be held in engagement with the toothed wheel 65 either by its weight on the right-hand side of the pivot 70 (Fig. 1), or by a suitable spring, as will be apparent. In that position of the parts, the armature 68 lies in the path of a lug 72 on the bell crank lever arm 57, preventing said arm from rising under the action of the spring 60 as the high portion of the cam 59 moves away from the roller 58.

The electromagnet 69 is energized near the end of the operating cycle, through means hereinafter described. When said electromagnet is energized it attracts the armature 68, removing the latter from the path of the lug 72 and also operating the arm 67 to withdraw tooth 66 from engagement with the wheel 65. Then, as the high portion of the cam 59 moves away from the roller 58, the lever arm 57 is operated by its spring 60, bringing the pawl 52 into engagement with the ratchet wheel 51 and turn-

ing said wheel to rotate the drum 48 through one step. The tape 47 is thereby advanced to bring the next code entry beneath the reader fingers 46. At the end of the cycle the electromagnet 69 is deenergized, and in the ensuing cycle of rotation of the cam 59 the high portion of said cam acts upon the roller 58 to restore the lever arm 57 to its normal position (Fig. 1), withdrawing the pawl 52 from engagement with ratchet wheel 51. As the armature 68 of the deenergized step magnet 69 returns to its normal (Fig. 1) position, above the lug 72 on the lever arm 57, the tooth 65 on the arm 67 reengages the toothed wheel 65.

A spring detent 75, supported at its upper end in any suitable manner from the reader framework, extends at its lower end into engagement with the ratchet wheel 51 to prevent said ratchet wheel from turning backward when pawl 52 is withdrawn. When the tooth 66 engages the wheel 65 it positively locks the reader drum in proper position and prevents rotation thereof by undue tension of the reader tape reeling mechanism. The latter may be of conventional type and is not shown, it being well understood that the tape passes from the drum 43 to a suitable storage reel.

It will be noted further that in the above-described embodiment, the reader drum cannot be advanced while the electromagnet 69 is deenergized. Energization of said magnet is a prerequisite to operation of said drum. Thus the latter cannot be advanced during a current failure.

The reader may cooperate with ten reperforators as indicated by Fig. 10 to select individual reperforators in accordance with digits of the numbers represented by the code perforations on the reader tape, and to reproduce on the tapes of the selected reperforators the code perforations appearing on the reader tape. As in the aforementioned Mallina application, the ten reperforators correspond to the digits 1 to 9 and zero, and their selection is under the control of digits in the numbers on the reader tape. Also, the reperforators in the present system are electrically selected and controlled, and involve various features not present in the reperforators of said pending application.

It will be understood that, if desired, certain of the code information on the reader tape may be transformed into other information by relays, in well-known manner, before transmission to reperforators, or may be omitted. For instance, the starting times of calls on a reader tape may be subtracted by relays from the completion times to give the call durations, which may then be sent to reperforators. Also, code information on the reader tape as to unanswered calls may be excluded from transmission. Relay systems for accomplishing these ends are well understood in the art and may be employed in conjunction with the reader tape entries, if desired, to alter correspondingly the transmission of information to the reperforators. To illustrate the operation of the invention, however, it will suffice to consider the direct transmission of code information from the reader tape to different reperforators.

The reperforator

An embodiment of a reperforator unit adapted for use in the present invention is illustrated in Figs. 2-6, and may be constructed as follows:

Each reperforator unit includes twenty-eight code magnets 80 (Figs. 2 and 6), each corresponding to one of the reader fingers 46. In Fig. 6,

a bank of seven code magnets is shown, in conjunction with cooperating elements. As illustrated in Fig. 2, four of said banks, designated 1, 2, 3, and 4 may be arranged in the reperforator unit, providing a total of twenty-eight code magnets. Thus, in Fig. 2, the bank 1 contains seven code magnets, designated 80₁, while the seven magnets in bank 2 are designated 80₂. Each of the other banks likewise contains seven code magnets. For convenience, certain of the code magnets in each bank may be staggered with respect to others, as illustrated.

Each code magnet 80 has an armature 81 which normally acts as a latch, restraining from movement a corresponding reperforator lever 82. Each of said levers 82 extends from a corresponding one of a series of hubs 33, journaled on a shaft 84 extending between side walls 85 and 86 of the reperforator unit framework. Each hub 33 also carries an arm 87 provided with a pin 88 (Figs. 2, 3) for perforating a tape 89 passing over the reperforator drum 90 (Figs. 3 and 6). The pins of alternate reperforator arm 87 may be staggered, in correspondence with the alternately staggered reader pins 46, so that the same pattern appearing on the reader tape is reproduced on the reperforator tape.

Each reperforator arm is movable in a corresponding slot in a stationary comb-like member 91, while other arms 92, 93, extending from the hub 33 are also movable in slots of stationary comb-like members 94, 95; whereby the arm assembly is guided during rotation with said hub, and the pin 88 is maintained accurately over the proper portion of the reperforator tape.

In the normal position of the parts, all of the arms 87 of the reperforator unit rest upon a frame comprising a cross bar 96 carried by a pair of side arms 97, 98 (Figs. 2 and 6), which are pivotally mounted on the shaft 84. Arms 99, 99, extending from said side arms carry rollers 100, 100 which engage came 101, 101, on a suitable drive shaft. As indicated in Fig. 6, each of said arms 99 may have connected thereto a spring 102 for maintaining the roller 100 in constant contact with the cam 101. If desired, each reperforator unit may have a separate drive shaft, driven at constant speed in unison with the drive shafts of the reader and the other reperforators. Alternatively, the drive shaft 35 of the reader may extend not only through the reader but also through the ten reperforator units. In the present system the same drive shaft 35 is illustrated for both the reader and the reperforators.

Normally, the movable reperforator frame comprising the bar 96 and side arms 97, 98 is prevented from operation by latches 104, 104, formed as armatures of electromagnets 105, 105, and engaging the side arms 97, 98, as shown in Figs. 2 and 6. The magnets 105, 105, are termed "select magnets," since their energization is essential to operation of the reperforator unit. Until they are energized, none of the reperforator levers 87 can move downwardly to effect perforation of the tape on the drum 90, even though code magnets 80 be energized.

As long as a code magnet is deenergized, its armature 81 is maintained by a spring 81' in latching engagement with the arm 82 of the rotatable arm assembly, thus precluding operation of the corresponding arm 87 to perforate the tape, even though the cross bar 96 and arms 97, 98 are moved downwardly. However, energization of any code magnet 80, in response to closing of the corresponding reader contacts 17-18, removes its armature 81 from engagement with the

corresponding arm 82. Then, if the select magnets 105 of the reperforator unit are energized, the springs 103 draw the arms 97, 98 and cross bar 96 downwardly during the rotation of the cams 101 and drive shaft 35, so that those levers 87 which have been released by energized code magnets 80 in said reperforator unit are moved downwardly by springs 106, to perforate the tape of said unit in exact accordance with the perforations of the reader tape engaged by the fingers 46.

Following the perforating of the tape 89 by the released lever arms 87, the cross bar 96 is moved upwardly to its normal position by the cams 101, restoring said lever arms to their normal upward position. Also, following said perforating of said tape, the drum 90 is advanced one step to bring a fresh portion of the tape beneath the perforating pins 88. The stepping mechanism for the drum may be constructed as follows.

Secured to the drum shaft 90' (Fig. 3) is a ratchet wheel 110 (Figs. 2, 3, and 5). Engageable with said ratchet wheel is a pawl 111 (Figs. 2 and 5), mounted on a leaf spring 112 (Fig. 5) carried by a rock arm 113. The latter is pivoted at 114 (Figs. 3, 5, and 7) and is continually urged by a spring 115 in a direction for engaging said pawl 111 with said ratchet wheel 110. Normally said pawl is disengaged from said ratchet wheel. A spring detent 110', supported at its upper end in any suitable manner on the reperforator framework, extends at its lower end into engagement with ratchet wheel 110 to prevent said ratchet wheel from turning backward when pawl 111 is withdrawn.

Mounted for pivotal movement about the same axis as the arm 113 is a bell crank lever 116 comprising an arm 117, carrying a roller 117' which engages a cam 118 on the drive shaft 35. Another arm 119 of said bell crank lever has a laterally extended end portion 120 which lies adjacent to lug 121 projecting laterally from an intermediate portion of the rock arm 113. As shown in Figs. 5A-5C, the lug 121 has a notch 122 in its lower edge, while the lateral extension 120 of the arm 119 has in its upper edge a notch 123 lying below the aforementioned notch 122. Movable within the notch 123 is a resilient finger 124 which projects from the armature 125 of an electromagnet 126. The latter may be termed the reperforator "step magnet."

