

Nov. 27, 1951

R. F. MALLINA

2,576,844

MECHANICAL GANG PERFORATOR

Filed Dec. 15, 1945

5 Sheets-Sheet 1

FIG. 2.

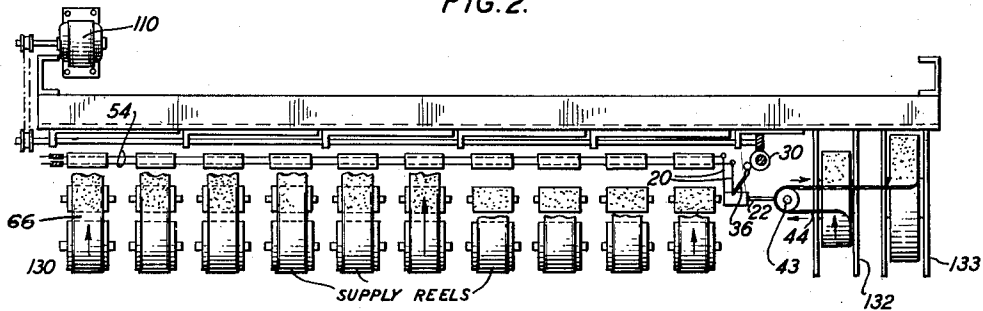


FIG. 1.

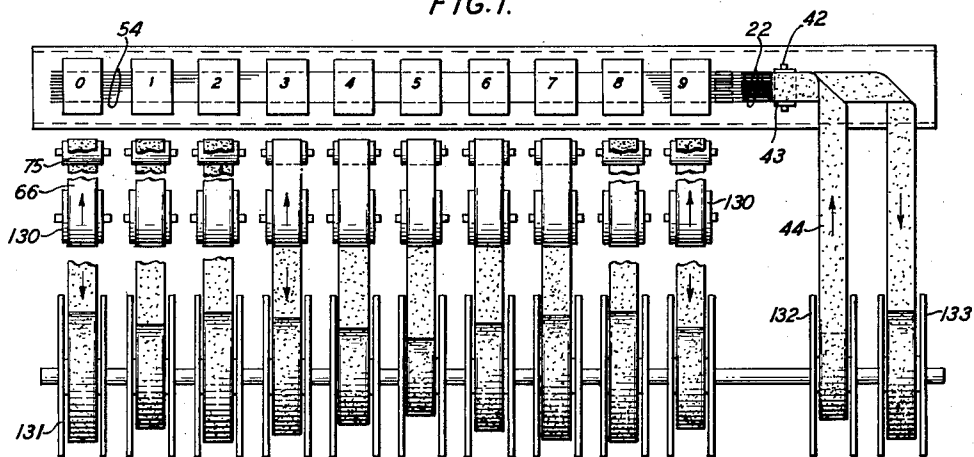


FIG. 3.

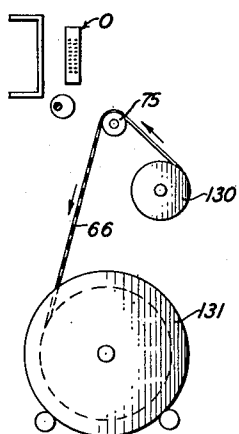
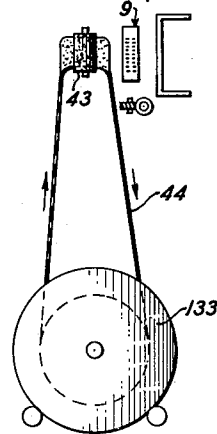


FIG. 4.



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FIG. 5.

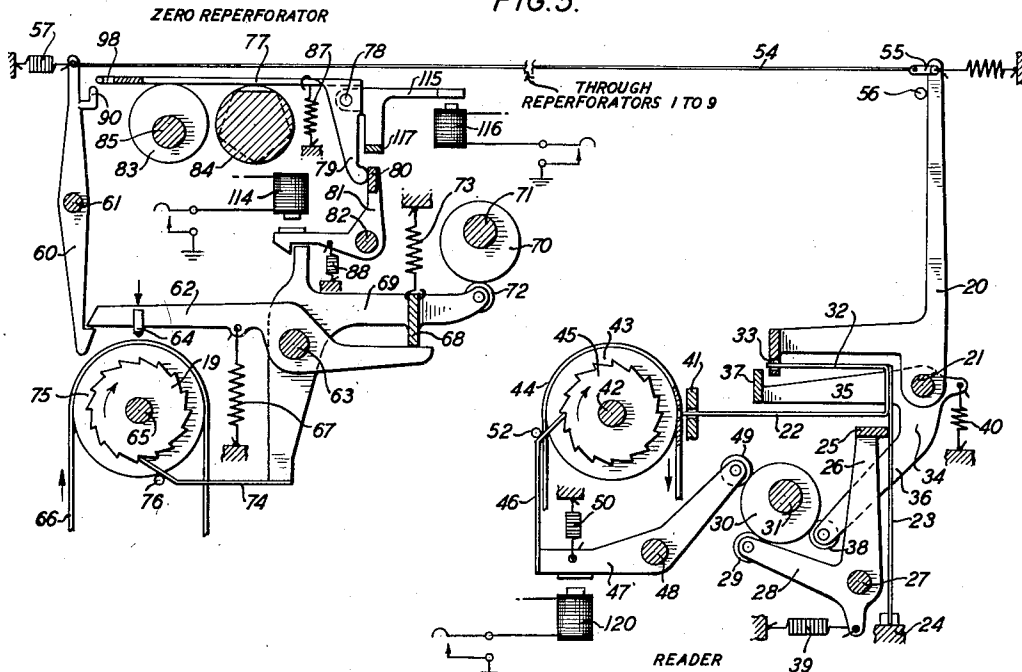
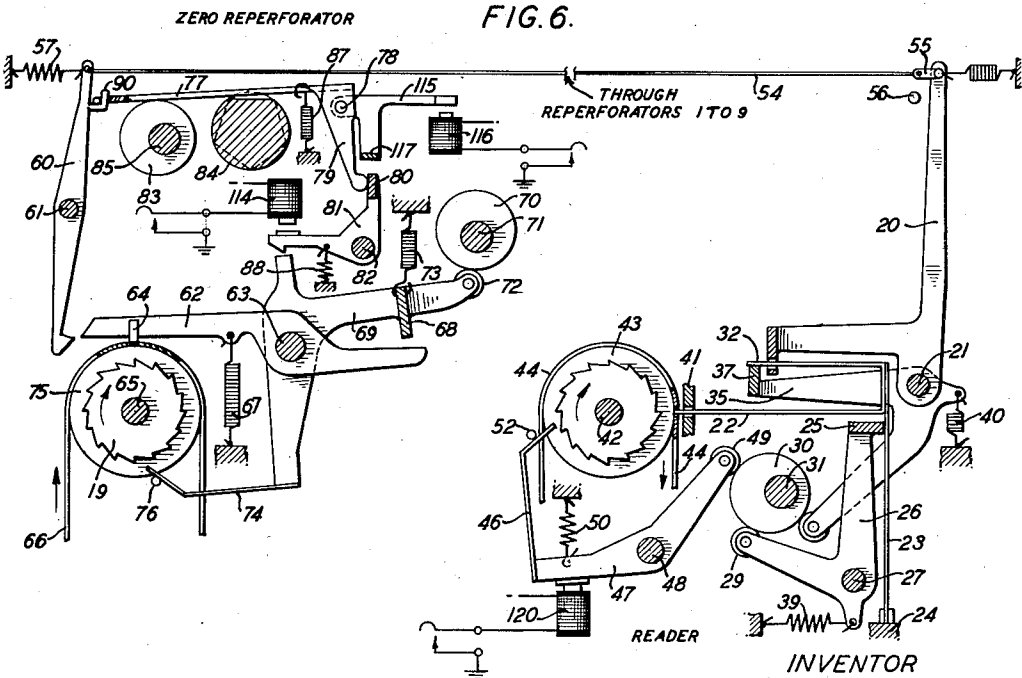


FIG. 6.



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FIG. 8.

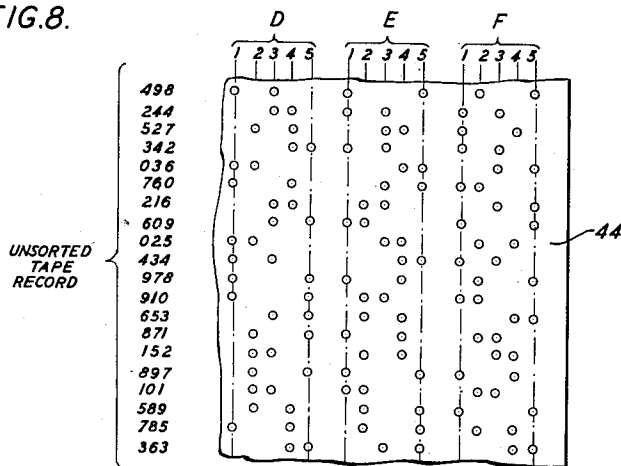
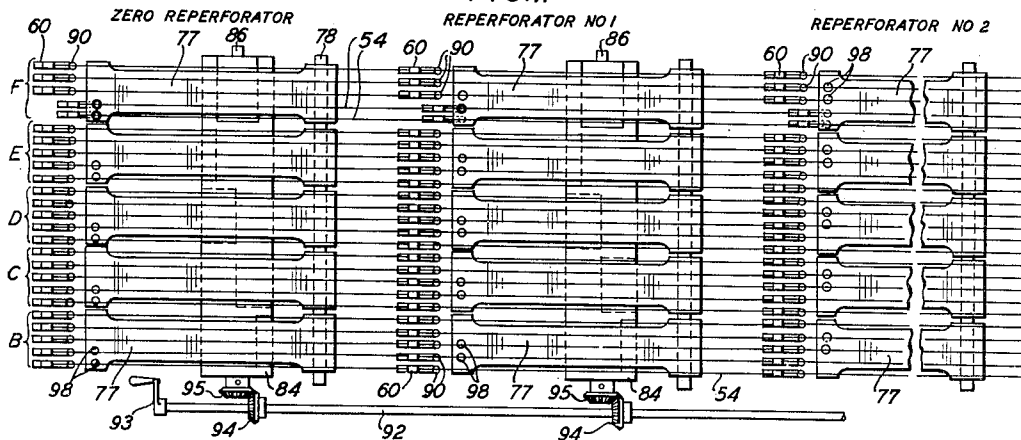


FIG. 9.

