June 14, 1949. R. F. MALLINA 2,473,437

MECHANICAL PERFORATOR

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FIG. 1

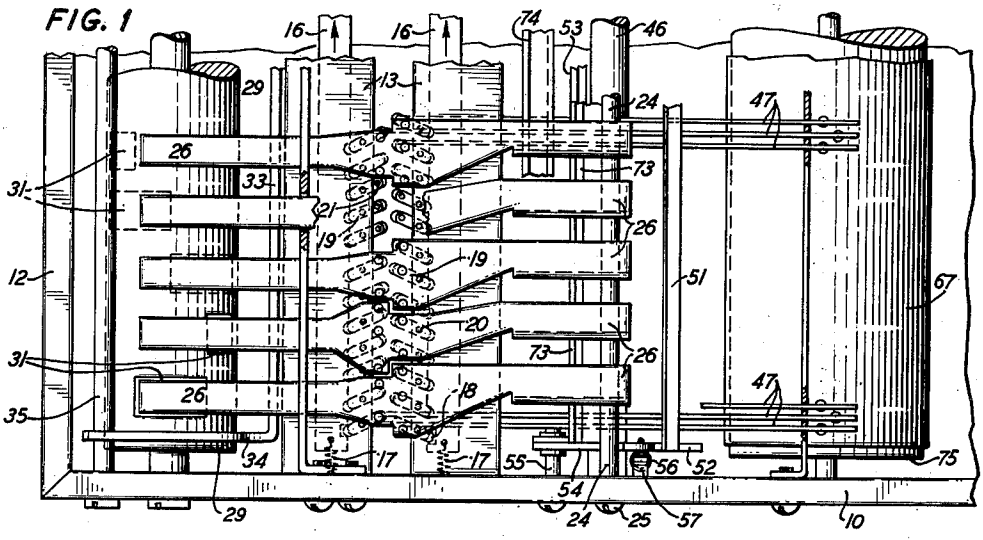

FIG. 2

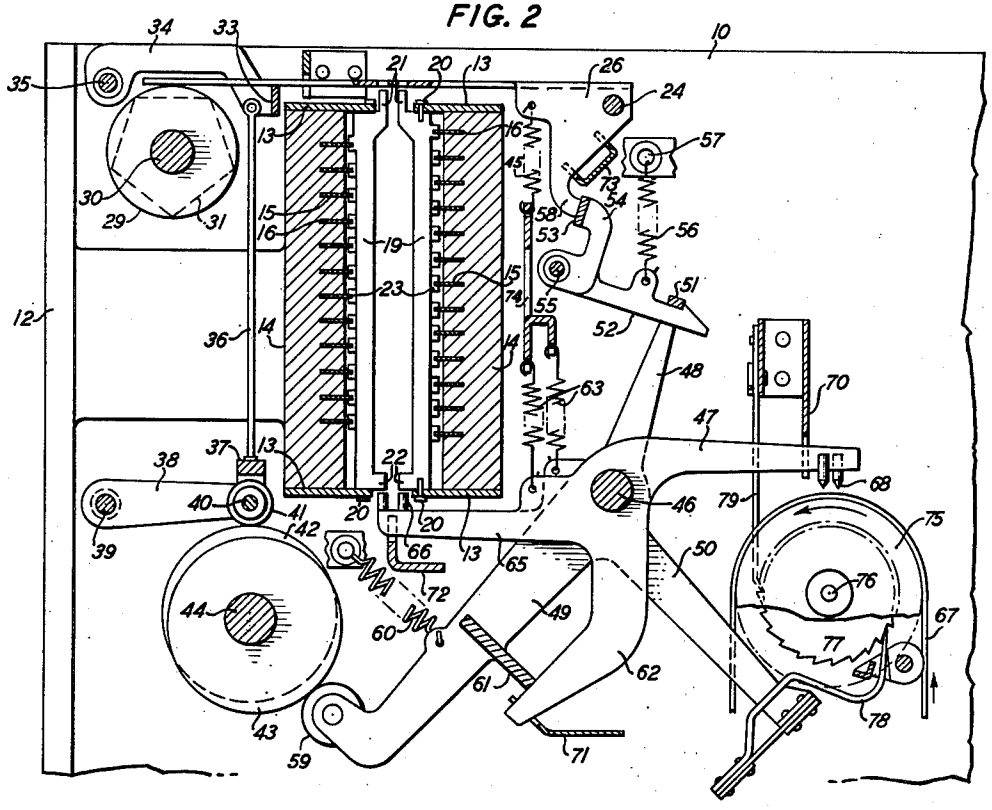

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FIG. 3

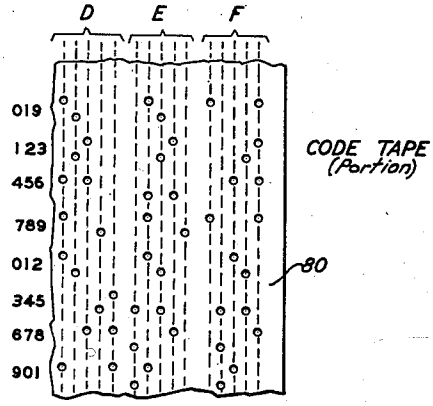