The roller 117' of the bell crank lever 116 is continually maintained in engagement with the periphery of the cam 118, through the action of a spring 127 adjacent the spring 115 and connected to a pin 128 on the arm 119 of said bell crank lever. During each cycle of rotation of the drive shaft 35, the lever arm 119 is rocked upwardly, carrying with it the finger 124 of the armature 125. However, no motion is imparted to the drum stepping arm 113 unless the electromagnet 126 is energized as an incident to the selection of the reperforator. Thus, while the lever arms 119 of all ten reperforators are raised in unison during rotation of the cams 118 on the drive shaft 35, only the arm 113 of the selected reperforator will be operated, and only in that reperforator will the reperforator drum 90 and tape 89 be advanced.

When the stepping magnet 126 is deenergized, a spring 125' (Figs. 2 and 5) holds the armature 125 and finger 124 in such position that no motion is transmitted from the lever arm 119 to the arm 113. Said finger 124 at such times lies in the notch 123 in the position shown in Fig.

5C, directly beneath the notch 122, so that raising of the arm 119 will simply carry said finger 124 into said notch 122 without transmitting any motion to the lug 121 or to the arm 113 from which said lug extends. When, however, the magnet 126 is energized, its armature is attracted and the finger 124 is shifted in the notch 123 to the position shown in Fig. 5A, wherein said finger is removed from registry with the notch 122 and lies directly below the portion 129 of the lug 121. Then, when the arm 119 moves upwardly, said finger 124 engages said portion 129 of the lug 121, carrying upwardly said lug (Fig. 5B) together with the rock arm 113, and raising the pawl 111 with respect to the ratchet wheel 110 as a preliminary to advancing said ratchet wheel. Concurrently with the raising of the arm 113, an arm 130 integral therewith is moved upwardly to bring its tooth 131 into engagement with a toothed wheel 132 secured to the drum 90, thereby positively preventing rotation of the drum by any torque applied to the tape by the take-up reel. The latter (not shown) may be of any desired type. It will, of course, be understood that in each of the reperforators the tape passes from a suitable supply source over the drum and thence to a take-up or storage reel.

As the high portion of the cam 118 recedes from the roller 117' during the rotation of the drive shaft 35 the arm 119 descends under the action of its spring 127, and likewise the arms 113 and 130 descend under the action of the spring 115. During said descent of said arms 113 and 130, the tooth 131 is withdrawn from engagement with wheel 132, and the pawl 111 engages the ratchet wheel 110 and advances the latter one step, together with the drum 90 and tape 89. At the end of its downward stroke, the pawl 111 rests against a stop 133 (Fig. 5), which stop prevents further descent of said pawl and of the arm 113. The lever arm 119, however, moves further downwardly, sufficiently to permit the finger 124 to be retracted to the position shown in Fig. 5C, the stepping magnet 126 being in the meantime deenergized.

The advancing of the drum 90 is, of course, timed to take place in an appropriate portion of the cycle of operation of the drive shaft 35, as will be hereinafter more specifically noted.

Selection of reperforators

As previously noted, twenty-five of the reader fingers 46 may be considered as divided into five groups of five each, said groups corresponding to units, tens, hundreds, etc. of the digital channels or orders of the code entries on the reader tape. Each digit, as previously indicated, is characterized by two perforations out of a fixed pattern of five, so that each of the possible digits 1 to 9 and zero can be represented by two perforations spaced differently across the channel allocated to a digit.

The operation of each of the ten reperforators is determined by said digits 1 to 9 and zero in the controlling digital channel. Thus when the controlling digit of a code entry on the reader tape is "zero," the "zero" reperforator will be selected for operation; the No. 1 reperforator will be selected when the controlling digit of the reader code entry is "1"; and so on. The code entries on the reader tape are furthermore first to be sorted under control of the units channel, and subsequently in the tens, hundreds, etc. channels successively.

For accomplishing the foregoing purposes the

select magnets 105 of the reperforators may be coordinated with the reader contacts as illustrated in Fig. 8. In that figure, the select magnets 105 are designated 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9 respectively, corresponding to the ten different reperforator units. While in the reperforator unit hereinbefore described two select magnets are shown (Fig. 2), one for each arm 97, 98 of the frame which controls the reperforator arms 27, only one select magnet is shown for each reperforator unit in Fig. 8 to avoid unnecessary complication of wiring. It will of course be understood that only one select magnet need be employed for the reperforator arm controlling frame in each reperforator, and that, if two be utilized, they may simply be connected in the same circuit, either in parallel or in series.

The selection of reperforator units may, as shown in Fig. 8, be effected through five relays 140—144, which may be termed "select relays." These are controlled from the reader contacts.

In Fig. 8, the twenty-five pairs of reader contacts 17, 18 assigned to code number digits are shown. Each of said pairs is connected for closing circuits through corresponding code magnets 80 in the respective reperforators. For instance, in said Fig. 8 one of the code magnets 80 of a reperforator unit is shown connected to one of the reader contacts 18. Upon engagement of that contact by the adjacent contact 17, a circuit is closed through said code magnet as follows: From battery 145, through wire 146, contact 17, contact 18, wire 147, the winding of code magnet 80, wire 148 to ground, and thence to battery 145. Said code magnet is thus energized and attracts its armature 31, releasing the corresponding reperforator arm 32 (Fig. 6). At the same time, in the nine other reperforators the code magnets connected to the aforementioned pair of closed contacts 17—18 are energized, releasing the associated reperforator arms. In short, each of the twenty-five pairs of reader contacts assigned to a code number digit is connected to ten code magnets, in the respective reperforators, to energize said code magnets when the pair of reader contacts is closed. To avoid unnecessary confusion in Fig. 8, only one code magnet is shown.

Each contact controlling lever 22 in the reader mechanism may close not only a pair of contacts 17—18 as hereinbefore described, but also a further pair of contacts 17'—18' (Figs. 1B and 8). Thus, as shown in Fig. 1B, each reader contact assembly may comprise not only the contacts 17—18, but also a contact 17' on a leaf spring 16' joined to the leaf spring 16 by a link 150 of insulating material. Adjacent the contact 17' of the assembly is a contact 18' on a leaf spring 19', normally held out of engagement with contact 17' by a blade or arm 20'. The various elements of each assembly are mounted in an insulating unit 14' (Fig. 1B) whereby they are insulated from each other as well as from the supporting bracket 15 to which said unit is attached. It will be seen that with this arrangement, the counter-clockwise rotation of any of the reader levers 22, in response to engagement of the corresponding finger 46 with a perforation of the reader tape, will move contact 17 of the associated contact assembly into engagement with contact 18 and will also move contact 17' into engagement with contact 18'. Upon reverse rotation of said lever 22 to its normal unoperated position, the contacts 17, 17' aforementioned will be separated from the respective contacts 18, 18', by the return to normal position of the respective leaf springs 16, 16'.

Thus, as shown in Fig. 8, each of the twenty-five pairs of contacts 17—18 assigned to code number digits is associated with a pair of concurrently operated contacts 17'—18'. In the Fig. 8 wiring diagram the twenty-five contact assemblies (each comprising a pair of contacts 17—18 and 17'—18') are shown divided into five rows or banks designated B, C, D, E, and F respectively, and each containing five of said contact assemblies. Said five banks may be considered as corresponding to the aforementioned channels or orders (units, tens, hundreds, etc.) of the code entries.

Five contacts 17' first are connected to the select relay 140, five other contacts 17' (second in each bank) to the select relay 141, and so on. Thus, in Fig. 8, the contacts 17' in the first or left-hand vertical row of contact assemblies in the banks B—F are connected to wire 152 to which the winding of the select relay 140 is connected. Similarly, the contacts 17' in the second vertical row of said assemblies are connected through wire 153 to select relay 141, the third vertical row of contacts 17' to select relay 142 through wire 154, the fourth row through wire 155 to select relay 143, and the fifth row through wire 156 to select relay 144. The windings of said relays 140—144 are also connected, through the respective wires 157—161, to the aforementioned wire 146 which is connected to battery 145.

A grounded contact selector arm 162 is movable into engagement with any desired one of a group of contacts 163—167. Wires 168—172 are connected to the respective contacts 163—167 and also to contacts 18' in the respective banks B—F. Wire 168, as shown, is connected to all of the contacts 18', in bank B, wire 169 to all contacts 18' in bank C, and so on.

The selector arm 162 is movable manually into engagement with the desired one of the contacts 163—167 to select the desired channel or denominational order which is to control the selection of reperforators. As long as said arm 162 is in engagement with contact 163, the reader tape digits in the units channel (channel B) will control the reperforator selection. Similarly when said arm 162 is in engagement with any of the other contacts 164—167 the reader code entry digits in the corresponding channel will determine what reperforators shall be selected.