REPERFORATORS 0 TO 9									
0	1	2	3	4	5	6	7	8	9
760	871	342	653	244	025	036	527	498	609
910	101	152	363	434	785	216	897	978	589
1ST SORT BY UNITS									
101	910	025	434	342	152	760	871	785	897
609	216	527	036	244	653	363	978	589	498
2ND SORT BY TENS									
025	101	216	342	434	527	609	760	871	910
036	152	244	363	498	589	653	785	897	978
3RD SORT BY HUNDREDS									

FIG. 7.



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FIG.10.

REPERFORATOR SELECTOR CODE

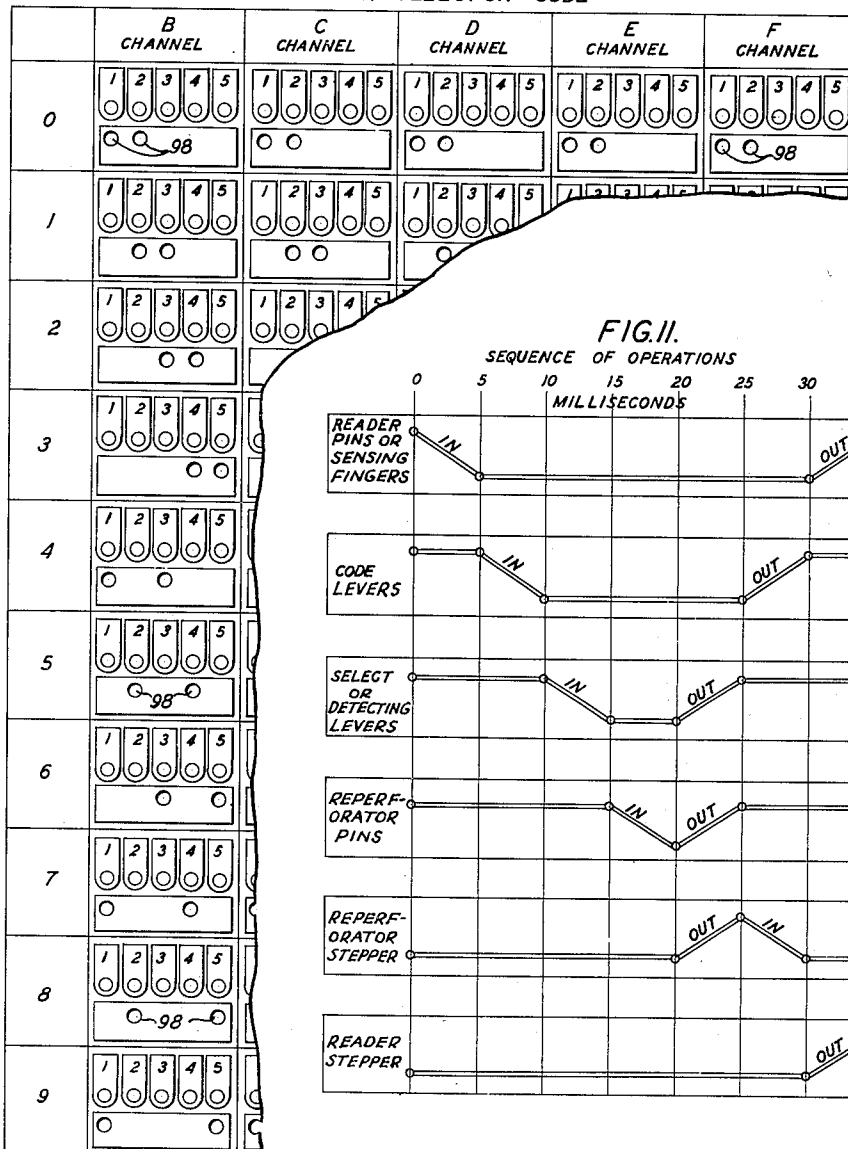
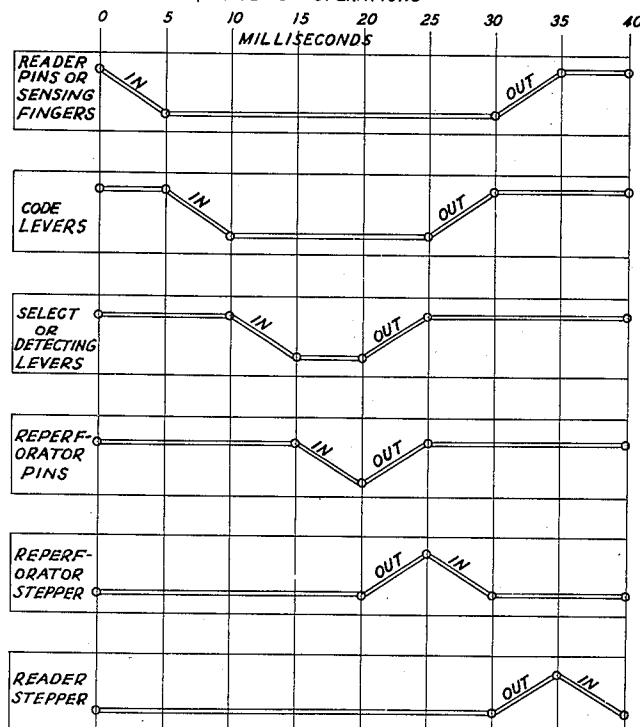


FIG.11.

SEQUENCE OF OPERATIONS



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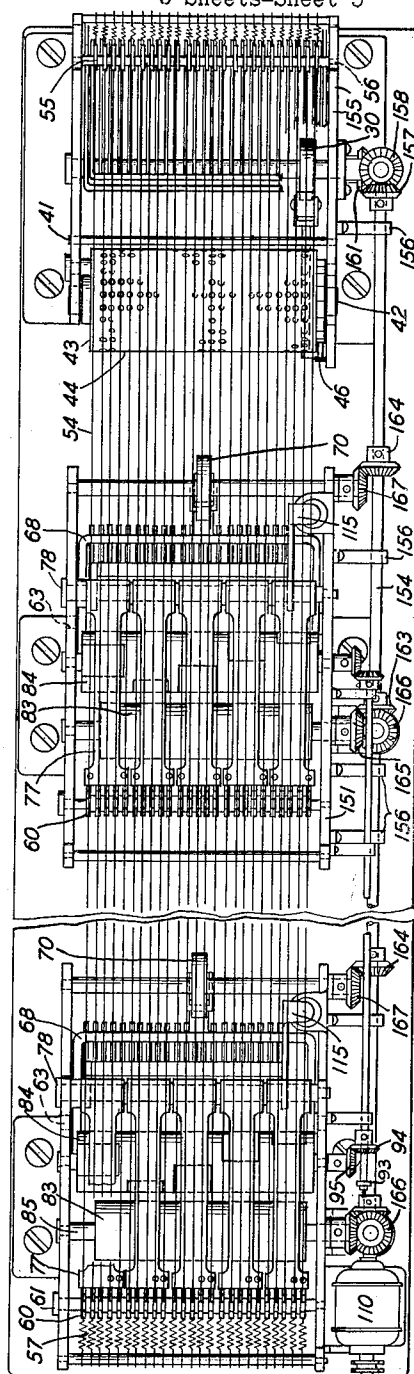
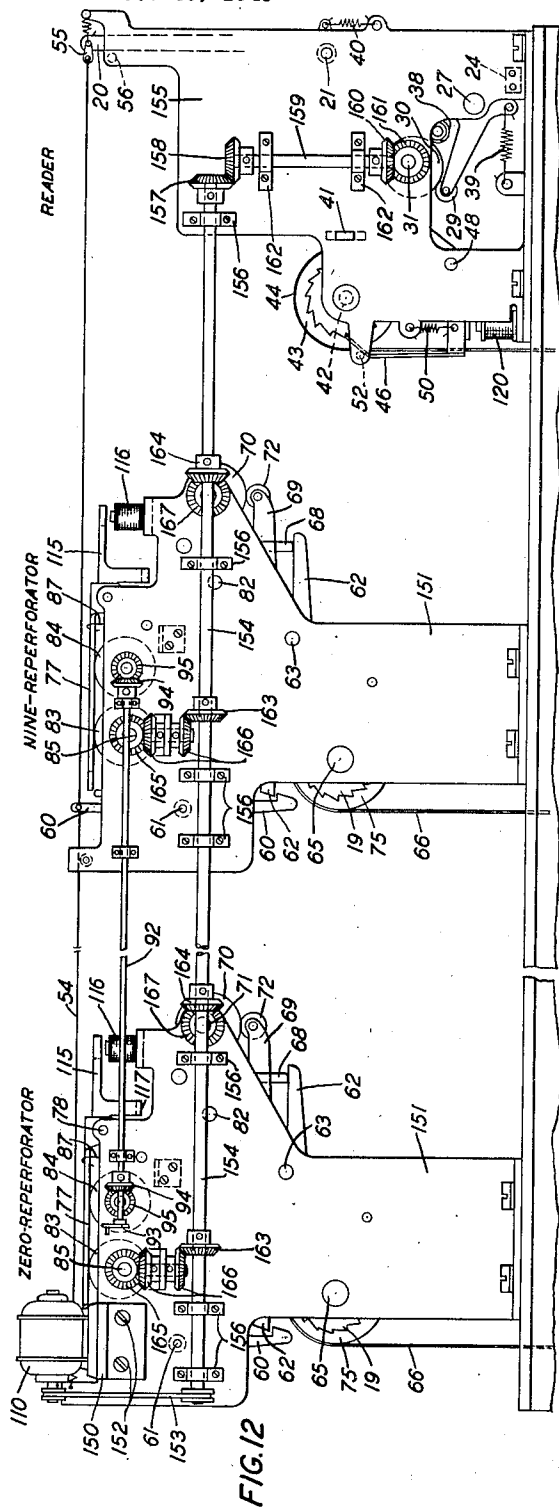