FIG. 4

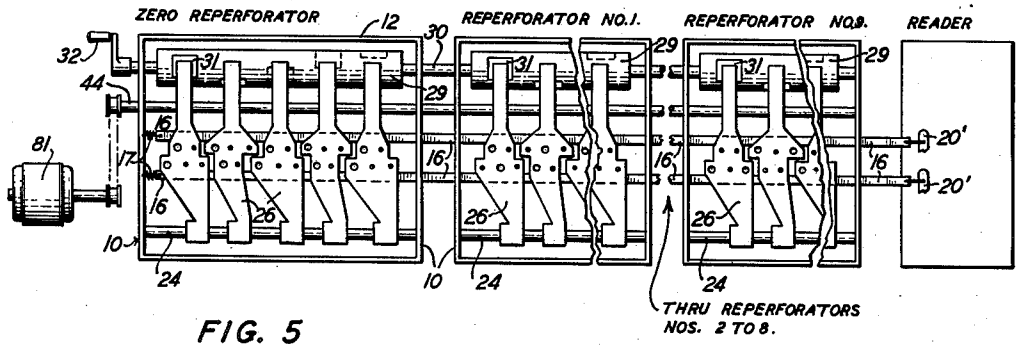


FIG. 5

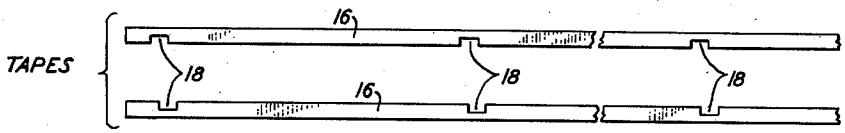
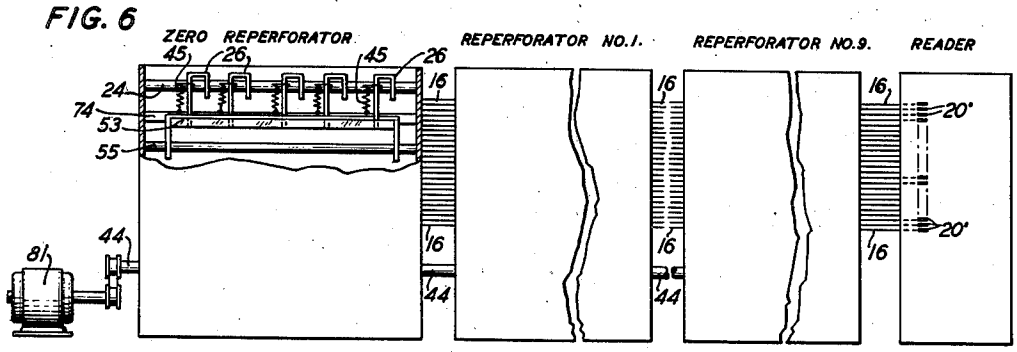


FIG. 6



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MECHANICAL PERFORATOR

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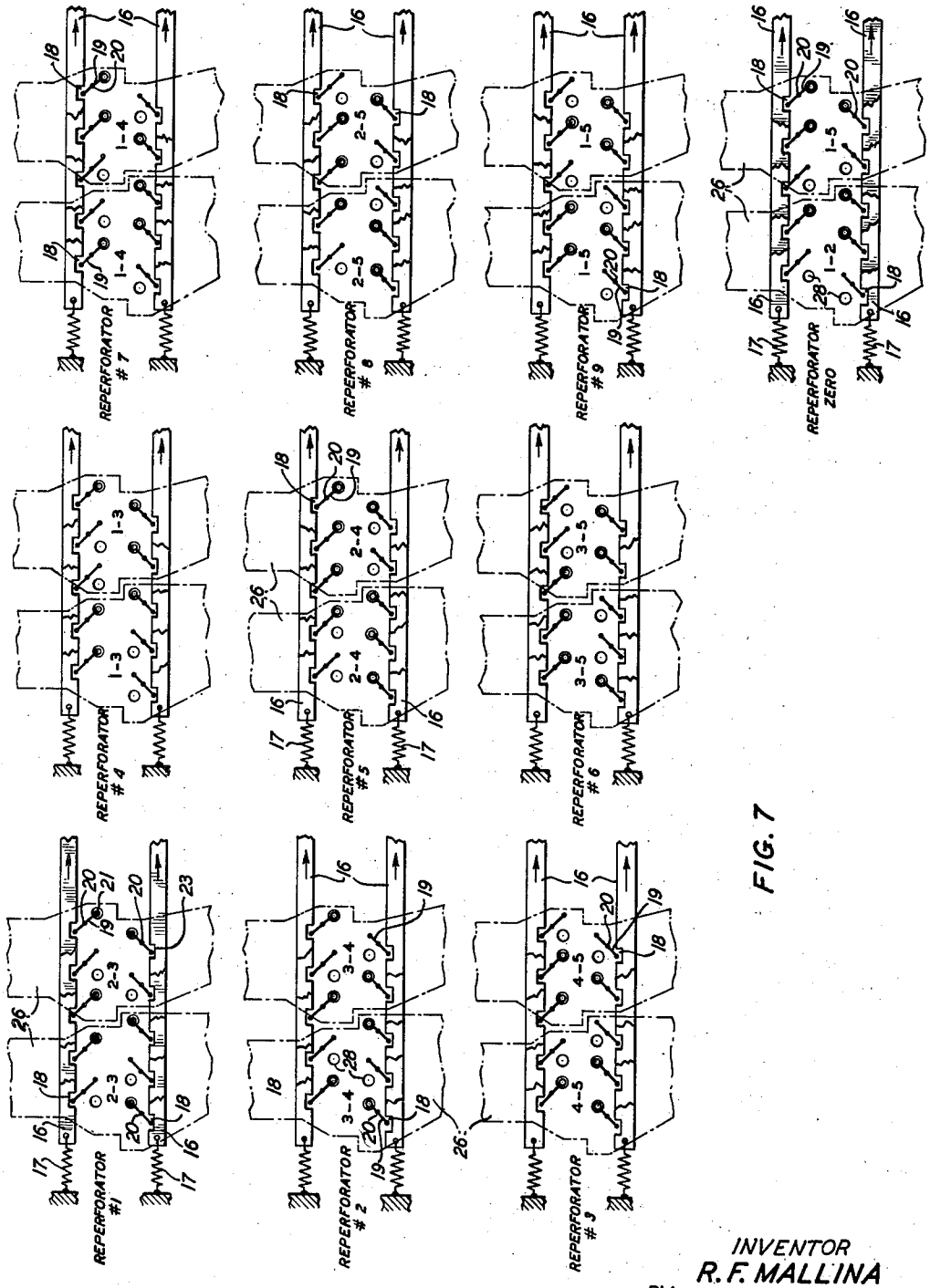