It has been previously noted that when the reader contacts 17—18 at the right-hand end of the bank B are closed, the code magnet 80 shown in Fig. 8 is energized from battery 145 by way of wire 146, said closed contacts 17—18, and wire 147. At this point, it may be observed that said wire 146, is connected to all of the reader contacts 17, in groups of five in parallel. Thus, a wire 174 connects said wire 146 to all of the contacts 17 in bank B in Fig. 8; wire 175 connects wire 146 to all of contacts 17 in bank C; while wires 176, 177 and 178, respectively, connect said wire 146 to contacts 17 in the respective banks D, E and F.

Each reader contact 18 is connected to the windings of ten code magnets, one in each reperforator, as has been previously observed. Hence, when any pair of reader contacts 17—18 is closed, corresponding code magnets in ten reperforators are energized.

The select relays 143—144 control the selection of reperforators by connections shown in Fig. 8, as follows:

The windings of the select magnets 105 are shown connected to batteries 103, and also,

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through various wires, to contacts of different groups of the select relays 140—144. More specifically, the winding of select magnet 105 for the "zero" reperforator is connected through wire 181 to fixed contact 182 of select relay 141. When the latter is energized, its movable contact 183 engages contact 182, connecting the latter to contact 184 of relay 140. However, no circuit is established through said magnet 105, unless relay 140 is also energized. When that takes place, a circuit is closed from battery 180, through said magnet 105 for the "zero" reperforator, wire 181, fixed contact 182 and movable contact 183 of select relay 141, contacts 184 and 185 of select relay 140, thence to ground and back to said battery 180. Said select magnet 105 for the "zero" reperforator is thus energized (as is likewise the companion magnet 105 for that reperforator if a pair thereof are employed), thus releasing the cross bar 96 which underlies the perforating arms 87 of said reperforator. At the same time, the code magnets 80 corresponding to the closed reader contacts 17—18 are released in all of the reperforators, but only in the "zero" reperforator will the perforating arms 87 be moved downwardly to reproduce on the tape 89 the code entry appearing on the reader tape 47.

Similarly, the select magnet 105 for the No. 1 reperforator is connected, through a wire 186, to a contact 187 of select relay 142. When this relay is energized, its movable contact 188 engages fixed contact 187, but no current can flow through said select magnet for the No. 1 reperforator until select relay 141 is also energized so that its movable contact 189 engages contact 190. In other words, energization of both relays 141 and 142 is essential to the selection of the No. 1 reperforator.

The select magnet 105 for the No. 2 reperforator is connected through wire 191 to contact 192 of select relay 143. The movable contact 194 of that relay is in turn connected to fixed contact 195 of relay 142, which contact is engageable by movable contact 196. Hence the No. 2 reperforator will not be selected unless both relays 142 and 143 are energized.

Likewise, each of the remaining reperforators is selected only when a certain combination of select relays is energized. The connections from the select magnets 105 for the ten reperforators to the corresponding pairs of select relays 140—144 are clearly shown in Fig. 8 and need not be described in further detail. It will be apparent from an inspection of Fig. 8 that selection of the various reperforators requires energization of the respective pairs of select relays indicated by the following table.

Reperforator No.	Select Relays Energized
0	140 and 141.
1	141 and 142.
2	142 and 143.
3	143 and 144.
4	140 and 142.
5	141 and 143.
6	142 and 144.
7	140 and 143.
8	141 and 144.
9	140 and 144.

Sorting of code entries

The operation of the apparatus so far described may be illustrated by considering an example of code entries and the sorting thereof. For purposes of illustration, the following description

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deals with sorting of three-digit numbers only; it being understood, however, that the number of sorts is determined by the number of digits in the entries. For example, five-digit numbers require five sorts; four-digit numbers require four sorts, etc. The sorting is done by channels or digital positions. That is, the first sort is controlled by the units digit; the second sort by the tens digits, and so on. In order to sort in the units channel, the selector arm 162 is moved to the position shown in Fig. 8 wherein it engages the contact 163. In that position of the selector arm the select relays 140—144 will respond only to the operation of contacts in the B or units channel. It may further be noted that in the code pattern employed for illustrative purposes, the following combinations of reader contacts 17—18 (counting from the left) in any of the banks B—F, correspond to the digits 0—9:

Digit	Pairs of Reader Contacts 17—18
0	1 and 2.
1	2 and 3.
2	3 and 4.
3	4 and 5.
4	1 and 3.
5	2 and 4.
6	3 and 5.
7	1 and 4.
8	2 and 5.
9	1 and 5.

Thus, if the number represented by the code perforations engaged by the reader fingers is 210, the first and second pairs of contacts 17—18 from the left in the units bank B are closed; also the second and third pairs of contacts 17—18 in the tens bank C, and the third and fourth pairs of contacts 17—18 in the hundreds bank D.

The closing of said pairs of reader contacts 17—18 energizes, in each of the ten reperforators, the first and second code magnets 80 in the units channel, the second and third code magnets in the tens channel, and the third and fourth code magnets in the hundreds channel. At the same time, the closing of the first (from the left) pair of reader contacts 17'—18' in bank B energizes the select relay 140, while the closing of the second (from the left) pair of reader contacts 17'—18' in said bank B energizes the select relay 141. As previously pointed out, the concurrent energization of these relays results in energization of the select magnet 105 of the zero reperforator. Hence that reperforator is selected for operation, and its lever arms 87 that are released by the energized code magnets are moved downwardly to perforate the tape of that reperforator to reproduce the code designation of the number 210. None of the other reperforators is selected for operation at this time, since the only select relays energized when arm 162 engages contact 163 are those connected to reader contacts which are operated in the bank B; and the only select relays so energized in the above example are the relays 140 and 141. Hence only the zero reperforator is selected under these conditions.

Assume now that the next number on the reader tape is 762. In response to engagement of the reader fingers 46 with the code perforations corresponding to that number, the third and fourth pairs of contacts 17—18 are closed in bank B, the third and fifth in bank C, and the first and fourth in bank D. Concurrently, the third and fourth pairs of contacts 17'—18' in bank B are

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closed, energizing the select relays 142 and 143. The select magnet 105 of the No. 2 reperforator is thereby energized, so that only that reperforator will reproduce upon its tape the code entry corresponding to 762.

The third number on the reader tape may be assumed to be, for example, 533. Engagement of the reader fingers 46 with the perforations corresponding to that number will result in the closing of the fourth and fifth pairs of contacts 17—18 in bank B, the fourth and fifth in bank C, and the second and fourth in bank D. At the same time, the fourth and fifth pairs of contacts 17—18' in bank B are closed, energizing the select relays 143 and 144, so that the select magnet 105 of the No. 3 reperforator is energized. Hence only the No. 3 reperforator will reproduce upon its tape the code entry corresponding to 533.

Carrying the example further, it may be assumed that the following further numbers appear in code on the reader tape:

401	935	289
389	752	098
894	510	307
648	673	
925	444	
157	821	
076	166	

Carrying the operations through these numbers, the number 401 will appear in code on the tape of the No. 1 reperforator, 389 on the tape of the No. 9 reperforator, 894 on the tape of the No. 4 reperforator, and so on, the reperforator selected in each operation being that corresponding to the digit of units order in the number represented in code on the reader tape.

Following the running of all of the foregoing numbers through the reader, starting with 210, and continuing through 762, 533, 401 and the remaining numbers in succession as hereinbefore listed (which is the order in which they appear on the reader tape in the example under discussion), the numbers will be distributed as follows on the tapes of the reperforators:

Reperforator Number	Entry
0	210
1	510
2	401
3	821
4	762
5	533
6	673
7	894
8	444
9	925
	935
	076
	166
	157
	307
	048
	098
	389
	289

The next step is to sort under the control of the digits of tens order, for which purpose the selector arm 162 is engaged with contact 164, placing the selector relays 140—144 under the control of the contacts 17—18' in bank C. It has been noted in the foregoing example that the numbers 210 and 510 appear in code on the tape of the zero reperforator; the numbers 401 and 821 on the tape of the No. 1 reperforator; the numbers 762 and 752 on the tape of the No. 2 reperforator, and so on. The individual reperforator tapes are now passed consecutively through the reader,

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that is, the tape of the zero reperforator is passed through the reader first and is followed by the tapes of the reperforators Nos. 1—9, inclusive.