FIG. 13

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UNITED STATES PATENT OFFICE

2,576,844

MECHANICAL GANG PERFORATOR

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Application December 15, 1945, Serial No. 635,355

21 Claims. (Cl. 164—114)

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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 an orderly 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 independent items. For example, and as shown and described in W. W. Carpenter's 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 Patent 2,112,951, issued April 5, 1938 to W. W. Carpenter.

The present invention, while relating to apparatus particularly suitable for use in such a system as is disclosed in either 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, like the inventions of these patents, is applicable to other than automatic telephone message accounting systems.

By way of illustration, the code entries recorded on the primary tape are illustrated as corresponding to multidigit numbers which may, but need not necessarily, correspond to telephone numbers.

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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 order.

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 an orderly arrangement of values, 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 the medium of mechanical linkages, or code wires, 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 simultaneously prepare for operation corresponding combinations of perforating levers of each of ten reperforators whereby each of the ten reperforators is rendered potentially operative to reproduce, on its individual tape recording medium, the code pattern of the reader tape. A feature of the invention resides in the use of mechanical means only, for conveying the code information carried by a primary record, or tape, to a multiplicity of individual reperforators whereby the code entries of the primary record may be duplicated, or repeated, on the individual recording media, or tape, of the reperforators.

Another feature of the invention contemplates the use of mechanical means for causing the selection of any one of a group of reperforators for operation to reproduce, on its individual recording medium, or tape, the code perforation patterns of the reader tape. More particularly, each reperforator is provided with means for recognizing, or detecting, a different one of the digital patterns of which a code entry may be composed. This detecting means comprises a detecting, or select lever for each digital position of a code entry all of which levers in the same reperforator are provided with apertures arranged to simulate the same digital pattern. Each digital pattern of a code entry on the reader tape is made up of two perforations out of a fixed pattern of five and the patterns simulated by the apertures of the detecting or select levers of the several reperforators are arranged in a similar manner so that each

reperforator may be said to be characterized in accordance with a different digital pattern. For example, the apertures in the detecting, or select levers of the so-called "zero" reperforator, are arranged to simulate the digital pattern of the digit zero; the apertures of the detecting, or select levers of the "units" reperforator, are arranged to simulate the digital pattern of the digit "1"; and so on. The detecting, or select, levers of each reperforator, are so disposed relative to a plurality of latch levers in the reperforator that when a combination of latch levers is actuated under the control of the reader, in accordance with the digital pattern which characterizes the reperforator, projections integrally associated with the latch levers will be moved into positions in which they register with the apertures of the detecting levers. Unless registry of the said apertures with the said projections of the operated latch levers is effected, the perforating levers of the reperforator are precluded from operation and the reperforator will not function to reproduce the primary tape code entry encountered by the sensing fingers of the reader. To elucidate further, and assuming a code entry to consist of five digits, the entry is considered to consist of five channels each allocated to one digit of the five-digit entry. 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. Thus the five detecting, or select levers of any one reperforator correspond respectively to the five channels, or digital positions of an entry and are each provided with two apertures arranged to simulate the pattern of the particular digit which is to determine the operation of the reperforator. Obviously, there are ten reperforators, the operation of each of which is determined by a different one of the digits 1 to 9, and zero. Thus the so-called "zero" reperforator will respond only to the reading of a code entry on the reader tape in which the controlling digit is "zero"; the No. 1 reperforator will respond only to the reading of a code entry containing the controlling digit "1"; and so on. The response of a reperforator, as previously indicated, results from the registry of the detecting lever apertures with the projections of the reperforator latch levers operated by the reader.

A further feature of the invention resides in the use of manually operable means for permitting the code entries of the reader tape to be sorted by channels, or digital positions, that is, any group of entries may be sorted in successive steps by utilizing the digits of the various channels as the controlling digits. For example, a group of entries may be first sorted in the units channel and subsequently in the tens, hundred, etc., channels. To accomplish this the aforementioned detecting or select levers of each reperforator are located immediately above an individual select cylinder having five flat surfaces displaced 72 degrees apart and arranged spirally along the length of the cylinder, and manually operable means is provided whereby the said cylinders of all ten reperforators may be simultaneously set so as to selectively present a flat surface to the undersurface of the same channel select lever in each reperforator thereby rendering only that particular select lever of each reperforator operable, all other levers being blocked against operation by the flat-free portions of the cylinders.

When the select cylinders are set so as to present flat surfaces to the underside of the units channel select levers, for example, the sorting operation will be carried out under control of the units digits of the code entries. Similarly, when the cylinders are set to present flat surfaces to the underside of the tens channel select levers the sorting will be carried out under control of the tens digits of the code entries, and so on. The number of sorting operations required on any group of numbers is determined by the number of digits in the numbers being sorted as is more fully described hereinafter.

A still further feature of the invention resides in novel means for selectively coupling the code levers of the reader, or sensing device, with a common operating member under the direct control of the sensing fingers. More particularly, each sensing finger of the reader is provided with an integral select finger, or interponent member, having one end normally disposed in an aperture of the corresponding code lever and adapted to project therefrom, in response to the entry of the sensing finger into a tape perforation, into the path traversed by the code lever operating member. Thus, when the said operating member operates, it actuates all the code levers corresponding to the sensing fingers whose select fingers, or interponent members, are projected into its path, all other code levers remaining stationary.

These and other features of the invention will be readily understood from the following detailed description when read in connection with the accompanying drawings, in which:

Fig. 1 is a schematic elevation of an assembly of ten reperforators and one reader, or sensing device;

Fig. 2 is a schematic plan view of the assembly shown in Fig. 1; in this figure, as in Fig. 1, the code tapes are turned 90 degrees from their actual positions shown in Fig. 12;

Figs. 3 and 4 are left and right end views of the assembly schematically shown in Figs. 1 and 2;

Fig. 5 constitutes a sectional view taken across one reperforator and across the reader, or sensing device schematically shown in Figs. 1 and 2. In this figure the apparatus is illustrated in its normal, or unoperated condition. The reperforator unit, illustrated at the left of the figure, while designated "zero reperforator" is representative of all ten reperforators indicated schematically in Figs. 1 and 2. The break in the code wire 54 is intended to indicate that nine other similar reperforators, 1 to 9, as well as the zero reperforator illustrated, are controlled by the single reader, or sensing device shown at the right of the figure;

Fig. 6 is a view corresponding to Fig. 5 showing the reperforator and reader units in one of their operated positions;

Fig. 7 is a top plan view of three reperforator units showing, particularly, the five select levers of each reperforator and their corresponding channel select cylinders, the manually operable means for variably setting the select cylinders, and illustrates the manner in which the latch levers of all reperforators are controlled by the reader through the medium of a common group of code wires;

Fig. 8 discloses a fragmentary section of a primary code tape bearing twenty unsorted code entries symbolized by code perforations. This figure which includes a showing of the numbers which correspond to the code perforations de-

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picted on the tape clearly illustrates how each of the digits 1 to 9 and zero is represented by two perforations out of a fixed pattern of five. In this figure only numbers of three digits are illustrated for purposes of simplicity, and the digital channels allocated to the units, tens and hundreds digits of the numbers are designated by the letters F, E and D, respectively;

Fig. 9 shows three groups of rectangles, each rectangle representing a portion of a reperforator tape. The three groups illustrate graphically the results of three sorting operations and show how the unsorted numbers of Fig. 8 are arranged on the ten reperforator tapes after each sort;

Fig. 10 is a schematic representation of the select lever code. It will be observed that the five select levers of each of the ten reperforators are characterized by the same code represented by two holes located in two out of five possible positions and that corresponding code levers of each of the ten reperforators are characterized by a different code of two out of a fixed pattern of five. This figure corresponds in part to the showing of Fig. 7;

Fig. 11 is a diagram showing graphically the sequence of operations of the various elements of the reperforator and reader units; and

Fig. 12 is a side elevation of two reperforator units and a reader, and illustrates how the various rotational elements thereof are driven by a common motor; and

Fig. 13 is a top plan view of the apparatus shown in Fig. 12.