FIG. 7

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MECHANICAL PERFORATOR

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Application January 20, 1947, Serial No. 722,977

11 Claims. (Cl. 164—115)

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This invention relates to tape perforators and particularly to a tape perforator of the type designed to function as one of a group of perforators, under the selective control of a code-sensing device, in a system for sorting code entries recorded in mixed-up fashion on a primary recording medium, such as a code tape.

In a system of the above described general character disclosed in my copending application, Serial No. 635,355, filed December 15, 1945, a primary recording medium, such as a code tape has recorded thereon a multiplicity of unsorted multidigit numbers, each digit of which is symbolized by a different patern of two perforations derived from a fixed pattern of five. A group of ten reperforators functions under control of a common code-sensing device to selectively reproduce, on individual code tapes, the code-symbolized numbers of the primary tape in numerical order, each reperforator being conditioned to reproduce on its tape only those numbers which contain a particular digital code patern. The reperforators are individually designated as the Nos. 1, 2, 3 . . . 9 and zero reperforator and each is physically characterized by the code pattern of the digit by which it is individually designated. The physical characterization of each reperforator determines which of the code-symbolized entries, or numbers recorded on the primary tape are selectively reproduced on the individual code tapes of the reperforators. Thus the No. 1 reperforator operates to reproduce on its individual code tape only those numbers which contain the digital pattern of the numeral 1. Similarly, the No. 2 reperforator operates to reproduce only those numbers containing the digital pattern of the numeral 2; and so on.

Furthermore, the system provides means whereby the reperforators are rendered operable to reproduce numbers containing their individually characterizing digital patterns only when the digital pattern appears in a particular digital position. Thus, a multiplicity of code-symbolized numbers appearing on the primary tape may be subjected to sorting operations corresponding in number to the number of digital positions in the numbers sorted. For example, in sorting five-digit numbers, the sorting operations are undertaken successively in the units, tens, hundreds, etc. channels, or digital positions, and when the final sort is completed the tape of each reperforator wil contain a series of code-symbolized numbers arranged in numerical order, the numbers reproduced on each reperforator tape bearing, in the highest digital position thereof, the

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digital pattern by which the reperforator is physically characterized. Thus the tape of the No. 1 reperforator wil have reproduced thereon, in numerical order, all the numbers of the ten thousand series recorded on the primary tape; the tape of the No. 2 reperforator will have reproduced thereon, in numerical order, all the numbers of the twenty thousand series; and so on.

It is the object of the invention disclosed herein to provide an improved perforator unit, or reperforator of the type disclosed in the above-identified copending application, which is fully mechanical in operation and control; is simple and compact in design and positive in operation; and which otherwise lends itself to gang operation under control of a common code-sensing device, or reader.

The reperforator of this invention comprises a plurality of tape perforating levers and a corresponding number of code levers mounted for limited rotation about their longitudinal axes under control of a code sensing device. Each code lever is provided at one end with a code pin and at its other end with an integral projection constituting an interference or interponent member for normally inhibiting a corresponding perforating lever against operation. Disposed immediately above each group of five code pins is a select lever provided with two code holes patterned to symbolize a particular digit. When the code levers are operated in such a manner as to bring two of the code pins thereof into alignment with the two holes in the select lever and the select lever is otherwise enabled to operate, it does so to permit the operation of a corresponding pair of perforating levers, it being understood that, incident to the operation of any code lever, its associated interponent member is moved out of the line of travel of the corresponding perforating lever. Thus, each of a gang of reperforators is physically characterized to detect the operation of a particular pair of code levers corresponding to a particular digit and is enabled to operate a corresponding pair of perfoating levers and thereby effect a coresponding peforation on a recording tape. Each reperforator is provided with as many select levers as there are characters or digits in the items which are recorded on a primary tape and which are to be reproduced by the reperforators and manually operable means is provided for selectively enabling the select levers so that an item on the primary tape and including a code pattern corresponding to the code pattern by which the select levers are physically characterized may

be caused to be reproduced on a reperforator tape depending upon the digital position in which the particular code pattern appears. In other words, the perforator of this invention through the media of code patterned select levers can be enabled to reproduce on its code tape only items which contain a particular code pattern and may be selectively enabled to reproduce such item only when the particular code pattern appears in a particular digital position. The code employed in the present case is the well known, so called "two out of five" code used in the system of the above-identified copending application. However, in the present case the five points on the tape allocated to any digital position are arranged in two rows instead of in one row, the positions in the two rows being staggered relative to each other. This does not, in any way, distinguish the code from that employed in my earlier application since the code is determined in each case by the transverse positions on the tape.

The features which characterize the tape perforator of this invention will be readily understood from the following detailed description when read with reference to the accompanying drawings, in which:

Fig. 1 is a top plan view of a reperforator embodying the features of the invention;

Fig. 2 is a front elevation, partly in section, of the reperforator shown in Fig. 1;

Fig. 3 is an enlarged fragmentary section of a primary code tape illustrating the manner in which each of the digits 1 to 9, and zero is symbolized, in code, by two perforations derived from a fixed pattern of five;

Fig. 4 is a top plan view of three reperforator units and a code-sensing device 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; the metal tapes which operate under control of the code-sensing device to set the reperforator code levers, and the common motor means for driving the cam shaft of the reperforators;

Fig. 5 illustrates the metal tapes employed to operate the reperforator code levers under control of the code-sensing device, or reader;

Fig. 6 is a front view schematic corresponding to the top plan schematic of Fig. 4; and

Fig. 7 is an enlarged schematic view illustrating a portion of each of two select levers of each of ten reperforators. This figure is primarily an explanatory schematic view employed particularly to illustrate the manner in which the select levers are individually characterized by a distinctive code pattern of two perforations, or holes derived from a fixed pattern of five.