Again, as each entry is run through the reader, a reperforator is selected to receive the reader entry, but now the reperforator selected is controlled by the digit of the tens order in the entry on the reader tape. Consequently, in the foregoing example, the reperforator entries will be as follows, after the entries previously appearing in the reperforator tapes have been run through the reader, starting with reperforator zero and ending with reperforator 9:

Reperforator Number	Entry
0	401
1	307
2	210
3	510
4	821
5	925
6	533
7	935
8	444
9	648
	752
	157
	762
	166
	673
	076
	389
	289
	894
	098

Since it has been elected, for simplicity of description, to deal in the foregoing example with three-digit numbers only, a third sort is the final one. This third sort is done in accordance with the hundreds order digits, or those in the channel D. The selector arm 162 is accordingly advanced into engagement with contact 165. Again the individual reperforator tapes obtained from the second sorting operation are passed through the reader consecutively. As a result of this third sort there are obtained ten new tapes. The numbers appearing in code on these tapes are as follows:

Reperforator Number	Entry
0	076
1	098
2	157
3	166
4	210
5	289
6	307
7	389
8	401
9	444
	510
	533
	648
	673
	752
	762
	821
	894
	925
	935

It will be seen that the foregoing numbers are now in numerical order and have been derived from the indiscriminately arranged numbers originally appearing on the reader tape.

Code checking mechanism

Means are provided for preventing operation of the tape-stepping mechanism of the reader, and also of the selected reperforator, if more or less than the proper number of reader fingers 46, in any of the banks B—F, enter perforations designating an entry in the reader tape. As previously noted, the code system in connection with

which the present invention is illustrated utilizes "two out of five" perforation positions for each digit; i. e., each digit is represented by two perforations out of a fixed pattern of five. Hence, in that code system, two reader fingers in each bank of five must enter perforations designating a code entry. If more or less than two fingers in any of the banks B—F enter perforations on the reader tape, the system is not operating properly. To check the code operation, we provide mechanism which may be constructed substantially as follows:

Referring to Figs. 3 and 6, each of the perforating levers 87 of each reperforator unit has a finger 87' projecting from an end thereof. For each bank of five of said perforating levers (corresponding to a respective one of the reader finger banks B—F) there is provided in each reperforator unit a reed bank 200, pivotally mounted on a rod 201 supported in the reperforator framework. As shown in Fig. 4, each reed bank 200 comprises five reeds 202 of resilient metal or other suitable material projecting from a block 203. Said reeds extend beneath the fingers 87' of the associated bank of five perforator levers 87. In Fig. 2, only one of said reed banks 200 and associated set of five perforator levers are shown; for simplicity of illustration, the reed bank 200 and bank of perforator levers there illustrated being of "tens" order, corresponding to bank C of the reader contacts.

In the embodiment shown in Fig. 3, each reed bank is integral with a lever 204 having a lateral projection 205 resting against a leaf spring 206. The latter normally maintains said lever and reed bank in the position shown in Fig. 3, with the reeds engaging the under surfaces of the fingers 87' of the associated perforator levers. The spring 206 carries contacts at its upper end for engagement with contacts 207 and 208, carried respectively by leaf springs 209 and 210. Normally, the contact 207 is in engagement with the corresponding contact on the spring 206, but the contact 208 is spaced from the associated contact on said spring. A stop 211 prevents spring 210 from moving further towards spring 206.

If, now, only one of the adjacent bank of perforator levers 82 moves downwardly, only one reed of the reed bank is depressed and lever 204 is turned clockwise, but not sufficiently to bring spring 206 into engagement with contact 208. If more than two of said perforator levers are operated, lever 204 is turned clockwise sufficiently not only to engage spring 206 with contact 208, but also to disengage said spring from contact 207. A stop 212 prevents spring 209 from following spring 206 through an extent corresponding to the turning of lever 206 by more than two perforator levers.

When, however, two perforator levers 82 in the group cooperating with reed bank 200 are depressed, the lever 204 is turned clockwise sufficiently to engage spring 206 with contact 208, without disengaging said spring from contact 207. Both of said contacts 207 and 208 are connected in series with the step magnet 126 of the reperforator, as well as the reader step magnet, so that said magnets cannot be energized unless both of said contacts are engaged simultaneously by the spring 206. It will, of course, be understood that a similar contact assembly is provided for operation by each of the other reed banks, and that the contacts 207 and 208 of all of said assemblies are in series with each other and with the step magnet of the reperforator unit con-

taining said reed banks, as well as the reader step magnet, so that no current will flow through the windings of said magnets unless exactly two out of five perforator levers are operated in each of the banks B—F.

In Figs. 3A, 4, 4A, 4B and 4C we have shown an alternative contact arrangement for operation by each reed bank. In this arrangement, each reed bank is integral with a double lever 215—216 having contacts 217—218 (Fig. 9) carried by its upper ends. Normally, the parts are maintained by a spring 219 in the position shown in Fig. 3A, with the reeds engaging the under surfaces of the fingers 87' of the corresponding perforator levers 87. In this position the contacts 217—218 engage opposite faces of an insulator 220. The latter forms part of an assembly comprising insulators 220 and 221 and a contact 222 interposed between said insulators.

When only one perforator lever 87, in the associated group of five, is depressed the reed bank and connected levers 215—216 are moved to the position shown in Fig. 4A, wherein the contacts 217—218 have not yet been brought into engagement with contact 222. When two of said levers are depressed, the levers 215—216 of the associated reed bank are moved sufficiently to bring the contacts 217—218 into engagement with said contact 222, as shown in Fig. 4B. When more than two of said levers 87 are depressed, the levers 215—216 are moved to bring the contacts 217—218 beyond the contact 222 into engagement with the insulating block 221, as shown in Fig. 4C.

The five sets of contacts 217—218 are connected in series with each other, as shown in Fig. 9. They are also connected in series with the step magnet of the reader as well as the step magnet of the reperforator unit containing said contacts, as indicated in Fig. 9, so that the tape stepping mechanisms of said reader and reperforator unit cannot be operated unless two out of five of the levers 87 in each of the five banks of said reperforator unit have been depressed.

In the upper right-hand portion of Fig. 2 there is shown a reed bank having three reeds, operable by perforator levers controlled by the three reader fingers other than the twenty-five assigned to the five channels B—F referred to. As previously noted, these three extra reader fingers are used for certain control purposes, well understood in the art, and need not be discussed. It will be apparent that the reed bank consisting of the three reeds, engaged by perforator levers controlled by the three extra reader fingers above mentioned, may cooperate with a contact assembly (similar to those of Figs. 3 or 3A but closed upon depression of one of said levers) and connected in series with the five other reed bank contacts above described, as well as with the reader and reperforator step magnets. For the purposes of the present invention, however, said three-reed bank may be disregarded.

In Fig. 8, code check contacts associated with lever 87 of a reperforator are indicated diagrammatically at 217 and 220, in series with the winding of the reader step magnet 69 by way of wires 225 and 226. It will be understood that in Fig. 8 the showing is simply diagrammatic, and that all five sets of code check contacts of the reperforator are in series with each other and with said step magnet as above explained. When the five sets of code check contacts in said reperforator unit are closed, current flows from battery 223 through said winding of step magnet 69, wire 226, wire 225, and the five sets of closed code contacts

to ground, and thence back to battery 228. Said code contacts are also connected to the winding of the step magnet 126 of the reperforator unit which contains said contacts, by way of wires 225, and 226, and certain contacts of a reperforator check relay as will presently be described.

Checking of reperforator selection

Connected in parallel with the respective reperforator select magnets 105 are reperforator check relays 230, so that whenever a select magnet 105 is energized the corresponding select relay 230 is also energized. Each check relay 230 has a plurality of movable contacts 231, 232, 233, cooperating with fixed contacts 234, 235, and 236, respectively. When any of said check relays is deenergized, its contact 231 is in engagement with fixed contact 234, while its contacts 232 and 233 are out of engagement with the respective fixed contacts 235 and 236.

Assuming, for example, that the select magnet 105 for the No. 9 reperforator is energized, the check relay 230 in parallel with said select magnet is concurrently energized, separating its contact 231 from contact 234, and engaging its contacts 232 and 233 with the respective contacts 235 and 236. Current can now flow from battery 237 through the winding of the step magnet 126 of the No. 9 reperforator, thence through wire 238, contact 232, contact 235, wire 239, wire 240, wire 226, wire 225, the code contacts 220—217, to ground, and thence back to said battery 237. It will thus be seen that said step magnet is energized when said relay 230 is energized and the code checking contacts are closed. But if said relay 230 is not energized, or if any of the five sets of code checking contacts in the reperforator is open, the step magnet 126 of said reperforator cannot be energized, and the reperforator tape will not be advanced.

Similarly, none of the other reperforator tapes can be advanced unless the check relay for the particular reperforator is energized and the five sets of code checking contacts in that reperforator are closed. Since each check relay is connected in parallel with a corresponding one of the select magnets 105, no check relay will be energized unless the proper connections are established for energizing the corresponding select magnet.