Before entering into the detailed description of the structural design and operation of the reader and reperforator units a brief reference will be made to Figs. 1, 2, 3 and 4, which as previously indicated, are schematic representations of an assembly of ten reperforators and a single reader. Each of the ten reperforators designated 0, 1, 2 . . . 9, respectively, includes besides the structure disclosed at the left of Figs. 5 and 6, a tape supply reel 130 and a tape take-up reel 131 mounted on suitable shafts. The reader unit similarly is provided with a tape supply reel 132 and a take-up reel 133. As will be more fully described hereinafter, the reperforator tape 65 and the reader tape 44 are fed over their respective rollers, or drums 75 and 43 in step-by-step manner under control of individual stepping mechanisms. These drums are substantially hollow cylinders with equally spaced rows of holes corresponding to the spacing and rows of perforations required for the coded tape. The reader tape 44 constitutes a primary record bearing a plurality of five digit numbers, symbolized as code perforations, which have been recorded on the tape in a mixed-up or non-sequential numerical order. Each digit, as shown in Fig. 8 is represented by two perforations chosen out of a total of five and each digital position of a number is allocated a channel having five possible points in which perforations may appear. A five digit entry on the tape therefore will consist of five groups of two perforations extending across the width of the tape, each group of perforations being located within the space defining one channel.

The tape perforations are recognized, or sensed by the sensing fingers (schematically indicated at 22 in Figs. 1 and 2) of the reader unit and as each sensing finger enters a perforation in the reader tape it functions to effectively couple a corresponding code lever 20 with a common operating member 36, the latter being controlled by

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the reader cam 30. In accordance with a particular code entry on the reader tape therefore, a corresponding group of code levers 20 is operated by the cam 30 to exert a pull to the right on a corresponding group of code wires 54. As will be more fully described hereinafter, the operated code wires selectively prepare a corresponding group of perforating levers 62 (Figs. 5 and 6) in each reperforator unit for operation under control of a cam 70, there being one such cam (shown in Fig. 13) for each reperforator. The code wires 54, in effect, constitute mechanical linkages which interconnect the code levers 20 of the reader with corresponding latch levers 60 (Figs. 5 and 6) of each of the ten reperforators, the said latch levers constituting the means whereby the perforating levers of the reperforators are prepared for operation. The manner in which the prepared perforating levers are operated; the manner in which the selection of a particular reperforator is attained; and the manner in which the number sorting operations are performed will appear from a later description.

It is to be understood that the reader cam 30 and the reperforator cams 70 and 83 (Figs. 5 and 6) are operated synchronously by a motor 110 (Figs. 2, 12 and 13) through any suitable gearing. The showings of Figs. 1 to 4, inclusive, are entirely schematic and are relied upon merely to provide an over-all picture of the assembly of the gang perforator of this invention and to indicate, particularly, that a group of ten reperforators is controlled by a single reader, or sensing device, and to illustrate that this control is exercised wholly mechanically. Figs. 12 and 13 are employed primarily to illustrate the common driving mechanism for the reperforator and reader cams 70, 83 and 30. The schematic figures together with the other figures of the drawings, when considered in the light of the following detailed descriptions afford a complete disclosure of the system embodying the features of the invention.

The reader or sensing device

The reader or sensing device of this invention is shown diagrammatically at the right of Figs. 5 and 6. In a preferred embodiment of the invention the reader includes twenty-five code levers 20 which are mounted in alignment on a common shaft 21, only one of the levers being disclosed in Figs. 5 and 6 for reasons of simplicity of disclosure. Each code lever is essentially L-shaped terminating at the junction of its two arms in an integral depending projection having a hole therein for the accommodation of the shaft 21. The horizontal arm of the code lever is provided at its extremity with an integral projecting portion having a hole 33 therein the purpose of which will appear as the description progresses.

For each code lever 20 there is provided a sensing finger 22 which is essentially a substantially U-shaped rod-like structure fixed to the top of a supporting wire 23 in any suitable manner. The wire 23 is fixed to the reader frame indicated at 24 and is normally biased, or pretensioned in a direction towards a common bar 25 which is formed integrally with the lever 26. The lever 26 is rotatably mounted on a shaft 27 and the bar 25 carried by the lever 26 extends transversely across the reader so as to constitute a common abutment for all the supporting wires 23 and to normally restrain the corresponding sensing fingers 22 against movement in their operating direction. It is to be understood that the sensing

fingers tend to move to the left, viewing Figs. 5 and 6, because of the normal tension given the supporting wires 23. The lever 26 is provided with an integrally formed arm 28 projecting outwardly and upwardly therefrom near the lower extremity thereof. This arm supports the roller 29 which constitutes a follower for cam 30. The cam 30 is fixed to the shaft 31 and is rotatable therewith.

The sensing finger comprises the lower and longer arm 22 of the U-shaped rod carried by the supporting wire 23. The upper and shorter arm 32 constitutes an interference or interponent member or select finger which is threaded through the hole 33 in the code lever 20.

A second lever, common to all the code levers 20 of the reader is rotatably supported by the shaft 21 and comprises the horizontal leg 35 and the angularly depending leg 36. The lever leg 35 terminates in a bar 37 which, like the common bar 25, spans substantially the entire depth of the reader so as to serve as a common operating element for all the select fingers, or interponent members 32 of the reader. The lever leg 36 supports a roller 38 which constitutes a follower for cam 30. The rollers 29 and 38 are held in constant engagement with the periphery of cam 30 by springs 39 and 40, respectively.

The forward or left ends of the sensing fingers 22 project slightly through corresponding holes or apertures in the template 41, which like common bars 25 and 37 may extend the full depth of the reader structure, or sufficient thereof to accommodate all of the sensing fingers 22.

A shaft 42 parallels and is spaced from the template 41 and carries the reader drum 43 in such a position that the plane of the center transverse axis thereof is coincident with the horizontal plane of the sensing fingers 22, the spacing of the drum 43 from the extremities of the sensing fingers being slightly greater than the thickness of the reader tape 44 which is carried over and propelled by the drum.

A ratchet wheel 45 is formed integrally with or otherwise secured to the end wall of drum 43, disclosed in Figs. 5 and 6, so as to be rotatable in unison therewith on the shaft 42. A leaf spring pawl 46 extends vertically from the extremity of the horizontal leg of lever 47 which is rotatably supported by shaft 48. The lever 47 also includes an upwardly angularly extending leg which supports, at its extremity, the roller 49 which constitutes a follower for the cam 30. A coil spring 50 normally biases the lever 47 in such a direction as to insure constant engagement between the roller 49 and the cam 30. The lever 47, pawl 46, and ratchet 45 provide means for stepping the reader drum 43. The pawl 46 is provided with an inwardly projecting portion the end of which normally engages a tooth of the ratchet 45, as shown in Fig. 5. A stop 52 serves as a guide for the pawl 46 during its movements relative to the ratchet 45.

The reader or sensing device operates in the following manner: the reader tape 44 is propelled by the reader drum 43 in consequence of the operation of the stepping lever 47 and its associated pawl 46. This stepping action will be described more fully hereinafter. Suffice it to say at this time that a transverse row of code signals in the nature of perforated embossments on the tape is aligned with the working ends of the sensing fingers 22 and that the reader is in the condition illustrated by Fig. 5. It is to be understood that in actual practice there are

twenty-five sensing fingers 22 embodied in the reader design elected for illustrative purposes, though but one appears in Figs. 5 and 6. Also that the code tape, as previously indicated, includes five channels each of which provides five possible positions in which perforations may appear. Since the function of the sensing fingers is to explore the code tape for perforations there would be twenty-five such fingers.

For purposes of description it will be assumed that the tape 44 presents to the sensing fingers 22 a transverse row of perforations corresponding to a five-digit number whose hundreds, tens and units digits are 4, 9 and 8 as shown in Fig. 8, which occupy the corresponding channels D, E and F on the tape. It is deemed adequate to confine the description to the functioning of the reader in connection with three digits rather, though it is to be understood that, as illustrated the reader will function to handle numbers of five digits.

As shown in Fig. 8 the digit 4, or the hundreds digit of the number selected for descriptive purposes is represented by a perforation appearing in each of the first and third positions of that portion of the tape allocated to channel D, or the hundreds channel; the digit 9, or the tens digit is represented by a perforation in each of the first and fifth positions of that portion of the tape allocated to channel E, or the tens channel; and the units digit 8 is represented by a perforation appearing in each of the second and fifth positions of that portion of the tape allocated to channel F, or to the units channel. Considering only that portion of the tape which includes only channels D, E and F, it is apparent that the positions of the perforations therein will determine which of the sensing fingers 22 will function to recognize the code which represents the number 498.

The sensing fingers, as previously indicated, are tensioned by their supporting wires 23 against the common bar 25 which is an integral part of the lever 26. As the cam 30 is rotated under the control of a motor (not shown in Figs. 5 and 6) it first functions to cause lever 26 to rotate on shaft 27 in a counter-clockwise direction against the restraining influence of spring 39 and to thus move the common bar 25 out of engagement with the supporting springs 23 of all the sensing fingers 22. All the sensing fingers thus tend to move to the left. Only those sensing fingers which encounter perforations in the code tape 44 will move sufficiently to the left to permit the ends of the corresponding select fingers 32 to be projected over the edge of the common member 37 carried by lever 35, all other sensing fingers will be obstructed in their movements by the unperforated portion of the tape. In the case assumed, which involves the digits 4, 9 and 8, six sensing fingers which correspond to the positions of the perforations symbolizing the number 498 will be moved to the left sufficiently to render the six corresponding select fingers, or interponent members 32 to project from their respective holes 33 in corresponding code levers 20 so as to assume positions immediately above the common operating member 37.

