May 8, 1956 R. F. MALLINA 2,744,578

CODE TAPE PERFORATORS

Filed Nov. 2, 1951 2 Sheets-Sheet 1

FIG. 1

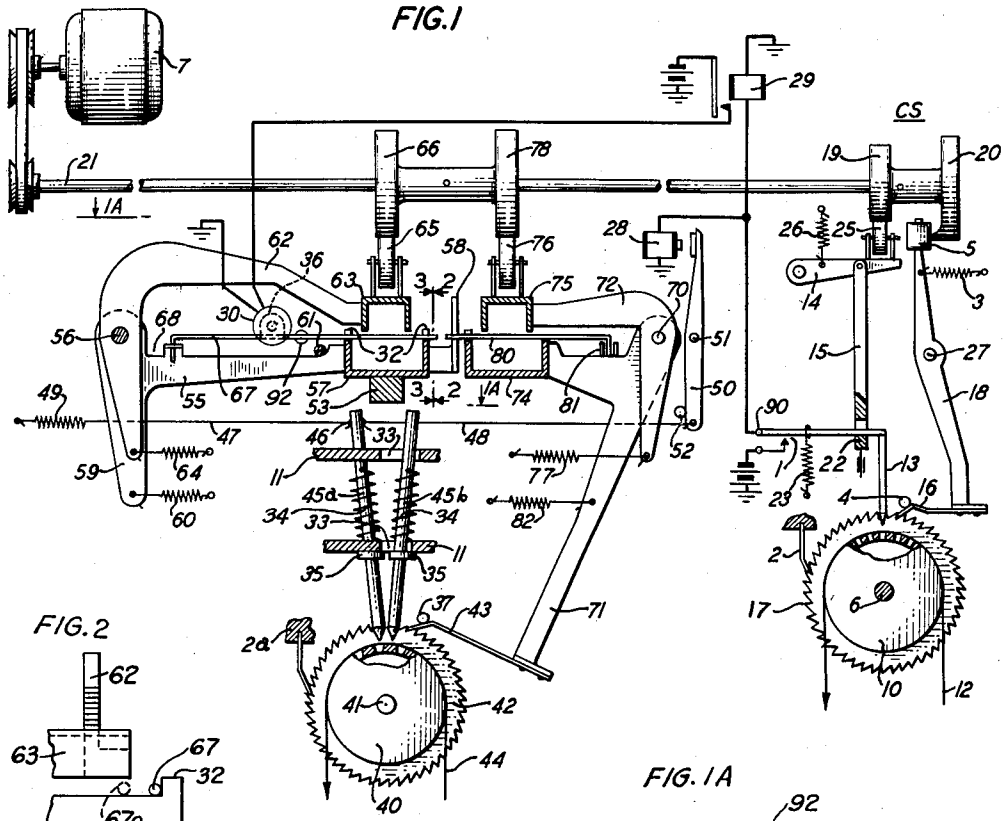


FIG. 2

FIG. 3

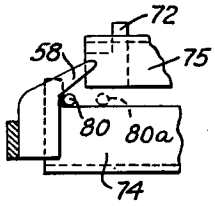


FIG. 1A

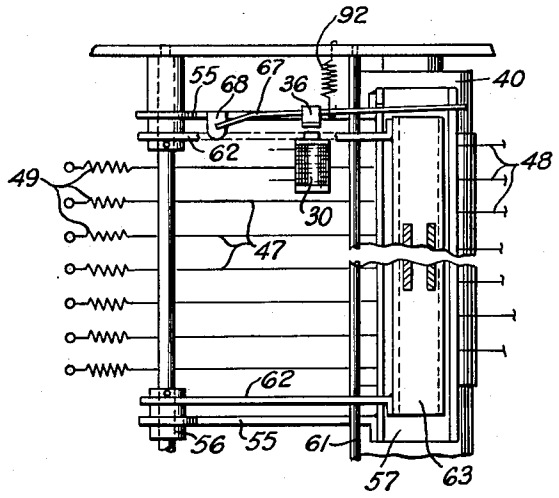
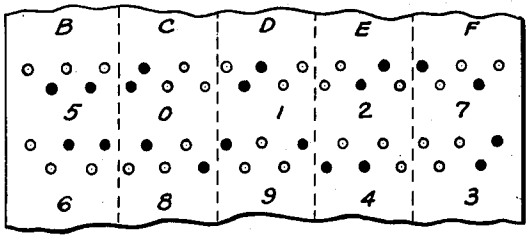


FIG. 4



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May 8, 1956 R. F. MALLINA 2,744,578