The fixed contact 236 of each check relay is connected to a wire 241 which in turn is connected to a wire 242 and contact 243. A grounded contact 244 cooperates with a cam 245 on the main drive shaft 35, and is operated by said cam in each cycle of operation of the system to engage said contact 244 with contact 243 for a substantial portion of the cycle, thereby maintaining a holding circuit closed through any energized check relay 230 by way of the battery connected to said relay, the movable contact 233, fixed contact 236, and contacts 243—244. Said cam 245 and associated contacts insure energization of the check relay until a definite time in the cycle, when said cam releases the contact 243 from engagement with contact 244.

Further check-insuring against improper operation of unselected reperforator unit

The rocking frame 97—98 of each reperforator unit controls a pair of contacts 250, 251 (Fig. 8) which in turn are connected to wires 252, 253, respectively. As shown in Fig. 8, the side wall 97 of the rocking frame there illustrated diagrammatically may carry a lug or projection 254 of insulating material, overlying the associated

contact 250. As long as the rocking frame is in the position wherein it is latched by the armature of the corresponding select magnet 105, the contact 250 is out of engagement with contact 251 as shown in Fig. 8. When, however, said frame rocks out of said position pursuant to energization of said select magnet, the contact 250 is engaged with said contact 251.

The wire 253 is connected to the movable contact 231 of the check relay 230 of the reperforator unit, while wire 252 is connected to the winding of a battery cut-off relay 255. The latter is connected to a main battery 256 which normally supplies current to all of the other batteries through contacts 257—258, as is well understood in the art.

Whenever the check relay 230 corresponding to any reperforator unit is energized, the separation of its contact 231 from contact 234 prevents the closing of a circuit through the battery cut-off relay by closure of the contacts 250, 251 of the corresponding reperforator unit. If, however, the rocking frame of any reperforator unit were to operate while the corresponding check relay is deenergized, the closure of the contacts 250—251 of that unit will cause current to flow from battery 256 through the winding of cut-off relay 255, wire 252, contacts 250 and 251, wire 253, contacts 231 and 234 of the corresponding deenergized check relay 230, thence to ground and back to said battery 256. The cut-off relay is thus energized, separating the contacts 257—258 and cutting off the supply of current from battery 256, whereby the system is thrown out of action. At the same time, the cut-off relay 255 engages its grounded movable contact 260 with contact 261, closing a holding circuit through said cut-off relay. Said holding circuit may, if desired, include a light or bell to signal disruption of operation of the system, as will be apparent. The system will remain out of action following energization of said relay 255 until an attendant manually opens said holding circuit, after remedying the difficulty which caused the closure of contacts 250, 251 during deenergization of the corresponding check relay 230. Upon opening said holding circuit, relay 255 is deenergized and its contact 257 returns into engagement with contact 258, with consequent resumption of supply of current to the system from the main supply battery 256.

As indicated in Fig. 8, the contacts 250, 251 may be designated as a "unit check," since they provide a check against improper operation of an unselected reperforator unit. If, for instance, a reperforator unit was properly selected for operation in one cycle, but the armature of its select magnet should happen to stick in its operated position despite deenergization of said magnet, the rocking frame of said unit would operate in the next cycle owing to failure of said armature to return to its latching position shown in Fig. 6. Of course, if in the next cycle said select magnet were energized, the operation of said reperforator unit would be proper; and since the corresponding check relay 230 is energized concurrently with said select magnet the ensuing reperforator operation meets no interference. If, however, in said next cycle, said select magnet is not energized the operation of said reperforator unit is not intended; and, since the corresponding check relay is deenergized, the closing of contacts 250, 251 by operation of the rocking frame of said unit causes operation of the battery cut-off relay 255 as described above.

From the foregoing description it will be seen that neither the reader tape nor the tape of a selected reperforator unit can be advanced unless two out of five perforator levers are operated in each of the five banks of the selected reperforator unit. This is because the five sets of code checking contacts of said unit are in series with the reader step magnet 69 and are also in series with the step magnet 126 of said reperforator unit.

Furthermore, the step magnet 126 of any reperforator unit cannot be energized unless the corresponding reperforator check relay 230 is energized to close the contacts 232 and 235.

If any unselected reperforator unit operates, due for example to sticking of its select magnet armature in the unlatching position after operation in a preceding cycle, the battery cut-off relay is operated due to closing of the unit check contacts 250 and 251 while the corresponding select relay 230 is deenergized. The entire system is thereby thrown out of operation, and, if desired, a warning signal is given.

If the armature of a reperforator select magnet 105 should stick in unoperated or latching position when said magnet is energized, the levers 87 of the selected reperforator unit cannot go down, and hence the code check contacts remain open so that neither the reader step magnet 69 nor the step magnet 126 of the selected reperforator can be energized.

Current reducing provisions

Since ten code magnets are deenergized through the opening of one pair of reader contacts 17—18, considerable arcing would take place if the full operating current were broken. To avoid this, a resistance 263 is inserted in series with the code magnets, to reduce the current to a hold value. Said resistance 263, as shown in Fig. 8, may be interposed between wires 264 and 265, connected respectively to a movable contact 266 and a fixed contact 267. Wire 265 is also grounded as indicated. It will be understood that the wires 148 of all of the code magnets may be connected to the wire 264, as is the particular wire 148 illustrated in Fig. 8. A cam 268, rotatable with the main drive shaft 35, once in each cycle of operation of the system, controls the position of the contact 266 with respect to contact 267.

In the foregoing arrangement, the contacts 266 and 267 are closed at the start of the operating cycle, due to engagement of contact 267 with a high portion of the cam 268. The resistance 263 is thus short-circuited, rendering the full operating current available for energization of any of the code magnets 80 in response to closing of reader contacts 17—18. After said code magnets have been energized, a low portion of the cam 268 comes opposite the contact 266, and the latter withdraws from engagement with contact 267 (as shown in Fig. 8) so that current through the code magnets 80 must pass through the resistance 263. The current through said code magnets is thus reduced and is held reduced until after said magnets are deenergized. A high portion of cam 268 then returns contact 266 into engagement with contact 267, again short-circuiting the resistor 263 in preparation for energization of said code magnets in the succeeding cycle.

For convenience in following the sequence of operations in a complete cycle the chart shown in Fig. 7 may be noted, in connection with the schematic diagram of a reader, reperforator unit, and associated circuit connections in Fig. 7A. In the example here illustrated, the time of a complete cycle is assumed to be 40 milliseconds. The sequence illustrated is as follows:

(1) As the cam 44 rotates, the reader fingers 46 enter the code perforations in the reader tape 47. As indicated in the first line on the chart, this operation consumes 5 milliseconds. The fingers remain in the perforations for 25 milliseconds and are completely withdrawn at the end of 35 milliseconds in the cycle.

(2) When the reader fingers complete their stroke, the corresponding reader contacts are closed during rotation of the cam 34. This takes another 5 milliseconds. Said contacts later start to open at 25 milliseconds from the start of the cycle (being thus closed for 15 milliseconds) and are fully opened at 30 milliseconds.

(3) As previously noted, the reader contacts have two functions: (a) to operate one of the select relays 140—144, and (b) to operate ten code magnets 80, one in each reperforator unit. The operation of the select relay takes 10 milliseconds to close its contacts.

(4) The perforator check relay 230 corresponding to the selected reperforator unit is energized, commencing at 20 milliseconds from the beginning of the cycle. Its contacts close 5 milliseconds later.

(5) The perforator select magnet 105 corresponding to the selected reperforator unit is energized simultaneously with the above-mentioned check relay 230. Its operation takes 5 milliseconds to withdraw its latch from the rocking frame of the reperforator unit.

(6) The code magnets 80 in said reperforator unit corresponding to the operated reader contacts are energized concurrently with the select relays. However, while each select relay takes 10 milliseconds (from 10 to 20 in the cycle) to close its contacts, the operation of the code magnets takes only 5 milliseconds (from 10 to 15 in the cycle) to withdraw the latches from the associated perforator arms.

(7) The current reducer cam 268 opens the contacts 266, 267 at 15 milliseconds in the cycle and closes them at 35 milliseconds. Thus, when the reader contacts open, resistance 263 is in the circuit.

(8) The check relay hold cam 245 closes the contacts 243, 244 at 15 milliseconds and holds them closed until 35 milliseconds, at which time said contacts are opened. In the meantime, the select relays are deenergized at 25 milliseconds and their contacts are opened around 30 milliseconds. The cam 245 insures deenergizing of the check relay at a definite time in the cycle.

(9) The cams 101 (Figs. 2 and 7A) of the selected reperforator release the rocking frame controlling the perforator levers 87, so that those levers 87 unlatched by energized code magnets 80 effect perforation of the reperforator tape between 25 and 30 milliseconds in the cycle. Said cams restore said rocking frame and levers 87 to their normal elevated positions during the first 5 milliseconds of the next cycle.