As the cam 30 continues its rotation it acts upon the follower roller 38 so as to permit the spring 40 to rotate the lever 36 in a clockwise direction. The horizontal arm of lever 36 is thus raised and engages the projected ends of the six actuated select fingers 22 so as to lift them and thereby effectively couple the corresponding six

code levers 20 with the common operating member 37. The lever 36 under the action of spring 40 and through the coupling effected by the select fingers 32 moves those code levers 20 which correspond to the sensing fingers which entered the tape perforations, in a clockwise direction. A corresponding group of six code wires 54 is thereby pulled to the right against the restraining influence of spring 57. Thus, as a result of the action of the sensing fingers on the code tape bearing the code perforations corresponding to the number 498, six code levers 20 are selectively operated to pull a corresponding number of code wires 54 to the right. The functions performed by the code wires 54 will appear from a later description. It is understood that the upper extremity of each code lever 20 is permanently associated with a corresponding code wire through the medium of a connecting link 55 and that the code wire is normally tensioned by the spring 57 to hold the lever 20 against the stop 56. It will be pointed out in detail hereinafter that all the code wires 54 serve ten reperforators, one of which is illustrated diagrammatically at the left of Figs. 5 and 6.

As the cam 30 continues its movement of rotation it functions through the follower 40 to cause the stepping lever 47 to rotate in a counter-clockwise direction against the action of spring 50. The pawl 46 carried by lever 47 is thus moved out of engagement with the ratchet wheel and into a position from which it moves into engagement with the next succeeding tooth of the ratchet wheel when the cam 30 permits the spring 50 to restore the lever 47 to the position illustrated in Fig. 5, and to thereby rotate the reader drum one step. It will be understood that the cam 30 is so designed that it functions to permit the levers 26 and 36 to restore before the stepping of the reader drum to the next position takes place.

The reperforator

The reperforator construction is illustrated at the left of Figs. 5 and 6. Each reperforator unit includes twenty-five latch members 60 rotatably mounted on the shaft 61. The upper extremity of each latch member 60 is securely associated with or tied to one of the twenty-five code wires 54, it being understood that the code wires are common to all reperforators and that, therefore, each code wire is fixedly associated with ten latch members 60, one in each reperforator. Any one code wire is fixed to the corresponding latch member in each reperforator.

For each latch member 60 there is a corresponding perforation lever 62, all of which are mounted for rotation on the shaft 63 and each has fixedly mounted thereon a punch pin 64. A shaft 65 carries a drum 75 in such a position relative to the aligned punch pins 64 that the operating, or perforating ends of the latter occupy a plane which passes through the vertical axis of the drum. The latching portion of each latch lever 60 is normally projected below and is slightly spaced from the left end of the corresponding perforating lever 62 and functions to preclude the operation of the corresponding perforating lever until the latch lever is withdrawn from its normal position by the action of the corresponding code wire 54 as will be more fully described hereinafter. In the normal position of the perforation levers 62 the corresponding punch pins 64 clear the drum 75 which propels the paper tape 66. A coil spring 67 serves to supply the force which

moves the lever 62 in a counter-clockwise direction and causes the punch pin carried by the lever to perforate the tape 66.

Each perforating lever 62 extends to the right from the shaft 63 so as to abut a common bar 68 which is formed integrally with the lever 69. The lever 69 is rotatably mounted on the shaft 63 which, as previously indicated, also supports the perforation levers 62. The lever 69 is controlled in its movements by the cam 70 which is mounted on shaft 71, the right end of the lever carrying a roller 72 which bears upon the periphery of the cam and functions as a cam follower. A coil spring 73 serves to maintain the roller 72 in constant engagement with the cam 70. The lever 69 is provided with a depending arm which, at its lower extremity, carries a spring pawl 74 which, with the ratchet wheel 19 functions to propel the tape drum 75, step by step, in substantially the same manner as does the pawl 46 step the reader drum 43. A stop 76 maintains the pawl 74 in its ratchet engaging position.

Each reperforator is equipped with five selector bars or levers 77, there being one selector bar for each of the five channels, it being understood that five channels are required for five-digit numbers, four channels for four-digit numbers, etc. The selector bars 77 of each reperforator are mounted side by side on a shaft 78 and each selector is provided with an integrally formed depending arm 79, the lower end of which normally abuts a common bar 80 carried by the latch lever 81, which, in turn, is mounted on shaft 82.

The selector bars 77 extend to the left of the supporting shaft 78 in superposed relation to the operating cam 83 and a channel selecting cylinder 84 which are rotatably mounted on the shafts 85 and 86, respectively. A spring 87 serves to maintain the arm 79 of each selector 77 normally in engagement with the common bar 80. A similar spring 88 serves to maintain the latch lever 81 in the position shown in Fig. 5. At the left extremity of each selector 77 there are provided two holes. These holes occupy two positions across the selector out of a fixed pattern of five as clearly indicated by the schematic showing of Fig. 10. The five selectors of each reperforator have their holes similarly positioned while corresponding channel selectors of the ten reperforators are positioned differently. For example, and viewing Fig. 7, each of the five selectors of the "zero" perforator has two holes located in the first and second positions across the width of the selectors; each of the five selectors of reperforator No. 1 has two holes located in the second and third positions; each of the five selector bars of reperforator No. 2 has two holes located in the third and fourth positions, etc. These code holes are in accordance with the fixed "two out of five" pattern which is schematically illustrated in Fig. 10 and from which the numerical code is derived. The functions of these holes in the select bars 77 will appear from a later description.

As is clearly shown in Fig. 7, each selector 77 serves a group of five latch levers 60 and is disposed at right angles thereto. Each latch lever is provided with an L-shaped projection 90 located near the upper end of the latch. In the normal position of the latch levers 60 the projections 90 thereof are located below the left ends of their corresponding selectors 77 so as to be out of alignment with the holes 98 thereof. When the latch levers are actuated the projections 90 thereof are moved into vertical alignment with their corresponding selector holes 98 so as to occupy

positions which permit the selector holes to be entered thereby when the selectors are operated as will be more fully described hereinafter. The purpose of these projections and of the corresponding selector holes is to render possible the selective operation of the reperforators.

The selector cam, or cylinder 84 of each reperforator is common to all five selectors 77 and is provided with five flat portions, one for each channel. The flat portions are disposed 72 degrees apart in spirally staggered relation on the cylinder periphery so that the cylinder may be rotated to occupy any one of five positions, in each of which it presents one flat surface to the undersurface of a different one of the five selectors 77. The setting of the channel-selecting cylinders of the ten reperforators is attained through the medium of a shaft 92 having a hand crank 93 mounted on one end thereof and a pair of beveled gears 94, 95 for each reperforator. The gears 94 are mounted on the common shaft 92 and the gears 95 are mounted on individual shafts 86. The channel-selecting cylinders are employed in a sorting operation which will be described in detail hereinafter.

Reperforator operation

The reperforator operates in the following manner, it being understood that its function is to repeat, or reproduce on a code tape 66 the code perforations of the reader tape 44. In the description of the operation of the reader, or sensing device of this invention it was described how six reader code levers 20 were operated as a result of a corresponding number of sensing fingers 22 entering the perforations in the reader tape 44 corresponding to the code representing the numeral 498. In response to the operation of the code levers 20 a corresponding number of code wires 54 were pulled to the right against the action of coil springs 57. Considering only the operation of the reperforator shown at the left of Figs. 5 and 6 at this time, a corresponding number of latch levers 60 are caused to rotate clockwise on the shaft 61 under the action of the code wires 54. The projections 90 of the actuated latch levers are thus moved directly under the area of their respective selectors 77 which is allocated to the code holes 98, Fig. 10, by means of which the selection of one out of ten reperforators is determined. Similarly, the lower, or latching ends of the operated latch levers 60 are moved from under the left ends of corresponding perforating levers 62 thereby rendering such perforating levers available for operation. All other latch levers 60 maintain their normal positions relative to their corresponding perforating levers 62 and thus preclude the operation of such perforating levers. The force which causes the punch pins 62 to pierce the unperforated tape 66 is furnished by the coil spring 67 which is normally distended as shown in Fig. 5.

In the unoperated position of the perforating levers 62 the right-hand extensions thereof rest against the lower edge of the common bar 68 of the cam lever 69 which is controlled by the cam 70. The cam 70, mounted on shaft 71 is motor-driven and, as it rotates it permits the cam lever 69 to rotate counter-clockwise under the action of coil spring 73. This movement of the cam lever 69 lifts the common bar 68 so as to free the perforating levers 62 for counter-clockwise movement under the action of their respective springs 67. Obviously, only those perforating levers whose corresponding latch levers 60 have

been operated are free to so move. The punch pins 64 carried by the selectively operated perforating levers 62 are thus forced into the paper tape 66 to perforate the same in accordance with the levers 62 which were operated, which obviously, is in accordance with the code perforations in the reader tape 44 which, as described, determine the selective operation of the perforating levers 62 of the reperforator.

In the immediately preceding description of the operation of the reperforator unit no consideration has been given to the selection of a particular reperforator, it being understood that all ten reperforators do not respond simultaneously to repeat the code appearing on the reader tape, though corresponding perforating levers 62 in all ten reperforators are prepared for operation in the manner described.