CODE TAPE PERFORATORS

Filed Nov. 2, 1951 2 Sheets-Sheet 2

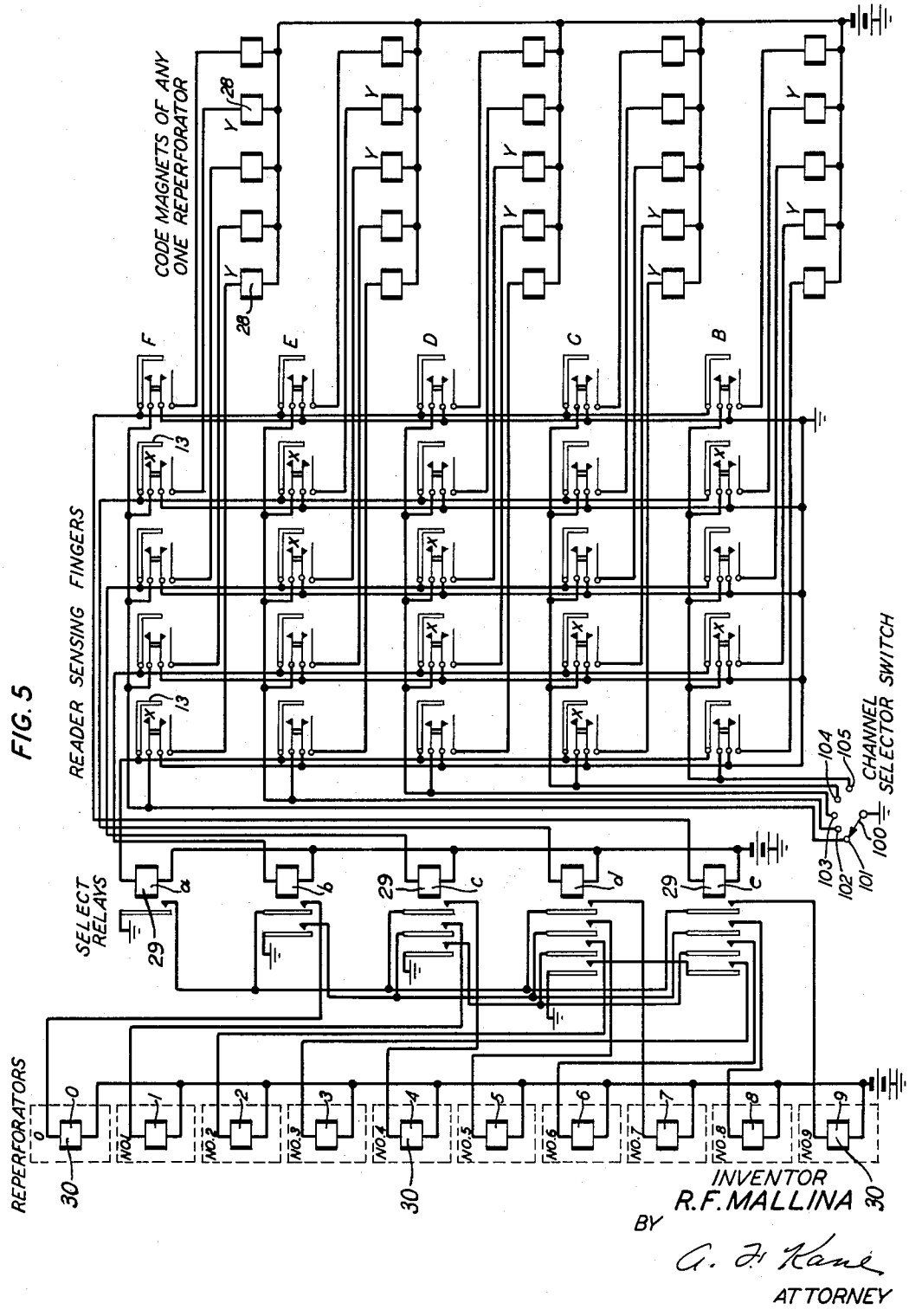

FIG. 5

United States Patent Office 2,744,578 Patented May 8, 1956

2,744,578

CODE TAPE PERFORATORS

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Application November 2, 1951, Serial No. 254,524

8 Claims. (Cl. 164—115)

This invention relates to code sorting systems and particularly to tape perforating devices used in sorting systems of the type in which coded entries indiscriminately recorded on a primary recording medium are caused to be selectively reproduced in orderly sequence on the recording media of a plurality of tape reperforators under the control of a common code sensing device, or reader.

In a known system of the type defined above, a primary recording medium, such as a paper tape, upon which perforation patterns symbolizing numerically identified items have been recorded is explored by the sensing fingers of the code sensing device, or reader, and as the reader fingers encounter perforations in the tape, corresponding punches or perforating pins in each of ten tape reperforators are prepared for operation to reproduce on individual paper tapes the perforation patterns encountered by the reader fingers. Each of the ten tape reperforators is differently preconditioned to detect a particular one of the ten digital patterns of which a numerically identified item may consist and to perform a tape perforating operation only when the item sensed by the reader contains the digital pattern the reperforator is preconditioned to detect. Means common to all the reperforators is provided whereby each reperforator is rendered selectively operative to reproduce a reader-sensed item which contains its corresponding characteristic digital pattern only when the said pattern occupies a particular digital position. Thus it is possible with such an organization of apparatus to reproduce on individual reperforator tapes and in orderly sequence, a multiplicity of coded items indiscriminately recorded on a primary tape. In the system briefly described and which is disclosed in my copending application, Serial No. 635,355, filed December 15, 1945, now Patent 2,576,844, granted November 27, 1951, the control exercised by the code sensing device, or reader, over the ten reperforators and the selectivity of operation thereof are attained wholly through mechanical means.

It is the object of this invention to provide an improved system of code sorting of the type disclosed in the above-identified copending application and to otherwise simplify the tape reperforators employed in such a system.

The attainment of this object is made possible by the use of a novel design of tape perforator, or reperforator, the selection of which and its preparation for operation to reproduce coded items sensed by a code sensing device are controlled by the code sensing device through the media of electromagnetically operated devices and the actual code reproducing, or punching operation is controlled through mechanically controlled instrumentalities.

In accordance with a particular feature of the invention each punch, or perforating pin of the reperforator is rendered individually responsive to the control of a corresponding sensing finger of a code sensing device through the medium of an electromagnetically operated code lever. More particularly, the reperforator code levers

which individually prepare corresponding perforator pins for operation are individually controlled by code magnets which, in turn, are directly controlled electrically by the sensing fingers of the code sensing device, whereby the operation of groups of code sensing fingers in sensing particular code patterns is reflected to corresponding reperforator code levers and therefore, to corresponding reperforator punch pins. In this manner information recorded in code on a recording medium explored by a code sensing device is relayed to the reperforator through electromagnetically operated means controlled by the sensing fingers of the code sensing device.