The reperforator of this invention is designed to reproduce five-digit numbers, each digit of which is symbolized on the primary code tape **80** (Fig. 3) by two perforations. In Fig. 3 the tape portion illustrated is fragmentary and shows only the areas thereof which are allocated to the units, tens and hundreds digital positions or channels. This limited showing is for purposes of simplicity only. Each digital position is allocated five points transversely positioned on the tape. The three digital channels, the units, tens and hundreds channels, are designated by the letters F, E and D, respectively. The code employed to identify each digit is the well known two out of five code, it being understood that ten different combinations of two perforations may be derived from a fixed pattern of five. In the illustration, the five points at which a perforation may be made are shown occupying two parallel transverse lines, the first, third and fifth positions occupying one line and the second and fourth positions occupying a second line. "Zero" is illustrated as symbolized by two perforations appearing in the first and second transverse positions; digit 1 is symbolized by two perforations appearing in the second and third positions; digit 2 by two perforations appearing in the third and fourth positions; digit 3 by two perforations appearing in the fourth and fifth positions; digit 4 by two perforations appearing in the first and third positions; digit 5 by two perforations appearing in the second and fourth positions; digit 6 by two perforations appearing in the second and fifth positions; digit 7 by two perforations appearing in the first and fourth positions; the digit 8 by two perforations in the second and fourth positions; and the digit 9 by two perforations in the first and fifth positions. As will be described more fully hereinafter, each of the ten reperforators which operate under the control of a code-sensing device is provided with five select levers which are physically characterized by a five-code hole pattern in which two of the holes identify a particular digital pattern, the digital pattern of the select levers of the No. 1 reperforator corresponding to the pattern of the digit 1; the digital pattern of the select levers of the No. 2 reperforator corresponding to the pattern of the digit 2; and so on. The select levers control the operation of the corresponding reperforator in accordance with the digital pattern carried thereby.

Referring now particularly to Figs. 1 and 2 of the drawings, the reperforator of this invention is housed in a suitable housing comprising front and rear walls **10**, one of which appears in Fig. 1 and the other in Fig. 2, and end walls **12**, only one of which appears in the drawings.

Two pairs of clamping brackets **13** are suitably mounted in spaced relation between the front and rear walls **10**. Between each pair of upper and lower brackets **13** there is clamped a selector tape supporting block **14**. This member may be constructed as a unitary element as disclosed, or it may consist of a plurality of superposed layers. The inner face of each block **14** is provided with a plurality of slots **15** which extend the entire length of the block. The slots of each block are spaced vertically equidistant from each other and the slots of one block are staggered with respect to the slots of the other block. As illustrated, the right block (Fig. 2) accommodates thirteen slots and the left block twelve slots. Each slot accommodates a flat metal tape **16**, which, as will appear from a later description, moves longitudinally in its particular slot under control of the code-sensing device and against the restraining influence of a coil spring **17**. The coil springs **17** normally bias the tapes **16** in their home positions, each spring having one end anchored to the front wall **10** and the other hooked, or otherwise secured to one end of the tape as shown in Fig. 1. It is to be understood that the tapes **16** are common to all ten reperforators and each is secured to the upper end of a code lever **20'** (Figs. 4 and 6) of a code-sensing device so as to individually respond to the movement of such code levers.

Each tape **16**, as illustrated in Fig. 5, is provided with one notch **18** per reperforator, so that in a sorting system involving ten reperforators each tape **16** is provided with ten equispaced

notches. The dimensions of the slots 15 and of the tapes 16 are such that a notch-bearing strip of each tape projects beyond the confines of its corresponding slot. As will appear presently, the tape notches serve to couple the tapes with corresponding reperforator code levers 19.

Within the area between the two inner faces of the blocks 14 there are located twenty-five code levers 19. Each code lever 19 is essentially a vertically mounted rod-like structure with a recess in each of its upper and lower ends. Each of these recesses accommodates a pin 20 which projects through a suitable hole in the overhanging portions of a pair of upper and lower mounting brackets 13 whereby the code lever is pivotally mounted thereon and adapted to rotate about its longitudinal axis under the influence of a corresponding flat metal tape 16. The movement of a tape 16 is imparted to its corresponding code lever 19 by virtue of the engagement of a tape notch 18 with a projection 23 extending laterally from one edge of the code lever. Since there are twenty-five tapes 16 each individual to a code lever 19 there are twenty-five code levers arranged in two oppositely disposed groups, with the levers of each group in horizontal alignment one in back of the other. The code lever projections 23 of the twenty-five levers are arranged in stepped formation thereby rendering them individually engageable by a different notch 18 in the tapes 16, the notches 18 of the tapes being similarly arranged in stepped array to permit this engagement. It is apparent from the description thus far advanced that whenever any of the tapes 16 is slid longitudinally in its corresponding slot 15 by the code levers 20' of the code-sensing device, or reader (Figs. 4 and 6), a corresponding reperforator code lever 19 is pivotally moved about its pivot pin 20 because of the coupling effected by its lateral projection 23 and the corresponding tape notch 18.