The selector

The selection of one reperforator out of ten and also the recognition of one channel out of five are effected in the following manner:

The paper tape, as previously indicated, is capable of recording five-digit numbers, 00,000 to 99,999, inclusive. The five-digit number requires five groups of code wires 54, there being five code wires serving each digital position of a number. The mechanism employed to select one reperforator out of ten consists of the five selectors 77 and a common latching lever 81. The left ends of the selectors 77 are each provided with two holes as previously described, which holes are a selection from a fixed pattern of five possible positions. Since there are ten different combinations of two holes each that may be selected from this fixed pattern of five, a selection of one out of ten reperforators is possible, each reperforator being characterized by selectors having two holes spaced differently across their widths.

When the code wires 54 pull on the upper ends of the latch levers 60 the projections 90 thereof are moved to positions in which they are in vertical alignment with the area of the selectors 77 in which the identifying code holes 98 appear. When the motor-driven cam 83 rotates so as to render the selectors 77 available for movement in a counter-clockwise direction about shaft 78 under the influence of springs 87, those selectors whose code holes are in alignment with the projections 90 of the operated latch levers 60 will respond to the influence of the springs 87 and will rotate counter-clockwise so that the projections 90 of the latch levers will enter the corresponding holes 98. All other selectors whose holes do not register with projections 90 will be blocked. If, for example, the number appearing on the reader code tape is a five-digit number whose units digit is "zero" the two code wires individually designated by the numeral 54 in Fig. 7 will be pulled to the right causing the displacement of the corresponding latch levers 60 of all ten reperforators. However since the selector 77 of only the "zero" reperforator has its code holes in the positions which register with the projections 90 of the actuated latch levers, only this selector will move downwardly under the action of its spring 87 when the cam 83 is rotated. All corresponding selectors 77 of reperforators Nos. 1, 2, etc., will be blocked since the projections 90 of the actuated latch levers 60 thereof do not register with the identifying code holes of the selectors thereof.

When the other end of the select lever 77 of the "zero" reperforator, for example, moves

downwardly, its extension 79 acts upon the common bar 80 of the latch 81 causing the unlatching of the lever 69. This allows the lever 69 of the selected reperforator to follow the rotating cam 70 and to therefore rotate in a counter-clockwise direction on the shaft 63 under the influence of spring 73. The common bar 68 is thus raised to clear all the perforating levers 62 for operation. Only those perforating levers 62 will operate, however, whose corresponding latch levers 60 have been operated. The operation of the selected perforating levers under the action of their corresponding springs 67 cause the corresponding punch pins 62 to perforate the tape 66. The lever 69 also moves the stepping pawl 74 into position to engage the next succeeding tooth in ratchet wheel 75 so that, when the lever 69 returns to normal position the pawl 74 functions to step the tape drum 75 one step.

As previously indicated, particularly on column 6, lines 24 to 28, the reader cam 30 and the reperforator cams 70 and 83 are operated synchronously by a motor 110 through suitable gearing. How this may be accomplished is clearly illustrated in Figs. 12 and 13. The motor 110 is shown mounted on a shelf-like support 150 which, in turn, is mounted on the vertical support 151 by suitable screws or bolts 152. Through the medium of a belt 153 the motor shaft is coupled to a common drive shaft 154 which is horizontally supported on the reperforator side-pieces 151 and the reader side-piece 155 through the medium of suitable bearings 156 which are suitably rigidly supported on the side walls 151 and 155. The right extremity of shaft 154 carries a bevel gear 157 which is in constant mesh with a similar gear 158 carried on one end of the shaft 159. The other end of shaft 159 mounts a bevel gear 160 which is in constant mesh with a similar gear 161 mounted on the reader shaft 31. The shaft 159 is supported in suitable bearings 162 mounted on the reader side wall 155. As the shaft 154 is rotated under control of the motor 110 the shaft 31 which supports the reader cam 30 is caused to rotate through the interaction of gears 157, 158, 160 and 161. At each reperforator's position the shaft 154 carries two bevel gears 163 and 164. The former communicates with the bevel gear 165 which is fixed to cam shaft 85 through suitable gearing indicated at 166. The bevel gear 164 communicates directly with a similar gear 167 which is mounted on cam shaft 71. The shaft 85 supports the reperforator cam 83 while shaft 71 supports the reperforator cam 70. Thus, as the common shaft 154 is driven by the motor 110 the reperforator cams 83 and 70 and also the reader cam 30 rotate at synchronous speeds. The means shown for rotating the reperforator and reader cams under control of the motor 110 is by way of illustration only.

Sorting

As hereinafter stated, a primary tape includes a multiplicity of code entries each representing a five-digit number, and these entries are not arranged on the tape in numerical order, or sequence, but appear in mixed-up, or jumbled fashion. In Fig. 8 a fragmentary section of a primary tape is illustrated showing a plurality of code perforations, each transverse line of which represents the last three digits of a number. As illustrated, the numbers represented by the code perforations are not arranged in numerical order. As a result of sorting operations corresponding

in number to the number of digits in the numbers, the entries may be caused to appear, in code, in numerical order on ten different tapes.

The sorting of the code entries is effected by passing the primary tape through the reader, or sensing device, so as to control the operation of the ten reperforators in the manner previously described. It will be understood that, prior to the starting of the operation of the reader and reperforators by the closure of a suitable switch in the circuit of motor 110, a blank or unperforated end of the reader tape will have been passed over the reader drum 43 and secured in any well-known manner to the take-up reel 133. Similarly, any well-known means may be employed to open the motor circuit when the entire reader tape has passed through the reader.

The following description deals with the sorting of three-digit numbers only, it being understood 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 digit, and so on. In order to sort in the units channel it is necessary that the selecting cylinders 84 of the ten reperforations be so positioned that each presents a flat surface to the undersurface of the selectors 77 which correspond to the units channels. In the disclosure in Fig. 7 the selecting cylinders are illustrated in the positions in which they present flats to the undersurfaces of their respective units channel selectors 77 so that when the primary tape is passed through the reader, or sensing device, the sort will be made in the units channel. In the illustrated example, Fig. 8, the first numeral code encountered by the sensing fingers of the reader is that which corresponds to the number 498 so that the No. 8 reperforator alone will respond selectively to the reader control to cause the numeral 498 to be reproduced, in code, on the tape of the No. 8 reperforator. As illustrated in Figs. 8 and 10, the digit 8 is represented by two perforations occupying the second and fifth positions in the fixed five-space pattern. The selectors 77 of reperforator No. 8, therefore, will have their code holes 98 located in the second and fifth positions, so that reperforator No. 8 will be the only one of the ten reperforators to reproduce the numeral encountered by the sensing fingers of the reader, as will now be described.

When the code perforations corresponding to the numeral 498 is encountered by the sensing fingers 22 of the reader (Fig. 5), six code levers 28, or two code levers in each of three groups corresponding to channels F, E, D, respectively, are operated. The second and fifth code levers 20 of the group corresponding to the units channel F will be operated as will also the first and fifth code levers 20 of the group corresponding to the tens channel E, and the first and third code levers 20 of the group corresponding to the hundreds channel D. The six code levers 20 thus operated pull the corresponding six code wires 54 to the right causing corresponding latch levers 60 in each of the ten reperforators to assume positions in which the projections 90 thereof are located directly under the ends of the selectors 77 bearing the code holes 98. Since the selectors 77 of only reperforator No. 8 have code holes corresponding to the units digit 8 and, therefore, which are now in alignment with the

latch lever projections 90, only these selectors of channel F will be able to follow the cam 83 as it rotates. The selectors of all other reperforators being blocked will be unable to follow their respective cams 83. Assuming the reperforator shown in Fig. 5 to correspond to the No. 8 reperforator for purposes of the immediate description, the selector 77, in following the cam 83, under the action of spring 87 causes the latch lever 81 to operate so as to free the cam lever 69 and to thereby permit it to follow the cam 70 under the action of spring 73. The common bar 68 is thus lifted, as cam 70 rotates, to clear all the perforating levers 62 of the No. 8 reperforator for operation. However, only those perforating levers whose latch levers 60 have been operated under control of the reader will be free to operate. The springs 67 of such perforating levers then function to cause the associated punch pins 64 to perforate the tape 66. In this manner the tape of the No. 8 reperforator is perforated so as to reproduce the code perforations of the primary tape corresponding to the number 498 and no other reperforators will operate at this time.

As the primary tape 44 is fed through the reader due to the stepping action of pawl 46 on the ratchet wheel 45 in a manner previously described, the next number encountered by the reader sensing fingers 22 is 244. Since the selectors 77 of reperforator No. 4 are the only selectors having code holes corresponding to the digit 4 which is the digit of the channel in which the sort is being undertaken, only the uppermost selector 77 of the reperforator No. 4 will have its two code holes 98 in registry with the projections 90 of the operated latch levers 60 of channel F. This selector is the only one therefore that will follow the cam 83 thereof. Consequently, only reperforator No. 4 will function to reproduce on its tape, in code perforations, the number 244 encountered by the sensing fingers 22 of the reader.

It is deemed unnecessary to describe in detail how each of the reperforators selectively functions to record the remainder of the numbers disclosed, by way of example, in Fig. 8. Suffice it to say that reperforator No. 7 will record the number 527; reperforator No. 2, the number 342; reperforator No. 6, the number 036; the zero reperforator, the number 760; reperforator No. 6, the number 216; reperforator No. 9, the number 609; etc. The individual reperforator tapes are represented by the first set of rectangles in Fig. 9 and show the numbers recorded thereon as the result of the first sort by units. It will be noted that all numbers having the same units digit are recorded on the same tape. For example, the numbers 760 and 910 are recorded on the tape of the "zero" reperforator; the numbers 871 and 101 are recorded on the tape of reperforator No. 1; etc.