Another feature of the invention contemplates the selection of the reperforators, in accordance with particular digital code patterns encountered by the sensing fingers of the sensing device, through the media of electromagnetically controlled means. More particularly, each of a plurality of reperforators is provide with a select magnet which, when operated under the control of the code sensing device in accordance with a particular code pattern encountered thereby, serves to render the prepared punch pins of the reperforator operable by the reperforator punch pin operator, or hammer. The punch pin operator, or hammer of the reperforator of this invention is normally in uncoupled relation to a cam-operated follower so that, while the follower responds continuously to the control of a continuously operating cam, the punch pin operator normally remains stationary. When the reperforator select magnet is operated in response to the sensing of a particular code pattern by the sensing device, it functions to mechanically couple the punch pin operator to the cam follower thereby rendering the punch pin operator, or hammer, operable by the rotating cam.

A related feature of the invention resides in a control circuit comprising a group of translating relays controlled directly by the sensing fingers of the code sensing device, which recognize and interpret the various code patterns by which the digits of a multidigit number are symbolized, to selectively control the electromagnetically operated coupling means of the reperforator in accordance with a particular digit-symbolizing code pattern.

Another feature of the invention resides in a novel method of and means for controlling the tape feed or stepping of the reperforator tape drum. A drum-stepping, or indexing lever is normally in uncoupled relation to a cam follower which cylically responds to a continuously operating cam and is mechanically coupled thereto by means directly under the control of the reperforator punch pin operator, or hammer, so that during the operation of the hammer the drum-stepping lever is effectively coupled to the cam follower to be operated thereby under control of the continuously operating cam. When thus operated, the drum-stepping lever disengages a stepping pawl from a ratchet associated with the tape drum and prepares it for reengagement with a succeeding tooth of the ratchet under the joint control of the cam and a coil spring. This reengagement of the stepping pawl with the ratchet which results in advancing the tape drum one step takes place after the reperforator punch pins have been withdrawn from the tape after having performed a perforating operation thereon.

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

Fig. 1 is a structural schematic view, partly in section, of a reperforator embodying the features of the invention and of a code sensing device, or reader, which controls the reperforator. In this figure, the electrical controls exercised by the sensing fingers of the code sensing device are shown schematically in that a single spring contact

is illustrated as controlling both the code magnets and the select relays, the latter being represented by a single relay **29**. Actually and as indicated in Fig. 5, each sensing finger controls a pair of spring contacts and the select relays **29** are five in number;

Fig. 1A is an enlarged plan view of a portion of the mechanism shown in Fig. 1, illustrating particularly the perforator select finger and the elements which control its movement;

Fig. 2 is an enlarged fragmentary detail view taken along the line **2—2** of Fig. 1, looking in the direction of the small arrows. In this figure the normal and alternate positions of the select finger, or interponent member which is controlled by the reperforator select magnet to couple the punch pin operator to the cam follower, are indicated;

Fig. 3 is an enlarged fragmentary detail view taken along the line **3—3** of Fig. 1, looking in the direction of the small arrows. In this view the interference, or interponent member and its associated camming device which cooperate in coupling the indexing, or stepping lever to its cam follower are shown in their normal and operated positions.

Fig. 4 illustrates a section of tape provided with perforations corresponding to the five-digit numbers 50127 and 68943; and

Fig. 5 is a circuit schematic drawing illustrating the manner in which the code magnets and select magnets of the reperforators are selectively controlled by the sensing fingers of the code sensing device, or reader.

In Fig. 1 there is illustrated a common drive shaft **21** which is continuously rotated at a uniform speed by a motor **7**. This shaft is hereinafter referred to as the cam shaft in that it carries the reader cams **19** and **20** and two cams **66** and **78** of each of ten reperforators. The cam shaft is thus common to all of ten reperforators of the type disclosed in Fig. 1 and to a single code sensing device, or reader CS which functions to selectively control the reperforators in accordance with code perforations appearing on a primary tape **12** and encountered by code sensing fingers **13** of the reader during a sensing operation.

The reperforator disclosed in Fig. 1 is herein characterized as a two-cam type in that separate cams are employed in controlling the actual tape perforating operation and the stepping of the tape-bearing drum. These cams **66** and **78** are shown as a single structure in Fig. 1. It is obvious that these two operations must be performed in a definite time sequence. The cams **66** and **78** are designed to insure this necessary sequence of operations.

Each reperforator is, of itself, a complete unit and consists essentially of a tape-bearing drum, a plurality of tape-perforating punch pins, a cam-controlled punch pin operator assembly, a cam-controlled stepping assembly for the tape drum, and a code lever for each punch pin. In the present description it is assumed that the coded items which appear as perforation patterns on a primary tape and are to be selectively reproduced on the tapes of the reperforators are five-digit numbers and that each digit is symbolized by two perforations out of a fixed pattern of five in accordance with the well-known "two-out-of-five" code and as illustrated in Fig. 4. Thus, it is evident that to accommodate such five-digit numbers each reperforator must include twenty-five punch pins and a corresponding number of code levers.

In order to simplify the drawing only one code lever **50** is illustrated. In actual practice the reperforator includes a group of twelve levers located to the right of the structure and a group of thirteen levers situated at the left. The levers of each group are mounted for limited rotation on a horizontal shaft such as shaft **51**. The upper end of each code lever **50** is suitably equipped so as to render it responsive to the energization of a corresponding electromagnet **28**. There being twenty-five levers **50**, there will be twenty-five code magnets **28** each located with respect to its corresponding lever in the manner illustrated. To the lower end of each code lever **50** there is secured one end of a code wire **48** which connects with an extension **47** thereof by way of an insert **46** which is fitted into a slot in the upper end of a corresponding punch pin **45***a*. The left end of code wire section **47** is secured to one end of a coil spring **49**, the other end of which is suitably anchored to the reperforator frame. There is one code wire and also one coil spring **49** for each punch pin such as **45***a* and **45***b*. It is understood of course that the coil springs **49** associated with punch pins such as pins **45***b* are located at the right and the corresponding code levers **50** at the left. Normally, the code levers **50** are held in contact with a stop rod such as rod **52** under the influence of their corresponding springs **49**.