Each code lever 19, at its upper end is provided with a vertically projecting integrally formed code pin 21 and at its lower end with a laterally projecting integrally formed member 22, which is herein defined as an interference or interponent member since it normally occupies a position relative to a pin 66 of a corresponding perforator lever 47 which precludes the operation of the perforator lever in a clockwise direction, and it is operable to an alternate position in which it clears the pin 66 to permit the operation of the corresponding perforator lever. Normally, each interponent member 22 of a code lever is located in the line of travel of a pin 66 of a corresponding perforator lever 47 so that when in their normal positions the interponent members 22 prevent the operation of their corresponding perforator levers. Obviously, when a code lever 19 is actuated by its respective tape 16 under control of the code-sensing device, its corresponding interponent member 22 is moved out of the line of travel of a pin 66 of a corresponding perforator lever 47 thus enabling the perforator lever for operation.

A shaft 24, horizontally mounted between the front and rear walls 10 of the reperforator carries five select levers 26. This shaft may be secured to the walls 10 in any suitable manner as by means of screws 25, one of which appears in Fig. 1. As illustrated in Figs. 1 and 4, the select levers 26 are mounted in horizontal spaced relation and each is irregularly contoured to provide a relatively large area substantially midway of its ends. Upon this area each select lever bears five code

holes 28. These code holes are schematically indicated in Fig. 4 and are more clearly illustrated in Fig. 7. In Fig. 4 only the two holes which constitute the physical characterization, in accordance with a particular digital code pattern, are shown complete whereas all five code holes are illustrated in Fig. 7.

The select levers 26 extend to the left (Fig. 1) from the supporting shaft 24 so as to bridge the code pins 21 of the code levers 19 and have their ends resting on the periphery of a select cylinder 29. Substantially midway of the code hole bearing portions and the left ends, the select levers are supported in normal positions on the bar 33 which is integrally formed with two right angularly disposed arms 34 which are mounted for rotation on the horizontal shaft 35. One arm 34 appears in Fig. 1 and the other in Fig. 2.

As previously indicated, each select lever is provided with five code holes 28 and is allocated to five code levers 19. One select lever is allocated to the five code levers which correspond to the units digital position of a number; another to the five code levers which correspond to the tens digital position of a number, and so on. Normally, and as clearly illustrated in Fig. 7, three of the code holes of each select lever are in vertical alignment with three code pins 21 of corresponding code levers 19 and two of the code holes are out of alignment with the remaining two code lever pins. It is apparent therefore that unless all five code holes 28 of a select lever are in vertical alignment with the corresponding code pins 21, the said select lever is precluded from operation in the direction of the code pins. Thus it is that with the code levers 19 in their normal unactuated positions the select levers 26 are inhibited from operating and can be operated only when the two misaligned code pins are brought into alignment with the corresponding select lever code holes.

In Fig. 7 the five select levers of any one reperforator are shown with their two misaligned code holes located in the same code positions. For example, the misaligned code holes of the select levers of reperforator No. 1 occupy the second and third positions which identify the digit 1; the misaligned code holes of the select levers of reperforator No. 2 occupy the third and fourth positions which identify the digit 2; and so on down to the zero reperforator, the select lever code holes of which occupy the first and second positions which identify zero. Each reperforator is therefore physically characterized by a code pattern which corresponds to the pattern of the digit by which the reperforator is designated.

The two code levers 19 of any reperforator whose code pins 21 are normally out of alignment with the code holes in the reperforator select levers, correspond to the two code levers 20' of the code-sensing device, or reader which operate when the reader senses a code pattern which symbolizes the digit by which the reperforator is physically characterized. When such a code pattern is encountered by the reader, the corresponding code levers 20' thereof operate (in a manner to be described) to actuate the corresponding code levers in all ten reperforators through the interconnecting tapes 16. If the code pattern encountered, for example, is that corresponding to the digit 2, code levers corresponding to code positions 3 and 4 will be operated in each reperforator. However, since it is only in reperforator No. 2 that the operation of the code levers cor-

responding to code positions 3 and 4 results in the alignment of all five code lever pins with their corresponding select lever code holes, only a select lever of the No. 2 reperforator will be enabled for operation. It is apparent therefore that by virtue of the identification of the select levers of each reperforator, in accordance with a different digital code pattern, the reperforators are rendered selectively operable to reproduce only those digits which contain their particular identifying digital code pattern, it being understood, and as will be more fully described hereinafter, that one of the reperforator select levers must be enabled in order for the reperforator to perform a punching operation.

Reverting back to Figs. 1 and 2, each reperforator is provided with a select cylinder 29 mounted on a common shaft 30 so as to be disposed immediately below the free ends of the select levers 26. The select cylinder is provided with five flat sections 31 disposed seventy-two degrees apart in spirally staggered relation on the cylinder periphery so that the cylinder may assume any one of five positions, in each of which it presents one flat surface to the underside of a different one of the select levers 26. The setting of the cylinder 29 is attained through the medium of a hand crank 32 (Fig. 4) mounted on one end of the shaft 30. The flat portions 31 of the select cylinder 29 are of sufficient depth to permit the free ends of corresponding select levers 26 to move thereinto under the action of individual coil springs 45, unless otherwise restrained from doing so. The shaft 30 is common to all ten reperforators and bears ten select cylinders 29, one for each reperforator.

Normally the five select levers 26 are restrained against counter-clockwise rotation about the shaft 24 by the common stop bar 33 previously referred to. This bar is horizontally disposed beneath the left ends of the select levers so as to provide a rest therefor. The resting edge of the bar 33 is in substantial alignment with the periphery of the select cylinder at its uppermost portion so that, when the bar moves downwardly in a manner to be described hereinafter, four of the five select levers will be incapable of following the bar because only one select lever at any one time is located directly above a flat portion on the cylinder. Thus by rotating the cylinder 29 to its various positions any one of the five select levers may be selected for operation. Selection of a particular select lever in this manner determines in which digital channel, or position a code sorting operation is to be undertaken.