The next sorting is done in the tens column, that is, the second sorting operation is controlled by the tens digits of the numbers recorded on the individual reperforator tapes. In this sorting operation the individual reperforator tapes resulting from the first sort are passed consecutively through the reader, 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 to 9, inclusive. Since the second sorting is done in accordance with the tens digits, or in channel E, the hand crank 83 is turned until a flat surface on each of the selecting cylinders

84 is presented to the underside of the selectors 77 corresponding to channel E. Rotation of the crank 93 to cause the select cylinders 84 to rotate clockwise through 72 degrees from the position they occupy in Fig. 7 will result in the required setting of the cylinders for sorting in the tens, or E channel.

It is believed unnecessary to describe in detail the operation of the reperforators during the second sorting since it is identical with that given above in connection with the first sorting operation except for the setting of the select cylinders just described. It need be said only that as a result of passing the ten individual reperforator tapes obtained from the first sort through the reader consecutively, there are obtained ten new individual reperforator tapes each of which bears, in code perforations, those numbers having the same tens digit. For example, and as indicated in Fig. 9, the tape of the "zero" reperforator bears the numerals 101 and 609; the tape of reperforator No. 1 bears the numerals 910 and 216; and so on.

Since it has been elected, for simplicity of description, to deal with three digit numbers only, a third and final sort is necessary which is done in accordance with the hundreds digits, or in the channel D. The hand crank 93, accordingly, is further advanced 72 degrees until a flat surface of each select cylinder 84 is located directly under the selector 77 of each reperforator corresponding to channel D, and 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 each of which bears those numerals (in code) which have the same hundreds digit, and the numbers on the tapes are arranged in numerical order. For example, and as shown in Fig. 9, the tape of the "zero" reperforator bears, in code, the numerals 025 and 036; the No. 1 reperforator tape bears the numerals 101 and 151; etc.

It is apparent from the foregoing description that the unsorted, or jumbled entries on the primary tape 44, as a result of the three sorting operations have been brought together and arranged in numerical order. The foregoing description deals only with numbers of three digits. It is clear that as the number of digits increases the number of sorts required will increase correspondingly.

The description of the operation of the sensing device and reperforators of this invention thus far has not dealt particularly with the sequence in which the various elements of the devices perform their functions. It is thought that this phase of the description may be better handled by enumerating the various steps performed during a complete cycle of operation in order of their occurrence. To further set forth the sequence of operation, Fig. 11 of the drawing is offered as a diagrammatic representation of the sequence in which the more important steps in the cycle are performed.

The sequence of operation

- (1) The reader pins or sensing fingers 22 enter the code perforations in the reader tape 44.
- (2) The code levers 20 operate.
- (3) The select lever 77 operates and receives the projections 90 of the latch levers 60 in the code holes 98.
- (4) The perforating levers 62 operate and cause

the reperforator punch pins to perforate the tape 66.

(5) The perforating levers 62 and the select levers 77 restore to normal. While the perforating levers restore, the reperforator stepper spring is tensioned.

(6) The reperforator stepper pawl 74 operates and the code levers 20 restore.

(7) The reader pins or sensing fingers 22 restore and the reader stepper spring is tensioned.

(8) The reader drum 43 is stepped to the next position.

The operations performed by the apparatus disclosed on the drawings are fully mechanical. That is, the code which the sensing fingers of the reader detect is mechanically transmitted to the latch levers 60 of the reperforators and the selection of one out of ten reperforator units is made mechanically.

If it is desired to nullify the reperforator selecting feature of the present invention in order to permit all reperforator units to perforate their respective tapes simultaneously for gang reproduction this may be accomplished by providing each reperforator with an electromagnet 114 which may be energized from any suitable source of current in any convenient manner. The energization of magnet 114 removes the latch lever 81 from its normal latching position relative to the cam lever 69 and removes the common bar 80 from contact with the arms 79 of select levers 77. Thus the selected perforating levers 62 of all ten reperforators will be free to operate, it being understood that all ten magnets 114 would be energized when simultaneous operation of all reperforator units is desired. While it is indicated that each reperforator be equipped with a magnet such as magnet 114 it is to be understood that a single magnet may be employed to control all ten latch levers 81. Wire connections between latches 81 of the ten reperforators similar to the wire connections between the latch levers 60 may be resorted to and controlled by a single magnet if desirable.

Similarly all reperforators may be blocked for inspection, maintenance or other purposes by the operation of a magnet 116 in each reperforator unit. The magnet 116 controls a lever 115 which when operated moves its common bar 117 to the left thereby preventing the operation of the select levers 77. Again these magnets may be individual to each of the reperforators or a single magnet may be utilized for gang operation.

Should it be desirable to stop the reader drum 43 for inspection, maintenance, or other reasons, this may be accomplished by means of an electromagnet 120 which, when energized, disables the reader stepping lever 47 which carries the stepping pawl 46. The electromagnets 114, 116 and 120 are not required in the normal operation of the sorting mechanism, which is wholly mechanical.

What is claimed is:

1. In a combined code sorting and reproducing mechanism by means of which multidigit entries, whose different digits are each symbolized by a different pattern of perforations on a recording medium to be sensed by a reading device, are selectively reproduced on the recording media of a plurality of reperforators, means controlled by the reading device in accordance with the digital patterns of an entry read by the reading device for preparing all the reperforators for operation to reproduce the digital patterns of the entry read, individual means at each of the re-

perforators for detecting a different one of the digital patterns of which an entry may be composed to the exclusion of all others, and means controlled by said detecting means and responsive to the detection thereby of a particular digital pattern for causing the operation of the corresponding reperforator.

2. In a combined code sorting and reproducing mechanism by means of which multidigit entries, whose different digits are each symbolized on the code tape of a reading device by a different pattern of perforations, are selectively reproduced on the tapes of a plurality of reperforators, individual means in each reperforator operable in combinations corresponding to each of the digital patterns of the entries read by the reading device, means controlled by the reading device for operating the said individual means of all the reperforators in combinations corresponding to the digital patterns of the entries read by the reading device, individual means at each of the reperforators for detecting the operation of a different combination of said individual means corresponding to a different particular one of the digital patterns of which a multidigit entry may be composed, and means controlled by the detecting means of each reperforator and responsive to the detection thereby of the operation of a particular combination of said individual means for causing the operation of the corresponding reperforator.

3. In a combined code sorting and reproducing mechanism by means of which multidigit entries, whose different digits are each symbolized on the code tape of a reading device by a different pattern of perforations, are selectively reproduced on the tapes of a plurality of reperforators, means controlled by the reading device for preparing all the reperforators for operation to reproduce the digital patterns of the entries read thereby, said means including latch levers which operate in combinations corresponding to the digital patterns of the entries read by the reading device, and means for rendering each of the reperforators selectively responsive to reproduce only the code entries read by the reading device which contain a digital pattern individually characteristic of each reperforator comprising means individually characterizing each of the reperforators in accordance with a different digital pattern and cooperating with the latch levers of the associated reperforator to detect an operated combination thereof corresponding to the characterizing digital pattern, and means controlled thereby for causing the operation of the corresponding reperforator.

4. In a combined code sorting and reproducing device by means of which multidigit entries, whose different digits are each symbolized on the code tape of a reading device by a different pattern of perforations, are selectively reproduced on the tapes of a plurality of reperforators, means controlled by the reading device in accordance with the digital patterns of an entry read by the reading device for preparing all the reperforators for operation to reproduce the digital patterns of the entry read, means individual to each reperforator for detecting a different controlling digital pattern occurring in any digital position of the entry read, manually operable means for setting the detecting means of all the reperforators so as to cause them to detect the controlling digital pattern when in a particular digital position of the entry, and means responsive to the detection of a controlling digital pattern in the

said particular digital position by the detecting means of any of the reperforators for rendering the corresponding reperforator operable.

5. In a combined code sorting and reproducing mechanism by means of which multidigit entries, each of the different digits of which is symbolized on the code tape of a reading device by a different pattern of perforations, are selectively reproduced on the tapes of a plurality of reperforators, a plurality of tape perforators for each reperforator, means individual to each tape perforator for preparing it for operation, wholly mechanical means controlled by the reading device in accordance with the digital patterns of an entry read by the reading device for simultaneously operating the tape perforator preparing means of all reperforators in combinations corresponding to the digital patterns of an entry read by the reading device whereby a corresponding combination of said tape perforators in each reperforator is prepared for operation, individual means at each reperforator for detecting the operation of a combination of the tape perforator preparing means thereof corresponding to a particular controlling digital pattern of the entry read by the reading device, and means controlled by said detecting means and responsive to the detection thereby of the operation of a combination of tape perforator preparing means corresponding to the said particular controlling digital pattern for rendering the corresponding reperforator operable.

6. In combination, in a combined code sorting and reproducing mechanism, a device for reading multidigit entries of a code tape, each different digit of an entry being symbolized on the tape by a different pattern of perforations, a reperforator comprising a detecting lever having apertures therein arranged to simulate a particular digital pattern of an entry on the tape of said reading device, latch levers having projections normally out of alignment with the apertures in said detecting lever, means controlled by the reading device when reading an entry containing the digital pattern simulated by the apertures of said detecting lever for operating a corresponding combination of said latch levers whereby the projections thereof are moved into alignment with the perforations in said detecting lever, means for operating said detecting lever to cause the apertures thereof to register with the aligned projections of the operated latch levers, means for operating said reperforator, and means responsive to the registering of the detecting lever apertures with the latch lever projections for enabling said reperforator operating means.