The twenty-five punch pins **45***a*, **45***b* are spring mounted between two shelf-like plates **11** which are provided with suitable slots **33** which freely accommodate the pins and permit them to be moved under the action of their corresponding code wires. The pins are arranged in two groups, one consisting of twelve pins **45***a* normally inclined to the left in the drawing and another of thirteen pins **45***b* inclined to the right. Those pins which incline to the left are controlled by the code levers located on the right of the structure whereas those which incline to the right are controlled by the code levers located on the left side of the assembly. The shank or pin portion located between the two plates **11** is encircled by a coil spring **34** which tends to urge the pin upward. To maintain the pins in the position illustrated each is provided with a stop ring **35** which abuts the under surface of the lower plate **11**.

A horizontal shaft **41** disposed immediately below the lower cone-shaped ends of the punch pins supports a tape-bearing drum **40** which may be of any suitable design such, for example, as shown in the copending application, Serial No. 588,401, filed April 14, 1945, now Patent 2,583,086, granted January 22, 1952 to W. W. Carpenter. The drum, or cylinder **40** is mounted on the shaft **41** for step-by-step rotation under control of a stepping pawl **43** which cooperates with a ratchet wheel **42** fixed to one end face of the drum. A paper tape **44** is fed over the drum **40** and is adapted to be perforated by the pins **45***a* and **45***b* when the pins, after having been selectively set by their corresponding code levers **50**, are driven downward into the tape by means of a punch pin operator.

The punch pin operator assembly comprises a pair of substantially horizontal levers **55** which at the inwardly projecting ends thereof support an integrally formed U-shaped, or channel member **57** which is disposed in superposed spaced relation to the punch pins **45**. The levers **55** are rotatably supported by a horizontal shaft or rod **56** and are provided with depending integrally formed arms **59** to each of which one end of a coil spring **60** is secured, the other end of which is suitably anchored to the reperforator frame. The spring **60** serves to normally exert a counter-clockwise pull on the lever **55** and to thereby maintain it normally in engagement with a common stop rod **61**. The U-shaped hammer **57** of the punch pin operator supports, on its under surface, a resilient pad **53** which, when the levers **55** are operated in a manner to be hereinafter described, engages the upper ends of those punch pins which previously have been positioned therebeneath incident to the operation of corresponding code levers **50**.

The punch pin operator is actuated by means of a lever, or cam follower **62** and a coupling select finger **67** under control of cam **66**. The lever **62**, at its outer end supports an inverted U-shaped integral member **63** which supports a roller **65** on its upper face. Through its associated roller **65**, the lever **62** responds to the control of cam **66**. A spring **64** serves to maintain the roller **65** and the cam **66** in constant peripheral contact.

The select finger is an elongated rod which is pivotally mounted in any suitable manner at **68** on the lever **55** and extends radially from its pivot support so as to span

the two edges of the U-shaped hammer **57** near its forward end as shown in Fig. 2. In this position the rod clears the forward end of the inverted U-shaped member **63** so that the lever **62** is free to follow the operations of cam **66** without interference from the rod. The lever **62** therefore, is free to operate under control of cam **66** without influencing the punch pin operator lever **55**. Intermediate its extremities the select finger **67** carries a magnetic element **36** which, actually, is the armature of a select magnet **30**. When the magnet **30** is deenergized, the select finger **67** is free to assume its normal position, shown in full line in Fig. 2, under control of suitable restoring means, such as springs **92**, in which position it abuts projections such as **32** which are integrally formed on the forward end of the hammer **57**. When the magnet is energized and the armature **36** is attracted to its operated position, the select finger **67** is moved to its alternate position which is illustrated by the broken outline **67***a* in Fig. 2. In this position the finger is interposed between the edges of the U-shaped members **57** and **63** so that any downward travel of member **63** is transmitted to the member **57** through the select finger **67**. Thus, under certain control conditions exercised by the reader CS and manifested by the energization of the select magnet **30**, the punch pin operator becomes effective to drive previously conditioned punch pins **45***a*, **45***b* into the tape **44**. In this manner the tape **44** is perforated in a pattern determined by the combination of punch pins operated.

Extending to the right of the outer flange of the U-shaped member or hammer **57** near its forward end and integrally formed therewith is a camming element **58** which cooperates with an interference or interponent member or finger **80** in controlling the operation of a tape drum stepping or indexing mechanism. A stepping lever **71** which is rotatably mounted on a horizontal shaft **70** comprises a horizontally disposed arm which terminates in the U-shaped portion **74** and the angularly depending lever arm **71** which carries at its outer end the stepping pawl **43**. The interponent finger **80** is pivotally mounted on the lever **71** at **81** and projects to the left therefrom so as to span the edges of the vertical sides of the U-shaped member **74** near its forward end. The finger **80** is pretensioned to normally maintain it against a lip on the forward end of member **74** as shown in Fig. 3, in which illustrated position the projecting end of the finger **80** is in contact with the sloping edge of cam **58**. In this position the finger **80** is located beyond the forward end of an inverted U-shaped member **75** formed integrally with the lever **72**. On the upper surface of the member **75** a roller **76** is supported which is held in constant peripheral engagement with the cam **78** through the action of spring **77**.