The stop bar 33 is controlled in its movement through a pair of link rods 36 (only one of which appears in Fig. 2) which connect with the horizontal rod 37 formed integrally with the end pieces 38 which are mounted for pivoted movement about the shaft 39. A shaft 40 disposed immediately below the rod 37 supports a roller 41 which functions as a cam follower, being in constant engagement with the periphery of the rear cam 42. The cam 42 and a second cam 43 are mounted on a common shaft 44. The shaft 44, like shaft 30 is common to all ten reperforators and has its longitudinal axis parallel to the longitudinal axis of shaft 30. Obviously, as the cam 42 is rotated, the bar 33 is moved downwardly during one part of the cycle of cam rotation and is then moved upwardly during the second part of the cycle. The bar 33 therefore is moved out of the path of the select levers 26 at regular intervals as the cam 42 is rotated, thereby permitting the one thereof whose free end is located opposite a flat surface on the periphery of select cylinder 29 and whose five code holes are in vertical alignment with the code pins 21 of the five corresponding code levers 19, to be moved in a counter-clockwise direction under the action of its individual coil spring 45.

A horizontally disposed shaft 46 supports twenty-five perforator levers 47 in equispaced relation and a common control member comprising three angularly disposed radial arms 48, 49 and 50. The arm 48 is connected to a similar arm (not shown in Fig. 2) by means of a common horizontal latch bar 51. The latch bar 51 extends substantially the entire depth of the reperforator and is normally in engagement with a common latch lever 52. The latch lever 52 is integrally formed with a yoke-shaped member 54 which is mounted on shaft 55 and whose crosspiece is designated by the numeral 53. The latch lever 52 is held in tensioned engagement with the common latch bar 51 by means of a coil spring 56 which has one end anchored to the front wall 10 at 57, and the other end in hooked engagement with the lever 52, as illustrated. Each of the five select levers 26 is provided with an integral offset projection 58 all of which normally abut the bar 53. Thus when any one of the select levers is operated in the manner previously described, its integral projection 58 serves to rotate the common latch lever 52 in a clockwise direction against the restraining influence of spring 56. This movement of the latch lever 52 unlatches the latch bar 51. As will be described presently, the unlatching of latch bar 51 enables the common control member comprising arms 48, 49 and 50 for operation under control of cam 43, it being observed that roller 59 carried by arm 49 of the control member is held in communication with the periphery of cam 43 by the action of spring 60.

The arm 49 of the control member carries a common stop bar 61 which, in the normal position illustrated, precludes the clockwise operation of the perforator levers 47, each lever 47 being provided with a depending radial arm 62 which abuts the lower edge of the common stop bar and which is held in tensioned engagement therewith by a corresponding individual coil spring 63. It is apparent that, when the latch lever 52 is actuated to clear the latch bar 51 incident to the actuation of one of the select levers 26, the control member, which includes the arm 49, is free to follow the cam 43 and when the cam 43 reaches a particular position in its rotation the bar 61 is moved away from the arms 62 of the twenty-five perforator levers 47. All twenty-five of the perforator levers 47 are therefore enabled but, as will be described hereinafter, only two of each group of five, coresponding to the digital code patterns of the number sensed by the code-sensing device will operate.

Each perforator lever 47 is provided with a second integral radial arm 65 which carries at its outer end a vertically projecting pin 66 which is normally in vertical alignment with an interponent member 22 of a corresponding code lever 19. As previously indicated, each digit of a number recorded on the primary tape 80 is symbolized by two particularly positioned perforations and when such a combination of code perforations is encountered by the sensing fingers of the code-sensing device, or reader, a corresponding pair of code levers 19 are pivotally operated about their supporting pins 20. When the code levers 19 are thus operated, their corresponding interponent

members 22 are moved out of the path of the pins 66 of the corresponding perforator levers 47. Thus it is that, though all twenty-five perforator levers 47 are enabled incident to the operation of a select lever 26 as described, only those perforator levers whose corresponding code levers have been operated will operate.

From the description thus far advanced it is apparent that, when a five-digit number is sensed by the code-sensing device, five groups of two flat tapes 16 will be moved longitudinally in their respective slots 15 to cause the operation of five corresponding groups of two code levers 19 in each reperforator. The operation of the ten code levers 19 removes their interponent members 22 out of the paths of the corresponding perforator lever pins 66 so that only the ten corresponding perforator levers will be capable of operation. Also, the operation of these ten perforator levers is dependent upon the operation of one of the five select levers 26 which, in turn, operates only in the event the sensed number contains the controlling digital code pattern by which the select levers are characterized.

When the conditions set forth above are satisfied and the ten perforator levers 47 are operated under control of their individual coil springs 63 and cam 43, the digital patterns of the sensed number will be reproduced on the reperforator tape 67. This code reproduction is effected by means of punch pins 68, one of which is carried at the outer end of each perforator lever 47. Thus, when a particular group of ten perforator levers 47 is actuated, corresponding to five groups of two code combinations symbolizing five digits, their associated punches 68 operate to reproduce, on the tape 67, five identical code patterns symbolizing a five-digit number sensed by the code-sensing device.

The perforator levers 47 and their integrally formed arms 62 and 65 are each individually guided in their direction of travel by common comb-like structures 70, 71 and 72, respectively. A similar device 73 serves the same purpose relative to the select levers 26.

The coil springs 45 and 63 which serve to actuate the select levers 26 and the perforator levers 47, respectively, have one end of each anchored to a transverse member 74 mounted between the front and rear walls 10 of the reperforator, the other ends thereof being anchored to the select levers and perforator levers as illustrated.