7. In a combined sorting and code reproducing system, means for reading perforated records containing entries symbolized thereon as code perforations, said means including a plurality of code levers and means for operating said code levers in combinations corresponding to the code perforations on said record; a plurality of reperforators each including individual perforating levers corresponding in number to the number of code levers of said reading means, and a latch lever individual to each of said perforating levers normally latching its corresponding perforating lever against operation; a code wire connecting each code lever of said reading means with a corresponding latch lever of each of said reperforators whereby a combination of latch levers in each of said reperforators corresponding to the combination of operated code levers in said reading means is actuated through the media of said

code wires to unlatch a corresponding combination of perforation levers in each of said reperforators, means in each of said reperforators for detecting the operation of a different combination of said reader code levers; and means controlled by the detecting means for causing the operation of the unlatched perforating levers of the corresponding reperforator.

8. In a combined sorting and code reproducing mechanism, means for reading perforated records containing entries symbolized thereon by perforation patterns, said entries representing multidigit numbers and said reading means including a plurality of code levers and means for operating the code levers in combinations corresponding to the digital patterns of the entries read by said reading means; a plurality of reperforators each including individual perforating levers corresponding in number to the number of code levers in said reading means, means for preparing each of said perforating levers for operation, a mechanical linkage connecting each code lever of said reading means with a corresponding preparing means of each of said reperforators whereby a combination of perforating levers in each reperforator corresponding to the combination of code levers operated in said reading means is prepared for operation, and means for rendering the perforating levers of each of said reperforators selectively responsive to reproduce particular entries read by said reading means comprising detecting levers for each of said reperforators having apertures therein arranged to simulate the digital pattern of a particular digit, means associated with the preparing means of each reperforator and adapted to register with the apertures of the corresponding detecting levers when the entry read by said reading means contains the digital pattern simulated by the said apertures, and means controlled by said detecting levers when the apertures thereof register with said last-mentioned means for causing the prepared perforating levers of the corresponding reperforator to operate.

9. In a reperforating system, a code tape reader comprising a tape having code perforations therein, a plurality of code levers and means for operating said code levers in combinations corresponding to the code perforations in said tape; a plurality of reperforators each comprising perforating levers corresponding in number to the number of code levers in said reader and a latch lever for each of said perforating levers normally positioned relative to its corresponding perforating lever so as to block the said perforating lever against operation; and means comprising mechanical linkages connecting each of the code levers of said reader with a corresponding latch lever of each of said reperforators whereby a combination of latch levers in each of said reperforators corresponding to the combination of code levers operated by said reader operating means is actuated to unblock a corresponding combination of perforating levers in each of said reperforators.

10. In a reperforating system, a code tape reader comprising a tape having code perforations therein, a plurality of code levers, and means for operating said code levers in combinations corresponding to the code perforations in said tape; a plurality of reperforators each comprising perforating levers corresponding in number to the number of code levers in said reader; and a latch lever for each perforating lever normally blocking the corresponding per-

forating lever against operation; a code wire connecting each of said reader code levers with a corresponding latch lever in each of said reperforators whereby a combination of latch levers in each of said reperforators is operated in response to the operation of a corresponding combination of said reader code levers to unblock a corresponding combination of perforating levers in each of said reperforators, and means mechanically cooperating with the latch levers of each of said reperforators for causing the operation of the unblocked perforating levers of the corresponding reperforator.

11. In a code reader, a record bearing perforations symbolizing code entries, a plurality of code levers, an operating device for said code levers normally in uncoupled relation thereto, sensing fingers corresponding in number to the number of said code levers, means for causing said sensing fingers to explore said record for code perforations, and means individual to each of said sensing fingers responsive to the finding thereby of a perforation in said record for coupling the corresponding code lever with said operating device.

12. In a code reader, a record bearing perforations symbolizing code entries, a plurality of code levers, a common operating device for said code levers normally in uncoupled relation thereto, sensing fingers corresponding in number to the number of said code levers, means for causing said sensing fingers to explore said record for code perforations, and means responsive to the finding of a code perforation in said record by any one of said sensing fingers for coupling the corresponding code lever with said common operating device comprising a select finger carried by each of said sensing fingers and adapted to be interposed between the corresponding code lever and said common operating device when the sensing finger finds a code perforation in said record, and means for operating said common operating device whereby said common operating device functions to operate the said code lever through the medium of the interposed select finger.

13. In a code reader, a record bearing perforations symbolizing code entries, a plurality of code levers each having an apertured projection, a common operating device for said code levers movable in front of the apertures in said code levers, sensing fingers corresponding in number to the number of said code levers, a select finger fixed at one end to each of said sensing fingers and having its other end freely disposed within the aperture of a corresponding code lever, means for causing said sensing fingers to move towards said tape to explore it for code perforations and to continue to move in the same direction when code perforations are encountered thereby, whereby the said select fingers experience a similar movement and those select fingers corresponding to the sensing fingers which encounter code perforations are projected outwardly from the apertures in their corresponding code levers and into the path traversed by said common operating device, and means for operating said common operating device whereby the ends of the projected select fingers are engaged by said common operating device to transmit the movement thereof to corresponding code levers.

14. Devices for reading and selectively transferring to one of a plurality of recording media a plurality of multicharacter entries, comprising sensing means for the whole of a multicharacter

entry, recording means for each recording medium for recording a multicharacter entry, and wholly mechanical means interconnecting the sensing means and the recording means of each recording medium controlled by the sensing of each multicharacter entry to limit the recording of that entry selectively in accordance with less than the whole of the characters of the multicharacter entry.

15. Devices for reading and selectively transferring to one of a plurality of recording media a plurality of multicharacter entries in which the characters have denominational and positional values comprising sensing means for the whole of a multicharacter entry, recording means for each recording medium for recording a multicharacter entry, and wholly mechanical means interconnecting the sensing means and the recording means of each recording medium and controlled by the sensing of each multicharacter entry to limit the recording of that entry selectively, first, in accordance with characters of one position only and, secondly, to a single recording medium designated by the denominational value of said individual characters.

16. In combination, means for sensing record strip borne indicia corresponding to and representing successive multicharacter entries in which characters have an individual significance and a positional significance, recording means for recording said multicharacter entries upon other record strips selectively according to the designated individual characteristics of characters in one position only, and mechanical means interconnecting the sensing means and the recording means for controlling the recording means selectively to inhibit recording by recorders undesignated by each individual character of said one position.

17. In combination, means for sensing record strip borne indicia corresponding to and representing successive multicharacter entries in which characters of different individual designations may be located in one position of the multicharacter entries, and recording means controlled wholly mechanically by said sensing means for recording identical entries upon one of several recording strips selectively according to the individual characters of their successive entries in a selected position, and common drive means for driving said sensing and recording means isochronously step by step to sense and rerecord each successive multicharacter entry.

18. In combination, means for sensing record strip borne indicia corresponding to and representing successive multicharacter entries in which characters of different individual designations may be located in one position of the multicharacter entries, and recording means for recording similar entries upon one of several recording strips selectively according to the individual characters of their successive entries in a selected position, settable means settable to any one of a number of conditions equal in number to the number of characters in the multicharacter entries, and means controlled in each condition of said settable means for establishing the selectivity of the recording means to control by characters of a particular position of said multicharacter entries.

19. In combination, a mechanical sensing device for reading code holes representing multidigit numbers, recording devices for recording code holes representing identical numbers on record media, and means including mechanical

interconnections between said sensing device and said recording devices whereby numbers having a particular digital value in a particular digital position are recorded exclusively on a particular medium, all numbers having another digital value in said digital position are recorded exclusively on a second particular medium, etc. for all said media.

20. In a combined code sorting and reproducing mechanism by means of which multidigit entries are reproduced on the recording tapes of a plurality of reperforators, each of the different digits of which is symbolized by a different pattern of perforations on a recording tape to be sensed by a reading device, the combination of a reading device, a plurality of reperforators, mechanical linkages interconnecting said reading device and said reperforators for preparing the reperforators to reproduce the digital patterns sensed by the reading device, means for conditioning each of said reperforators to reproduce on its recording tape only those entries sensed by said reading device which contain a particular digital pattern in a particular digital position whereby each of said reperforators, when operated, reproduces on its tape only those entries which contain the particular digital pattern in the particular digital position, means for inhibiting said conditioning means whereby all said reperforators, when operated, reproduce on their respective tapes all the entries sensed by said reading device, and means for operating said reperforators.

21. In a combined code sorting and reproducing mechanism by means of which multidigit en-

tries are reproduced on the recording tapes of a plurality of reperforators, each of the different digits of which is symbolized by a different pattern of perforations on a recording tape to be sensed by a reading device, the combination of a reading device, a plurality of reperforators, mechanical linkages interconnecting said reading device and said reperforators for preparing the reperforators to reproduce the entries sensed by said reading device, means for conditioning each of said reperforators to reproduce on its tape only those entries sensed by said reading device which contain a particular digital pattern in a particular digital position whereby each reperforator, when operated, reproduces on its tape only entries which contain the particular digital pattern in the particular digital position, means for inhibiting the conditioning means of certain reperforators whereby said certain reperforators, when operated, reproduce on their respective tapes all the entries sensed by said reading device, and means for operating said reperforators.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,997,156	Tauschek	Apr. 9, 1935
2,031,686	Borel	Feb. 25, 1936
2,112,951	Carpenter	Apr. 5, 1938
2,180,058	Jones	Nov. 14, 1939
2,204,957	Carpenter	June 18, 1940