The lever **72** is pivotally mounted on the shaft **70** and responds to the control of cam **78** when the latter is rotated. This response results in a reciprocating movement of the member **75**. While the finger **80** is located in its normal illustrated position the levers **72** and **71** are in uncoupled relation so that the latter remains stationary even though the former responds to the control of cam **78**. However, when the punch pin hammer **55** is moved clockwise about the support **56** in performing its punch operating function, the cam **58** moves with the punch pin operator and in so doing actuates the interponent finger **80** to its alternate position. In this position, which is indicated in broken outline in Fig. 3, the finger **80** is located in the line of travel of the inverted U-shaped member **75** so that as the latter is moved counter-clockwise about its support **70** under the action of cam **78**, the lever **71** experiences a similar movement. Thus the stepping pawl **43** is withdrawn from engagement with the ratchet wheel **42** and assumes a position in which its outer end is located opposite the next succeeding tooth of the ratchet. After the punch pin hammer **55** has completed its punching operation and restores to normal under the joint control of cam **66** and spring **60**, the cam **78** permits the lever **71** to return to normal under control of spring **82** so that the pawl **43** engages the next tooth on the ratchet wheel **42** and advances the drum **40** one step. This clockwise movement of lever **71** is arrested when the pawl **43** engages the stop **37**. It is to be understood that upon return to normal of the punch pin hammer the operated punch pins **45***a*, **45***b* restore to normal under the action of their respective coil springs **34** and are clear of the drum **40** before the pawl **43** functions to advance the drum.

As previously indicated the code levers **50** of the reperforator are operated by individual code magnets **28** which, in turn, are directly controlled by the sensing fingers **13** of the sensing device CS. The code sensing device, or reader comprises a tape drum **10** which accommodates the primary tape **12**, twenty-five sensing fingers **13**, a cam **19** and cam follower **14** which controls the operation of the sensing fingers, and an indexing mechanism comprising the stepping pawl **16**, its supporting lever **18** and the cam **20**.

The perforated tape drum or cylinder **10** of the reader is rotatably supported on the horizontal shaft **6** and may be of any suitable design. Disposed immediately above the drum **10** is a series of twenty-five sensing fingers **13**, only two of which appear in Fig. 1, each of which consists of a horizontal portion and an integral vertically depending leg. The fingers **13** are individually, pivotally mounted at **90** in any suitable manner and are arranged so that the ends of the depending legs thereof are in horizontal alignment and parallel to the axis of shaft **6**. The fingers are supported in their normal illustrated positions by means of a cross-bar **22** which is integrally associated with two connecting rods, only one of which is shown at **15**. Each finger **13** is pretensioned downward against the bar **22** by means of an individual spring **23** so that it has a normal tendency to move in the direction of the drum **10**. Each connecting rod **15** is pivotally secured to a lever **14** which, in turn, is pivotally mounted on the reader framework. The lever **14** illustrated, supports a roller **25** on its upper edge and with the roller **25** constitutes a follower for cam **19**. The cam **19** and roller **25** are maintained in constant peripheral engagement by spring **26** and is so designed that for each revolution thereof the connecting rods **15** and bar **22** are moved downward and then restored to their normal positions. It is during the downward movement of the connecting rod that the sensing fingers explore the primary tape for code perforations as will be described more fully hereinafter.

The cam **20** shown integral with cam **19** and mounted on shaft **21** controls the stepping lever **18** which is rotatably mounted on a horizontal shaft **27**. A roller **5** is carried on the upper end of lever **18** and is held in continuous peripheral engagement with cam **20** by spring **3**. At its lower end the lever **18** supports the stepping pawl **16** which serves to drive the ratchet **17** and therefore, the drum **10** to which the ratchet is fixed, in a step-by-step manner. The fixed pawl **2** serves to accurately position the drum **10** and to preclude clockwise rotation thereof. The fixed pawl **2'** serves the same purpose with respect to the reperforator drum **40**.

Reader operation

The reader or sensing device CS operates in the following manner: The reader tape **12** is propelled by the reader drum **10** in consequence of the operation of the stepping lever **18** and its associated pawl **16**. As a result of each stepping operation of the drum two rows of code perforations on the tape **12** are presented to the exploring ends of the two rows of sensing fingers **13**. As previously indicated there are twenty-five sensing fingers **13** embodied in the reader CS arranged in two rows of twelve and thirteen fingers, respectively. One such pin is shown in Fig. 1. Also, the code tape **12** includes five channels, B, C, D, E and F (Fig. 4) each of which provides five

possible positions in which perforations may appear. As shown in Fig. 4 the five possible perforation positions in each channel are staggered to effect two lines of three and two positions, respectively.

In the position of the reader illustrated it will be assumed that two rows of perforations comprising five groups of two perforations (each group symbolizing a particular digit as illustrated in Fig. 4) are located immediately below the exploring ends of the sensing fingers **13** and that, by means of the motor **7** and shaft **21**, the reader cams **19** and **20** are rotating.

As the cam **19** rotates, it forces the connecting rod **15** downward during the first portion of its cycle of operation. All twenty-five sensing fingers **13** thus are freed to respond to the influence of their respective springs **23** and accordingly they are moved in the direction of the drum **10**. All but ten of the fingers encounter imperforate portions of the tape **12** and are arrested in their downward travel thereby. The remaining ten fingers continue their downward travel and the exploring ends thereof pass through the code perforations in the tape **12**. Thus ten sets of contacts **1** are operated by their corresponding sensing fingers. The results of the closure of these ten contact sets will be described in detail hereinafter.

The contour of cam **20** relative to that of cam **19** is such that as the sensing fingers **13** enter the perforations in the tape, the lever **18** is moved in a counter-clockwise direction under the action of cam **20** and against the restraining influence of spring **3**. The pawl **16** is thus disengaged from the ratchet **17** and is located with its operating end in position to engage a different tooth of the ratchet when the cam **20** permits the spring **3** to rotate the lever **18** in a clockwise direction. This occurs just as the operated perforating pins are withdrawn from the drum apertures and under the action of spring **3** the lever **18** through the pawl **16** drives the drum **10** counter-clockwise to the next position. The stop **4** insures stopping of the drum in correct position. The code tape **12** is thus stepped around with the drum so that the next two rows of code perforations thereon are presented to the sensing fingers. The withdrawal of the punch pins is effected when the cam **19** permits the connecting rod **15** to be raised under the action of spring **26**.