(10) During the downward movement of said reperforator rocking frame, in the period between 25 and 30 milliseconds aforementioned, the unit contacts 250, 251 are closed. In case the

reperforator containing said downwardly moving rocking frame has not been selected for operation its check relay 230 remains deenergized; and a circuit is thus closed, by way of said unit contacts and the contacts 231, 234 of said check relay, through the battery cut-off relay 235. As previously described, this cuts off the battery supply from the entire system and immediately stops further operation. The unit check contacts are opened in the first 5 milliseconds of the next cycle.

(11) As previously noted, each bank of code check contacts operates properly only if two out of five perforator levers 87 in the associated group are actuated to produce perforations in the corresponding channel on the reperforator tape. If two out of five of said perforator levers move downwardly in each of the five banks assigned to the channels B—F, the corresponding five banks of code check contacts are operated to establish connections to the reader step magnet 89, and to the reperforator step magnet 126 via contacts 232 and 235 of the check relay 230 as previously described. Said code check contacts are closed as the corresponding perforator levers move downwardly to effect perforation of the reperforator tape, in the period between 25 and 30 milliseconds of the cycle; and they remain closed for the remainder of the cycle. Said code check contacts are restored to open condition during the first 5 milliseconds of the ensuing cycle.

(12) The perforating of the selected reperforator tape, as well as closure of the unit check and the code check contacts have been completed at 30 milliseconds. At this time the reperforator step magnet 126 and the reader step magnet 89 are energized. They complete their operation at 35 milliseconds. In the case of the perforator step magnet, an interference finger 124 is interposed between the cam lever 119 and the step lever 113.

(13) At 35 milliseconds, the perforator step cam 113 commences to raise the pawl 111 with respect to ratchet wheel 110, through the interference finger 124 and step lever 113. Said raising of said pawl is completed at 40 milliseconds. In this operation the spring 115 is tensioned. At the end of the first 5 milliseconds of the next cycle, after the perforator levers 87 have completed their stroke back to normal, the cam 118 permits said pawl, under the action of the spring 115, to move downwardly and to start stepping the ratchet wheel 110 and tape drum 90 through one step, such stepping being completed at the end of 20 milliseconds.

(14) As previously mentioned, the reader step magnet 89 is energized at 30 milliseconds. Said magnet attracts its armature 63, removing it from its position (shown in Fig. 1) above the lug 72 on the arm 57 of the bell-crank lever 55 which carries the pawl 52. Said removal of said armature 63 is completed within 5 milliseconds, or by the end of 35 milliseconds in the cycle.

(15) During the period from 35 to 40 milliseconds, the high portion of the cam 59 moves away from the roller 58, permitting the bell-crank lever 55 to be turned quickly clockwise by the spring 60, with consequent rotation of the ratchet wheel 51 and tape drum 43 by pawl 52 to advance the reader tape one step. This is completed by the end of the 40 millisecond cycle, at which time the magnet 89 is deenergized. In the ensuing cycle, the cam 59 actuates the bell-crank lever 55 counter-clockwise, during the period between 10 and

25 milliseconds, retracting the pawl 52 from the ratchet wheel into the position shown in Fig. 1, concurrently tensioning the spring 60.

What is claimed is:

1. In a combined code sorting and reproducing mechanism for multidigit entries, the different digits of which are each symbolized by a different pattern of perforations on a recording medium, a reading device comprising means adapted to cooperate with said perforations for sensing said entries, a plurality of reperforators each having perforating elements and a plurality of latches, one for each perforating element, for normally holding said elements in inoperative position, each of said reperforators also having a controlling frame operable to control movement to perforating position of those perforating elements whose latches are withdrawn, means normally preventing operation of said controlling frame, electromagnetic means controlled by said sensing means for withdrawing the latches from the perforating elements corresponding to the digital patterns of an entry sensed by said sensing means, and electromagnetic means for rendering operative the controlling frame of a particular one of said reperforators in response to a digital pattern in one of the digital orders of said entry.

2. In a combined code sorting and reproducing mechanism for multidigit entries, the different digits of which are each symbolized by a different pattern of perforations of a recording medium, a reading device comprising means adapted to cooperate with said perforations for sensing said entries, a plurality of reperforators each having perforating elements operable to reproduce the digital patterns of an entry sensed in said reading device, each of said reperforators having electromagnetic means for conditioning the perforating elements thereof for operation, and means for selecting a particular reperforator for operation in response to a digital pattern in one of the digital orders of said entry, said selecting means comprising a plurality of relays operable under control of said sensing means in combinations corresponding to the digital patterns in said digital order of the reader entries.

3. In a combined code sorting and reproducing mechanism for multidigit entries, the different digits of which are each symbolized by a different pattern of perforations of a recording medium, a reading device comprising means adapted to cooperate with said perforations for sensing said entries, a plurality of reperforators each having perforating elements operable to reproduce the digital patterns of an entry sensed in said reading device, each of said reperforators having electromagnetic means for conditioning the perforating elements thereof for operation, and means for selecting a particular reperforator for operation in response to a digital pattern in one of the digital orders of said entry, said selecting means comprising a plurality of relays operable under control of said sensing means in combinations corresponding to the digital patterns in said digital order of the reader entries, and means for varying the digital order determinative of reperforator selection.

4. In combination, a code tape reader having means for advancing said tape, a reperforator having a plurality of perforating elements mounted on hammers, means controlled by said reader for selectively preparing a predetermined number of said hammers for operation, means for operating said hammers, and means con-

trolled directly by movement of a predetermined number of hammers to perforating position for controlling said tape-advancing means.

5. In combination, a code tape reader having tape-advancing means, electromagnetic means for operating said tape-advancing means, a reperforator controlled by said reader, and means in said reperforator for completing an energizing circuit to said electromagnetic means.

6. In combination, a code tape reader having tape-advancing means, electromagnetic means for controlling said tape-advancing means, a reperforator having a plurality of perforating elements mounted on hammers, means controlled by said reader for selectively preparing a predetermined number of said hammers for operation, and means controlled by said hammers for operating said tape-advancing means.

7. In combination, a code tape reader having tape-advancing means, electromagnetic means for operating said tape-advancing means, a reperforator having a plurality of perforating elements mounted on hammers, means controlled by said reader for selectively preparing a predetermined number of said hammer-mounted elements for operation, means for operating the selected number of said hammer-mounted elements, and means controlled directly by the hammers of the said operated elements for energizing said electromagnetic means.

8. In combination, a code tape reader having tape-advancing means, electromagnetic means for operating said tape-advancing means, a reperforator controlled by said reader, said reperforator also having tape-advancing means and electromagnetic means for operating the same, and means in said reperforator for completing an energizing circuit to each of said electromagnetic means.

9. In combination, a code tape reader having tape-advancing means, electromagnetic means for controlling said tape-advancing means, a reperforator having a plurality of perforating elements supported on hammers, means controlled by said reader for selectively preparing a predetermined number of said hammers for operation, means for operating the selected number of said hammers, tape-advancing means in said reperforator, electromagnetic means for controlling said reperforator tape-advancing means, and means controlled directly by said operated hammers for energizing both said electromagnetic means.

10. A code tape reperforator having a plurality of hammer arms supporting perforating elements, means responsive to a code entry in a reader device for causing operation of a predetermined number of said hammer arms, tape-advancing means in said reperforator, and means brought into action upon operation of a predetermined number of said hammer arms for controlling said tape-advancing means.

11. A code tape reperforator having a plurality of hammer arms supporting perforating elements, means responsive to a code entry in a reader device for causing operation of a predetermined number of said hammer arms, tape-advancing means in said reperforator, electromagnetic means for controlling said tape-advancing means, and means responsive to operation of a predetermined number of said hammer arms for controlling energization of said electromagnetic means.

12. In combination, a code tape reader having tape-advancing means, a reperforator having a

plurality of hammer arms supporting perforating elements, means controlled by said reader for selectively preparing a predetermined number of said hammer arms for operation, means for operating said predetermined number of hammer arms to perforating position, contacts controlled directly by movement of said hammer arms to operating position, and means controlled by contacts corresponding to the operated predetermined number of hammer arms for controlling said tape-advancing means.

13. A code tape reperforator having a plurality of groups of perforating elements, said groups corresponding to respective orders of a code entry, means responsive to a code entry in a reader device for causing operation of a predetermined number of said perforating elements in each group, a plurality of contact means, one for each of said groups of perforating elements, means associated with each of said groups for operating the corresponding contact means in response to operation of only said predetermined number of perforating elements in said group, tape-advancing means in said reperforator, and means controlled by said plurality of contact means for controlling operation of said tape-advancing means.