The tape of the reperforator is fed over a perforated drum or cylinder 75 which is mounted on a shaft 76. Adjacent the inner face of the drum 75 and fixed thereto is a ratchet wheel 77 which is adapted to be stepped in a counter-clockwise direction by the stepping pawl 78 which is carried on the outer end of arm 50 of the control member. A stop pawl 79 communicates with the teeth of ratchet wheel 77 to preclude the possibility of play in the wheel and to insure correct positioning thereof with respect to the perforator punches 68.

The cams 42 and 43 are individually mounted on shaft 44 and are individually peripherally contoured to provide a definite time sequence in the operation of the elements controlled thereby.

Operation

In describing the operation of the perforator of this invention it will be assumed that the reperforator disclosed in Figs. 1 and 2 functions, as the "zero" reperforator, with nine other similar reperforators under the control of a single

code reader, or sensing device. The reader may be of the type disclosed in the copending application hereinbefore identified. This reader is designed to operate with code tapes on which each digit of a number is symbolized by two perforations out of a fixed straight line pattern of five. The reperforator of this invention is designed to reproduce code patterns made up of two perforations out of a fixed pattern of five arranged in two lines, as previously described. The reader of the above identified copending application will, however, accurately control the reperforator of this invention, though in actual practice the sensing fingers 22 of the said reader would be arranged in staggered relation instead of in horizontal alignment as illustrated in the said copending application. Also, to adapt the reader of the said copending application for operation with reperforators of this invention it is necessary that it be positioned so that the shafts thereof, such as 43, 31, 27 and 21 assume vertical positions instead of the horizontal positions illustrated. In this manner the twenty-five code levers 20 of the reader will be individually aligned with the twenty-five flat tapes 16 of the reperforators. However, the reader per se, does not constitute a part of the present invention and need not be disclosed other than in the schematic form shown in Figs. 4 and 6.

It will be further assumed that the primary tape 80 shown in Fig. 3 is fed into the reader and that it carries, in code perforations, the code patterns symbolizing the members shown in Fig. 3. For purposes of simplicity the description of the operation of the reperforator will be confined to the reproduction of a three-digit number, 019, it being understood that the reperforator, as illustrated, is designed to accommodate five-digit numbers.

When the primary tape 80 is fed to the constantly operating reader, or sensing device the sensing fingers 22 (Fig. 5 of the above-identified copending application) thereof encounter the code perforations symbolizing the number 019 and in the manner fully described in the said copending application, three corresponding groups of two code levers 20' are actuated. The reader code levers are schematically indicated in Figs. 4 and 6 and identified by the numeral 20'. More particularly, the code levers in the first and fifth positions of the units group of five levers, the code levers in the second and third positions of the tens group of five levers, and the levers in the first and second positions of the hundreds group of five levers are operated in consequence of the sensing fingers of the reader encountering the code perforations which symbolize the number 019.

It will be assumed, for descriptive purposes only, that the select cylinders 29 of all ten reperforators have been set to condition the reperforators to sort in the hundreds column, or digital position D (Fig. 3). Under this condition there will be presented to the undersurface of the free end of the select lever 26, corresponding to the hundreds digital position, in each reperforator, a flat surface 31 of their respective select cylinders 29. In response to the actuation of the reader code levers as described, a corresponding group of six actuating tapes 16 are longitudinally displaced, it being understood that each such tape is common to all reperforators and is secured in any suitable manner to an individual one of the reader code levers 20'. The displacement of the selected six tapes 16 causes corresponding code

levers 19 in each reperforator to be rotated about their pivots 20 to displace corresponding code pins 21 and interponent members 22 from their normal positions. Since the number 019 of the reader tape is being sensed and the sorting is being undertaken in the hundreds digital position, zero is the controlling digit. Zero is symbolized by two perforations appearing in the first and second code positions. Therefore only the preselected select lever 26 which is characterized by the perforation code symbolizing zero will be enabled. This is due to the fact that the code pins 21 of the code levers 19 of the hundreds digital position in each perforator have been set to simulate the code pattern of zero and only the zero reperforator has its select levers characterized by code holes symbolizing zero. Thus it is only in the zero reperforator that the actuated code pins 21, symbolizing zero, will be moved into alignment with their corresponding select lever code holes. In this manner the zero reperforator is selected to reproduce, in code, the number 019. In all other reperforators there will be code pins 21 out of alignment with their corresponding select lever code holes in the hundreds digital position, thus precluding the operation of the select levers and therefore of the reperforators.

The cam shaft 44 which is common to all reperforators is constantly rotating in synchronism with the reader cam shaft under the control of motor 31, Fig. 4. Thus the cams 42 and 43 of the zero reperforator rotate to control the operation of the enabled select lever 26 and of the control member, respectively, the latter consisting of the arms 48, 49 and 50. As the cam 42 rotates from its illustrated normal position, the bar 33 is lowered permitting the preselected select lever 26 to move counterclockwise about the shaft 24. When thus freed, the spring 45 functions to pull the select lever downwardly so that the five code holes thereof register with the corresponding five code pins 21 of the code levers allocated to the digital position. As this select lever operates as described, the latch lever 52 is moved clockwise due to the action of the select lever projection 58 on the bar 53. The latch levers 52 therefore are moved out of engagement with the common bar 51 to enable the control member, comprising the arms 48, 49 and 50. The cam 43, due to its particularly contoured periphery, permits the now freed control member to move clockwise about the shaft 46 under the action of spring 60. The stop bar 61 is then moved out of the path of the arms 62 of the perforator levers 47 and the stepping pawl 78 is retracted from the ratchet wheel 77 for engagement with the next succeeding tooth thereof.