Reperforator operation

In response to the closure of ten sets of contacts by the sensing fingers **13** of the reader CS ten corresponding code magnets **28** in the reperforator are operated as are also two select relays **29**. How these magnets and relays are controlled by the reader sensing fingers will be set forth in the description of Fig. 5. For purposes of the present description it will be assumed that a particular pair of relays **29** operates together with ten code magnets **28** in response to the operation of the sensing fingers **13** and that the operation of the particular pair of relays **29** results in the energization of the select magnet **30** of the reperforator shown in Fig. 1.

Each code magnet **28** operates a corresponding code lever **50** which, in turn, positions a corresponding punch pin **45***a*, **45***b* so that its upper end comes within the line of travel of the hammer pad **53**. Thus there are ten punch pins prepared for operation and each operated punch pin corresponds to a particular one of the reader sensing fingers **13** which has found a perforation in the primary tape **12**.

The energization of select magnet **30** causes the select finger **67** to assume its alternate position in which it is located directly under the inverted U-shaped member **63** of the punch pin hammer assembly, thereby effectively coupling the hammer with the actuating lever **62**. As the cam **66** rotates, it functions, subsequent to the operation of the select finger **67** to its alternate position, to move the lever **62** in a clockwise direction about the shaft **56**. In its downward travel the inverted U-shaped member **63** engages the select finger so as to drive it and the U-shaped hammer **57** downward. The pad **53** thus strikes the upper ends of the ten previously set punch pins **45** causing them to move in the direction of the drum **40**. The conical ends of these punch pins thus perforate the tape **44**. The perforation patterns which are produced on the tape **44** in this manner correspond to the perforation patterns which were encountered by the sensing fingers **13** of the code sensing device CS.

During the downward travel of the hammer **57** the cam **58** moves the interponent finger **80** under the inverted U-shaped portion of lever **72** of the indexing assembly as shown in Fig. 3. Thus the two levers **71** and **72** of the indexing assembly are effectively coupled. As the cams **66** and **78** continue to rotate, the latter drives the lever **72** in a counter-clockwise direction, the inverted U-shaped portion **75** thereof engaging the interponent member **80** and thereby driving the U-shaped member **74** downward. Thus the stepping lever **71** is rotated in a counter-clockwise direction about shaft **70** and the pawl **43** is moved out of engagement with the ratchet wheel **42** and its operating end assumes a position opposite a lower point on the toothed periphery of ratchet wheel **42**.

As the cams **66** and **78** continue to rotate, the former permits the levers **62** and **59** of the hammer assembly to restore to normal under the influence of their respective springs **64** and **60**. As the hammer clears the upper ends of the operated perforating pins **45***a*, **45***b*, their respective springs **34** function to withdraw the pins from the tape **44** and, since the code magnets **28** are now deenergized the springs **49** restore the pins to their normal positions.

As the punch pins **45** return to normal position the cam **78** permits the lever **72** to restore under the action of spring **77**. The stepping lever **71** therefore, is enabled to respond to the influence of spring **82** so that it moves in a clockwise direction about its support **70**. This movement of lever **71** causes the stepping pawl **43** to reengage the ratchet **42** at a point sufficiently low on the toothed periphery thereof to cause the drum **40** to be rotated to the next recording position. The drum is arrested in this position by the reengagement of the pawl **43** with the stop **37**. Thus a complete cycle of operations has been completed and the reader and reperforator have resumed their respective illustrated conditions. It is to be understood that the various reader and reperforator operations described above are performed in a definite time sequence which is determined by the relative contours of cams **19**, **20**, **66** and **78**.

Gang operation of reperforators

The manner in which a gang of ten reperforators of the type disclosed is controlled by a single code sensing device will now be described with particular reference to Fig. 5 and incidental reference to Fig. 1. The center portion of Fig. 5 constitutes a schematic showing of twenty-five code sensing fingers **13** of the reader or sensing device CS. As previously indicated each finger controls a set of two make contacts which, for descriptive purpose, are hereinafter referred to as upper and lower contacts. The lower make contacts associated with each sensing finger **13** are individually allocated to a particular code magnet **28** (Fig. 1) in each reperforator. The twenty-five code magnets of any one reperforator are shown at the right of the sensing fingers in Fig. 5. The operation of any one sensing finger results in the energization of a corresponding code magnet in each of ten reperforators over obvious circuits. Immediately to the left of the sensing fingers **13** in Fig. 5 are shown five control or select relays *a*, *b*, *c*, *d* and *e*, each of which is controlled by the upper contacts of the reader sensing fingers in a manner to be described presently. These relays in turn selectively control the operation of the select magnets **30** (Fig. 1) of the ten reperforators 0, 1, 2, . . . 9 schematically indicated at the extreme left of Fig. 5.

The code employed in the present system, as previously indicated, is the well-known "two-out-of-five" code where-

in each element or character of an entry appearing on the primary tape **12** (Fig. 1) is symbolized by perforations located in two-out-of-five possible positions occupying two transverse lines on the tape. Where the code entries correspond to five-digit numbers (Fig. 4) each of the five digital positions on the tape is defined as a channel, such as the units channel, the tens channel, and so on. Each digital position or channel has five transverse points at which perforations may appear in combinations of two perforations to differently symbolize each of the digits 1 to 9, and zero. It is well known that ten different combinations of two perforations each may be derived from a fixed pattern of five.