14. A code tape reperforator having a plurality of groups of perforating elements, said groups corresponding to respective orders of a code entry, means responsive to a code entry in a reader device for causing operation of a predetermined number of said perforating elements in each group, a plurality of contact means, one for each of said groups of perforating elements, means associated with each of said groups for operating the corresponding contact means in response to operation of only said predetermined number of perforating elements in said group, tape-advancing means in said reperforator, and electromagnetic means for controlling operation of said tape-advancing means, and connections between said plurality of contact means and said electromagnetic means for operating the latter in response to operation of all of said plurality of contact means.

15. In combination, a code tape reader having means for advancing said tape, a reperforator having a plurality of groups of perforating elements, said groups corresponding to respective orders of a code entry, means controlled by said reader for preparing for operation a predetermined number of said elements in each group, means for operating said prepared elements to perforating position, a plurality of contact means, one for each of said groups of perforating elements, means associated with each of said groups for operating the corresponding contact means in response to operation of only said predetermined number of perforating elements in said group, tape-advancing means in said reader, and means controlled by said plurality of contact means for controlling operation of said tape-advancing means.

16. In combination, a code tape reader having means for advancing said tape, a reperforator having a plurality of groups of perforating elements, said groups corresponding to respective orders of a code entry, means controlled by said reader for preparing for operation a predetermined number of said elements in each group, means for operating said prepared elements to perforating position, a plurality of contact means, one for each of said groups of perforating elements, means associated with each of said groups

for operating the corresponding contact means in response to operation of only said predetermined number of perforating elements in said group, tape-advancing means in said reader, electromagnetic means for controlling operation of said tape-advancing means, and connections between said plurality of contact means and said electromagnetic means for operating the latter in response to operation of all of said plurality of contact means.

17. A code tape reperforator having a plurality of groups of perforating elements, said groups corresponding to respective orders of a code entry, means responsive to a code entry in a reader device for causing operation of a predetermined number of said perforating elements in each of said groups, a plurality of contact means, one for each of said groups of perforating elements, pivoted means associated with each of said groups for operating the corresponding contact means in response to operation of only said predetermined number of perforating elements in said group, tape-advancing means in said reperforator, and means controlled by said plurality of contact means for controlling operation of said tape-advancing means.

18. In combination, a code tape reader having means for advancing said tape, a reperforator having a plurality of groups of perforating elements, said groups corresponding to respective orders of a code entry, means controlled by said reader for preparing for operation a predetermined number of said elements in each group, means for operating said prepared elements to perforating position, a plurality of contact means, one for each of said groups of perforating elements, pivoted means associated with each of said groups for operating the corresponding contact means in response to operation of only said predetermined number of perforating elements in said group, tape-advancing means in said reader, and means controlled by said plurality of contact means for controlling operation of said tape-advancing means.

19. A code tape reperforator having a plurality of groups of perforating elements, said groups corresponding to respective orders of a code entry, means responsive to a code entry in a reader device for causing operation of a predetermined number of said perforating elements in each of said groups, a plurality of movable assemblies, one for each of said groups of perforating elements, each of said assemblies having a plurality of flexible elements each adapted for operation by a corresponding perforating element in the associated group, a plurality of contact means, one for each of said assemblies and adapted for operation thereby in response to operation of only said predetermined number of perforating elements in said group, tape-advancing means in said reperforator, and means controlled by said plurality of contact means for controlling operation of said tape-advancing means.

20. In combination, a code tape reader having means for advancing said tape, a reperforator having a plurality of groups of perforating elements, said groups corresponding to respective orders of a code entry, means controlled by said reader for preparing for operation a predetermined number of said elements in each group, means for operating said prepared elements to perforating position, a plurality of movable assemblies, one for each of said groups of perforating elements, each of said assemblies having a plurality of flexible elements each adapted for

operation by a corresponding perforating element in the associated group, a plurality of contact means, one for each of said assemblies and adapted for operation thereby in response to operation of only said predetermined number of perforating elements in said group, tape-advancing means in said reader, and means controlled by said plurality of contact means for controlling operation of said tape-advancing means.

21. In combination, a code tape reader having means for advancing said tape, a reperforator having a plurality of groups of perforating elements, groups corresponding to respective orders of a code entry, means controlled by said reader for preparing for operation a predetermined number of said elements in each group, means for operating said prepared elements to perforating position, a plurality of contact means, one for each of said groups of perforating elements, means associated with each of said groups for operating the corresponding contact means in response to operation of only said predetermined number of perforating elements in said group, tape-advancing means in said reader, tape-advancing means in said reperforator, and means controlled by said plurality of contact means for controlling operation of both said tape-advancing means.

22. In combination, a code tape reader having means for advancing said tape, a reperforator having a plurality of groups of perforating elements, said groups corresponding to respective orders of a code entry, means controlled by said reader for preparing for operation a predetermined number of said elements in each group, means for operating said prepared elements to perforating position, a plurality of contact means, one for each of said groups of perforating elements, means associated with each of said groups for operating the corresponding contact means in response to operation of only said predetermined number of perforating elements in said group, tape-advancing means in said reader, electromagnetic means for controlling operation of said tape-advancing means, tape-advancing means in said reperforator, electromagnetic means for controlling operation of the last-mentioned tape-advancing means, and connections between said plurality of contact means and both of said electromagnetic means for operating the latter in response to operation of all of said plurality of contact means.

23. In combination, a code tape reader having means for advancing said tape, a reperforator having a plurality of groups of perforating elements, said groups corresponding to respective orders of a code entry, means controlled by said reader for preparing for operation a predetermined number of said elements in each group, means for operating said prepared elements to perforating position, a plurality of movable assemblies, one for each of said groups of perforating elements, each of said assemblies having a plurality of flexible elements each adapted for operation by a corresponding perforating element in the associated group, a plurality of contact means, one for each of said assemblies and adapted for operation thereby in response to operation of only said predetermined number of perforating elements in said group, tape-advancing means in said reader, tape-advancing means in said reperforator, and means controlled by said plurality of contact means for controlling operation of both said tape-advancing means.

24. In combination, a code tape reader having

means for advancing said tape, a reperforator having a plurality of groups of perforating elements, said groups corresponding to respective orders of a code entry, means controlled by said reader for preparing for operation a predetermined number of said elements in each group, means for operating said prepared elements to perforating position, a plurality of movable assemblies, one for each of said groups of perforating elements, each of said assemblies having a plurality of flexible elements each adapted for operation by a corresponding perforating element in the associated group, a plurality of contact means, one for each of said assemblies and adapted for operation thereby in response to operation of only said predetermined number of perforating elements in said group, tape-advancing means in said reader, electromagnetic means for controlling operation of said tape-advancing means, tape-advancing means in said reperforator, electromagnetic means for controlling operation of the last-mentioned tape-advancing means, and connections between said plurality of contact means and both of said electromagnetic means for operating the latter in response to operation of all of said plurality of contact means.

25. In a combined code sorting and reproducing mechanism for multidigit entries, the different digits of which are each symbolized by a different pattern of perforations on a recording medium, a reading device comprising means adapted to cooperate with said perforations for sensing said entries, a plurality of reperforators each having a tape-advancing means, electrical means controlled by said sensing means for selecting one of said reperforators for each entry in response to a digital pattern in one of the digital orders of said entry, and means in each reperforator controlled by said selecting means for controlling operation of said tape-advancing means.

26. In a combined code sorting and reproducing mechanism for multidigit entries, the different digits of which are each symbolized by a different pattern of perforations on a recording medium, a reading device comprising means adapted to cooperate with said perforations for sensing said entries, a plurality of reperforators each having perforating elements operable to reproduce the digital patterns of an entry sensed in said reading device, each of said reperforators having electromagnetic means for conditioning its perforating elements for operation, means interposed between said sensing means and said electromagnetic means for selecting a particular reperforator for operation in response to a digital pattern in one of the digital orders of said entry, each of said reperforators also having tape-advancing means, and means controlled by said selecting means for controlling the operation of the tape-advancing means of the selected reperforator.

27. A code tape reperforator having a plurality of groups of perforating elements, said groups corresponding to respective orders of a code entry, electrical means responsive to a code entry in a reader device for preparing for operation a predetermined number of said perforating elements in each group, electrical means responsive to a digital pattern in a predetermined order of said code entry for causing operation of said prepared perforating elements, a plurality of contact means, one for each of said groups of perforating elements, means associated with

each of said groups for operating the corresponding contact means in response to operation of only said predetermined number of perforating elements in said group, tape-advancing means in said reperforator, electromagnetic means for controlling said tape-advancing means, and connections controlled jointly by said digital pattern in said predetermined order of said code entry and by operation of all of said plurality of contact means for controlling the operation of said electromagnetic means.