The ten reperforators schematically indicated at the left of Fig. 5 are respectively designated the zero reperforator, the No. 1 reperforator, ... and the No. 9 reperforator and each is arranged to respond to the control of the reader CS only when the sensing fingers of the latter encounter a perforation pattern which symbolizes a particular digit. For example, the zero reperforator will respond to reproduce a coded item on tape **12** sensed by the reader CS only when the item contains the perforation pattern which symbolizes zero; the No. 1 reperforator will respond to reproduce a coded item only when the sensed item contains the perforation pattern symbolizing the digit 1; and so on. Furthermore, each reperforator may be rendered selectively operable to reproduce a coded item only when the item embodies the particular digital pattern in a particular digital position. This is accomplished by means of a manually operable switch **100** which may be moved manually into engagement with any of five contacts **101**, **102**, **103**, **104** and **105**. This switch is defined as a "channel selector switch" in that it determines the channel in which the controlling digital pattern must appear to effect the operation of the correspondingly identified reperforator.

For clarity of disclosure the twenty-five sensing fingers of the reader CS are arranged in five horizontal rows in Fig. 5, each row comprising five fingers. The top row of fingers serves the units channel F; the second row serves the tens channel E; the third row serves the hundreds channel D; the fourth row serves the thousands channel C; and the bottom row serves the ten thousands channel B. It will be observed that each of the contacts of the channel selector switch **100** corresponds to a particular group of five reader fingers so that each such contact is actually allocated to a different one of the five digital channels or positions of a five-digit number or entry which may be sensed by the reader fingers.

The position of switch **100** determines which of the five groups of sensing fingers is to be effective in controlling the operation of the select relays *a, b, c, d,* and *e,* and therefore determines in which of the five channels a sorting operation is to be performed. When the switch **100** is in engagement with contact **101**, the top row of sensing fingers is enabled to control the select relays and the sorting operation is performed in the units channel F; when the switch **100** is in engagement with contact **102**, the second row of sensing fingers is enabled to control the select relays and the sorting operation is performed in the tens channel E, and so on.

In order to more fully describe the operation of the system illustrated it will be assumed that the sensing fingers **13** of the code sensing device CS encounter, on the reader tape **12**, the digital code patterns which symbolize the number 50127.

When the digital patterns symbolizing the number 50127 are encountered during a sensing operation by the reader there will be operated two sensing fingers **13** in each group of five allocated to the five different digital positions. In Fig. 5 the sensing fingers which are operated under this condition are designated by the small letter *x*. As a result of these operations corresponding code magnets **28** in each of the ten reperforators will be energized and operated. The operated code magnets of one of the reperforators are designated by the small letter *y* in Fig. 5. The operated code magnets, as described hereinbefore, function to prepare corresponding perforating pins **45** in each of the reperforators for operation. Thus, each reperforator is conditioned to reproduce, on its tape **44**, code patterns symbolizing the number 50127.

It will be assumed for descriptive purpose that the sorting operation is to be performed in the units channel F and that the switch **100** has been set, accordingly, on the switch contact **101**. It will now be observed that only the operated sensing fingers **13** of the top row which are allocated to the units channel F are effective to control the operation of the select relays *a, b, c, d,* and *e* and that relays *a* and *d* of this group operate. With these relays operated, select magnet **7** operates in an obvious circuit. Select magnet **7** is individual to the No. 7 reperforator and, when operated, functions to effectively couple the hammer **55** and the cam follower **62** of the No. 7 reperforator thereby causing the hammer **55** thereof to respond to the control of cam **66** and to drive the selected punch pins **45***a*, **45***b* into the tape **44** of the reperforator. Thus the code patterns which symbolize the number 50127 and were sensed by the sensing fingers of the reader CS are reproduced on the tape of the No. 7 reperforator. Since all other select magnets are unoperated, no reperforator other than the No. 7 reperforator will perform a tape perforating operation. When the sensing fingers of the code sensing device restore, the energizing circuits of the code magnets **28** and of the select relays *a* and *d* are opened. With relays *a* and *d* deenergized the select magnet of the No. 7 reperforator is released.

To carry the description further it will be assumed that the sorting operation is to be performed in the tens channel E instead of the units channel F as described. In this case the switch **100** is moved into engagement with contact **102** which is individual to the second row of sensing fingers allocated to the tens channel. It is apparent that under this condition, select relays *c* and *d* operate and, in turn, operate select magnet **2** which is identified with the No. 2 reperforator. The No. 2 reperforator would then operate, to the exclusion of all other reperforators, to reproduce on its tape the code perforations which symbolize the number 50127.

Had sorting been undertaken in the hundreds channel D switch **100** would have been actuated to contact **103** to cause the operated sensing fingers **13** of the third row to operate select relays *b* and *c*. These relays, operated, cause the select magnet **1** of the No. 1 reperforator to operate and to enable the No. 1 reperforator for operation to reproduce, on its tape, the code symbols which characterize the number 50127.

Sorting in the thousands column C is effected by actuating switch **100** to contact **104** whereupon the operated sensing fingers of the fourth row become effective and cause select relays *a* and *b* to operate. These relays, in turn, operate select magnet **0** of the zero reperforator. The zero reperforator then functions to reproduce the perforation patterns corresponding to number 50127.

It is apparent from the foregoing descriptions that the reperforator of this invention combines both electrically and mechanically controlled means in reproducing, on a code tape, the code entries recorded on the tape of the code sensing device. More particularly, the setting of the perforating pins of the reperforator is effected through the medium of electrically responsive means under control of the sensing fingers of the sensing device, as is also the selection of the reperforator, whereas the actual perforating operation of the reperforator and the indexing thereof are effected through the medium of mechanical means controlled by a constantly rotating cam.