28. In a combined code sorting and reproducing mechanism for multidigit entries, the different digits of which are each symbolized by a different pattern of perforations on a recording medium, a reading device comprising means adapted to cooperate with said perforations for sensing said entries, a plurality of reperforators each having a tape-advancing means, relay means controlled by said sensing means for selecting one of said reperforators for each entry in response to a digital pattern in one of the digital orders of said entry, and relay means controlled by said selecting means for controlling operation of said tape-advancing means.

29. A code sorting and reproducing system comprising a code reader, a plurality of reperforators, means controlled by said reader for selecting one of said reperforators for operation, and means responsive to operation of an unselected reperforator for throwing both said reperforator and said reader out of action.

30. In combination, a code sorting and reproducing system comprising a code reader, a plurality of reperforators, electrical connections between said reader and said reperforators including means controlled by said reader for selecting one of said reperforators for operation, means for supplying electrical energy to said connections, and means responsive to operation of an unselected reperforator for cutting off said connections from said electrical energy supplying means.

31. In combination, a code sorting and reproducing system comprising a code reader, a plurality of reperforators, electrical connections between said reader and said reperforators including means controlled by said reader for selecting one of said reperforators for operation, means for supplying electrical energy to said connections, relay means responsive to operation of an unselected reperforator, and connections controlled by said relay means for throwing out of action said electrical energy supplying means.

32. A code tape reperforator having a plurality of perforating elements, means responsive to a code entry in a reader device for preparing for operation a plurality of said reperforating elements, operating means operable to cause movement of the prepared perforating elements to perforating position, selecting means potentially responsive to said code entry for controlling operation of said operating means, and means responsive to operation of said operating means while said selecting means is inactive for preventing further operation of said reperforator.

33. A code tape reperforator having a plurality of perforating elements, means responsive to a code entry in a reader device for preparing for operation a plurality of said reperforating elements, operating means operable to cause movement of the prepared perforating elements to perforating position, selecting means comprising a relay in said reperforator operable in response to said code entry for controlling operation of

said operating means, and means comprising a contact movable with said operating means and a back contact of said relay for preventing further operation of said reperforator.

34. A code sorting and reproducing system comprising a code reader, a plurality of reperforators, means controlled by said reader for selecting one of said reperforators for operation, and means responsive to operation of an unselected reperforator for throwing said reader out of action.

35. A code tape reperforator having a plurality of perforating elements, means responsive to a code entry in a reader device for preparing for operation a plurality of said reperforating elements, operating means operable to cause movement of the prepared perforating elements to perforating position, selecting means comprising a relay in said reperforator operable in response to said code entry for controlling operation of said operating means, a second relay for controlling a supply of energy to said reperforator, and means comprising a back contact of the first-mentioned relay and a contact movable with said operating means for energizing said second relay to cut off said energy supply.

36. A code sorting and reproducing system comprising a code reader, a plurality of reperforators, electrical means controlled by said reader for selecting one of said reperforators for operation, and electrical means responsive to operation of an unselected reperforator for throwing said system out of operation.

37. A code sorting and reproducing system comprising a code reader, a plurality of reperforators, electrical means controlled by said reader for selecting one of said reperforators for operation, and electrical means responsive to operation of an unselected reperforator for throwing said system out of operation, the last-mentioned means including a contact controlled by said selecting means.

38. In a combined code sorting and reproducing mechanism for multidigit entries, the different digits of which are each symbolized by a different pattern of perforations on a recording medium, a reading device comprising means adapted to cooperate with said perforations for sensing said entries, a plurality of reperforators each having a tape-advancing means, electrical means controlled by said sensing means for selecting one of said reperforators for each entry in response to a digital pattern in one of the digital orders of said entry, each reperforator also having relay means energized by said selecting means and controlling operation of said tape-advancing means, and cam means for maintaining said relay means energized for a predetermined time period.

39. In a combined code sorting and reproducing mechanism for multidigit entries, the different digits of which are each symbolized by a different pattern of perforations on a recording medium, a reading device comprising means adapted to cooperate with said perforations for sensing said entries, a plurality of reperforators each having perforating elements and a plurality of latches, one for each perforating element, for normally holding said elements in inoperative position, each of said reperforators also having a controlling frame operable to control movement to perforating position of those perforating elements whose latches are withdrawn, means normally preventing operation of said controlling frame, electromagnetic means energized under

control of said sensing means for withdrawing the latches from perforating elements in all said reperforators in accordance with the digital patterns of an entry sensed by said sensing means, means brought into action following energization of said electromagnetic means for reducing the current flowing therethrough for a predetermined time period, and means for rendering operative the controlling frame of a particular one of said reperforators in response to a digital pattern in one of the digital orders of said entry.

40. In a combined code sorting and reproducing mechanism for multidigit entries, the different digits of which are each symbolized by a different pattern of perforations on a recording medium, a reading device comprising means adapted to cooperate with said perforations for sensing said entries, a plurality of reperforators each having perforating elements and a plurality of latches, one for each perforating element, for normally holding said elements in inoperative position, each of said reperforators also having a controlling frame operable to control movement to perforating position of those perforating elements whose latches are withdrawn, means normally preventing operation of said controlling frame, electromagnets controlling the respective latches for said perforating elements, contacts closed by said sensing means for energizing the electromagnets to withdraw in all said reperforators the latches from the perforating elements corresponding to the digital pattern of an entry sensed by said sensing means, resistance means for reducing the current flow through said electromagnets, means for inserting said resistance in circuit with said electromagnets following closing of said contacts and for maintaining said resistance in said circuit until after said contacts are opened, and means for rendering operative the controlling frame of a particular one of said reperforators in accordance with a digital pattern in one of the digital orders of said entry.

41. In a combined code sorting and reproducing mechanism for multidigit entries, the different digits of which are each symbolized by a different pattern of perforations on a recording medium, a reading device comprising sensing means adapted to cooperate with said perforations for sensing said entries, a plurality of reperforators each having perforating elements, electromagnets for controlling the respective perforating elements, contacts closed by said sensing means for energizing in all said reperforators the electromagnets corresponding to the digital pattern of an entry sensed by said sensing means, resistance means for reducing the current flow through said electromagnets, and means for inserting said resistance in circuit with said electromagnets following closing of said contacts and for maintaining said resistance in said circuit until after said contacts are opened.

42. A code tape reader comprising means for sensing code perforations in a record tape, means comprising a member movable to a given position for advancing said tape, cam means adapted to hold said member in inactive position during a portion of the movement of said cam means and for releasing said member during another portion of said movement, an element restraining movement of said movable member from inactive position, and electromagnetic means for removing said element from restraining position.

43. A code tape reader comprising means for

sensing code perforations on a record tape, means comprising a movable member for advancing said tape, spring means urging said member into tape-advancing position, cam means adapted to hold said member in inactive position during a portion of the movement of said cam means and for releasing said member during another portion of said movement, means restraining movement of said movable member from inactive position, and electromagnetic means adapted upon energization to actuate said restraining means for releasing said movable member for operation by said spring means to advance said tape.

44. In combination, a code tape reader comprising means for sensing code perforations on a record tape, means comprising a movable member for advancing said tape, spring means urging said member into tape-advancing position, cam means adapted to hold said member in inactive position during a portion of the movement of said cam means and for releasing said member during another portion of said movement, means restraining movement of said movable member from inactive position, electromagnetic means adapted upon energization to actuate said restraining means for releasing said movable member for operation by said spring means to advance said tape, a reperforator controlled by said sensing means of said reader, and means controlled by said reperforator for controlling said electromagnetic means.

45. A code tape reperforator having a cam, a member operated by said cam, a tape-advancing member adjacent said cam operated member, an element movable with respect to said members for controlling the transmission of motion from said cam operated member to said tape-advancing member, and means for controlling the position of said element.

46. A code tape reperforator having a cam, a member operated by said cam, a tape-advancing member adjacent said cam operated member, an element movable with respect to said members for controlling the transmission of motion from said cam operated member to said tape-advancing member, and electromagnetic

means for controlling the position of said element.

47. A code tape reperforator having a plurality of groups of perforating members, a cam operated member, a tape-advancing member, an element movable for controlling the transmission of motion from said cam operated member to said tape-advancing member, and means dependent upon operation of a predetermined number of said perforating members in each of said groups for controlling the position of said element.

48. A code tape reperforator having a plurality of groups of perforating members, a cam operated member, a tape-advancing member, an element movable for controlling the transmission of motion from said cam operated member to said tape-advancing member, means for selecting said reperforator for operation, and electromagnetic means controlled jointly by said perforating elements and said selecting means for controlling the position of said element.

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