What is claimed is:

1. In combination, a code sensing device comprising a tape bearing code perforations patterned to symbolize the characters of a multicharacter entry, and sensing fingers

for exploring said tape for character-symbolizing code patterns, a tape perforator having punch pins individually corresponding to the sensing fingers of said code sensing device, electromagnetically operated means controlled by the sensing fingers of said code sensing device for preparing corresponding punch pins for operation in accordance with the character patterns of an entry encountered by the said sensing fingers, an operator individual to said perforator for actuating the prepared punch pins, continuously operating camming means for continuously operating said punch pin operator and normally ineffective to do so, and electromagnetically operated means controlled by the sensing fingers of said code sensing device in accordance with a particular character pattern encountered thereby for rendering said camming means effective to operate said punch pin operator.

2. In combination, a code sensing device comprising a tape bearing code perforations patterned to symbolize the characters of a multicharacter entry, and sensing fingers for exploring said tape for character-symbolizing code patterns, a tape perforator comprising punch pins individually corresponding to the sensing fingers of said code sensing device, electromagnetically operated means controlled by the sensing fingers of said code sensing device in accordance with the character patterns of an entry encountered thereby for individually preparing corresponding punch pins for operation, a continuously operating cam, a punch pin operator normally in uncoupled relation to said cam, and electromagnetically operated means controlled by the sensing fingers of said code sensing device in accordance with a particular one of the character patterns encountered thereby for coupling said punch pin operator to said continuously operating cam.

3. In combination, a code sensing device comprising a tape bearing code perforations patterned to symbolize the characters of a multicharacter entry, and sensing fingers for exploring said tape for character-symbolizing code patterns, a tape perforator comprising a tape drum carrying a tape, indexing means for said tape drum, punch pins located in superposed spaced relation to the tape on said drum and individually corresponding to the sensing fingers of said code sensing device, electromagnetically operated means controlled by the sensing fingers of said code sensing device in accordance with the character patterns of an entry encountered thereby for preparing corresponding punch pins for operation, continuously operating camming means, a punch pin operator normally in uncoupled relation to said camming means, electromagnetically operated means controlled by the sensing fingers of said code sensing device in accordance with a particular character pattern encountered thereby for coupling said punch pin operator to said camming means whereby said operator drives the prepared punch pins into said tape, and means controlled directly by said punch pin operator for conditioning said indexing means for operation by said camming means.

4. In combination, a code sensing device comprising a tape bearing code perforations patterned to symbolize the characters of a multicharacter entry, and sensing fingers for exploring said tape for character-symbolizing code patterns, a tape perforator comprising a tape drum carrying a tape, indexing means for said tape drum, a continuously operating cam for operating said indexing means and normally ineffective to do so, punch pins located in superposed spaced relation to said tape drum and individually corresponding to the sensing fingers of said code sensing device, a punch pin operator common to all said punch pins, electromagnetically operated means controlled by the sensing fingers of said code sensing device in accordance with the character patterns of an entry encountered thereby for aligning only corresponding punch pins with said operator for operation thereby, a second continuously operating cam for operating said punch pin operator and normally ineffective to do so, electromagnetically operated means controlled by the sensing fingers of said code sensing device in accordance with a particular character pattern encountered thereby for rendering said second cam effective to operate said punch pin operator whereby said operator drives the prepared punch pins into said tape, and means controlled directly by said punch pin operator for rendering said first cam effective to operate said indexing mechanism.

5. A tape perforator comprising a constantly rotating cam, a plurality of settable punch pins, a punch pin operator including a U-shaped member disposed immediately above said punch pins when said punch pins are set, means for setting said punch pins, a cam follower in constant engagement with said constantly rotating cam, said cam follower including an inverted U-shaped member disposed in vertical alignment with the U-shaped member of said punch pin operator and having the parallel arms thereof spaced differently from the parallel arms of said inverted U-shaped member whereby when said cam follower is actuated by said cam the inverted U-shaped member thereof moves freely within the U-shaped member of said punch pin operator to preclude the operation of said punch pin operator by said cam follower, a select finger pivotally mounted on said punch pin operator, and electromagnetically operated means for interposing said select finger between corresponding edges of said cam follower and of said punch pin operator whereby the movement of said cam follower effected by said cam is transmitted to said punch pin operator through said select finger to cause said punch pin operator to actuate said punch pins under control of said cam.

6. A tape perforator comprising in combination, a tape drum, indexing means for said tape drum, constantly operating camming means for operating said indexing means and normally ineffective to do so, punch pins disposed immediately above said tape drum, a punch pin operator, means including electromagnetically operated means for aligning certain of said punch pins with said punch pin operator, cam operated means normally in uncoupled relation to said punch pin operator, electromagnetically controlled means for coupling said punch pin operator to said camming means to cause said punch pin operator to be actuated thereby and to operate the aligned punch pins, and means including camming means formed integrally with said punch pin operator for rendering said constantly operating camming means effective to operate said indexing means.

7. In a tape perforator, a tape bearing drum, stepping means for said drum, a cam follower for operating said stepping means and normally in uncoupled relation thereto, a plurality of punch pins, a hammer for actuating said punch pins, means including electromagnetically operated means for aligning certain of said punch pins with said hammer, a cam follower for operating said hammer whereby said hammer strikes the aligned punch pins, camming means carried by said hammer, continuously rotating cams for operating said cam followers, and means controlled by said hammer-borne camming means incident to the operation of said hammer by its cam follower for coupling said stepping means with its cam follower.

8. A tape perforator camprising, in combination, a drum bearing a tape, punch pins disposed in superposed spaced relation to said drum, a common punch pin operator normally out of alignment with and adapted to drive said pins into said tape, electromagnetically controlled means for moving only selected ones of said punch pins into alignment with said common punch pin operator for operation thereby, a continuously rotating cam, a cam follower normally in uncoupled relation to said punch pin operator, and electromagnetically controlled means for coupling said cam follower to said punch pin operator.

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