With the twenty-five perforator levers 47 thus freed for operation, those levers whose corresponding interponent members 22 of the code levers 19 have been moved out of the line of travel of the projections 66 will fully operate, all other levers being restrained from actuation by their normally positioned interponent members 22. Thus a group of six perforator levers, corresponding to the code pattern of the number 019, in the zero reperforator will operate under the action of their corresponding coil springs 63 to cause their respective punches 68 to perforate the tape 67. It is obvious now, that the perforated code impressed on the tape 67 is an exact reproduction of the code sensed by the sensing device and symbolizes the number 019.

As the cams 42 and 43 continue to rotate, the control member, comprising arms 48, 49 and 50, is forced back into its original positions against the action of spring 60. The arm 48 reoccupies a position in which the bar 49 is conditioned for reengagement by the latch lever 52. The bar 61, secured to the arm 49 acts to restore the actuated perforated levers 47 to normal position, and the pawl 78 secured to the arm 50 reengages the ratchet wheel 77 and advances the tape cylinder 75 to the next punching position. The cam 42, through link 36 and bar 33 restores the operated select lever 26 to normal which, in turn, permits the spring 56 to restore the latch lever 52 to latching engagement with the common bar 51. In this manner the zero reperforator is restored to its original condition and prepared to repeat the described cycle of operations under the control of the cams 42 and 43.

The description of the operation of the reperforator of this invention thus far has not dealt particularly with the time sequence in which the various elements thereof and of the controlling sensing device perform their functions. It is thought that this phase of the description may be better understood by enumerating the various steps performed during a complete cycle of operation in order of their occurrence.

Sequence of operation

1. The reader sensing fingers enter the code perforations in the primary tape.
2. The reader code levers operate, as do also the perforator code levers.
3. The select lever 26 of the reperforator operates.
4. The perforator levers 47 operate and cause the reperforator punch pins 68 to perforate the tape 67.
5. The perforating levers 47 and the select lever 26 restore to normal.
6. The reperforator stepping pawl 78 operates to step the tape cylinder 75, and the reperforator code levers restore as do the code levers of the sensing device.
7. The sensing fingers of the reader or sensing device restore.
8. The reader tape drum is stepped to the next position.

The zero reperforator has now been operated to reproduce the number 019 on its tape 67. It is deemed unnecessary to repeat the operations of the reperforators in reproducing the other numbers recorded on the tape 80 (Fig. 3). It is apparent from the foregoing description that, as long as sorting is carried out in the hundreds channel, the No. 1 reperforator will operate to record the number 123; the No. 4 reperforator will operate to record the number 456; the No. 7 reperforator will operate to record the number 789; and so on. Similarly, if sorting has been undertaken in the tens channel E (Fig. 3) the No. 1 reperforator would operate to record the number 019; the No. 2 reperforator would operate to record the number 123; the No. 5 reperforator would operate to record the number 456; etc. It is to be understood that in practice the sorting operations follow a definite sequence starting in the units column, and repeated in the tens, hundreds, thousands, etc. columns. These sorting operations are more fully discussed in the above-identified first-mentioned copending application.

What is claimed is:

1. In a tape perforator, tape perforator means, means for enabling the perforator to perform a perforating operation, a group of code levers each

having an integrally formed code pin, a select lever having code holes corresponding in number to the number of code levers and normally positioned relative to said code levers so that less than the whole of the code pins thereof are in individual vertical alignment with corresponding code holes of said select lever, means for selectively operating said code levers to variably position the code pins thereof relative to corresponding code holes of said select lever, and means, including said select lever, responsive to the selective operation of said code levers in a manner to effect the individual vertical alignment of the code pins of all thereof with corresponding select lever code holes for operating said perforator enabling means.

2. In combination with a code-sensing device, a tape perforator including a group of five code levers each having a code pin, means including said code-sensing device for selectively operating said code levers in combinations of two levers to cause the code pins of said code levers to occupy positions simulating any of ten different patterns, a select lever having a code hole for each of said code lever code pins arranged therein to simulate a particular one of the said ten code patterns, means effective incident to an operation of said code levers in which the code pins thereof occupy positions simulating the particular code pattern simulated by the code holes of said select lever for causing the select lever code holes to register with the code lever code pins, and means responsive to such rgistration for enabling said tape perforator.

3. In combination with a code-sensing device, a tape perforator including five groups of five code levers, each code lever having a code pin, means including said code-sensing device for selectively operating the code levers of each of said groups in combinations of two levers to cause the code pins of said code levers in each group to occupy positions simulating any of ten different code patterns, a select lever for each group of code levers each having a code hole for each of the code lever code pins of a corresponding group of code levers, the code holes of each of said select levers arranged to simulate a particular one of the said ten code patterns, means for selectively enabling one of said select levers to control the operation of said perforator, means effective incident to an operation of said code levers by which the code pins of the group of code levers corresponding to the enabled select lever occupy positions simulating the particular code pattern simulated by the code holes of the select levers for causing the code holes of the enabled select lever to register with the code pins of the corresponding group of code levers, and means controlled by the select lever incident to the registration of its code holes with the code pins of the corresponding group of code levers for operating said tape perforator.

4. In combination, a code-sensing device comprising a plurality of selectively operable code levers, a plurality of reperforators each having code levers corresponding in number to the number of code levers of said code-sensing device, and means mechanically connecting each code lever of said sensing device with a corresponding code lever in each of said reperforators comprising a flat metal tape having one notch for each reperforator, and an integral projection on each of the said corresponding code levers of said reperforators recessed in one of the notches in said tape, whereby the operation of the code levers of said code-sensing device is communicated to corresponding code levers in each of said reperforators through said tapes.

5. In a code tape perforator, a group of vertical parallelly aligned pivotally mounted code levers each having an integral projection extending laterally from one vertical edge thereof, the lateral projection of each of said code levers being differently spaced from the upper end thereof to effect a group of stepped projections occupying a common vertical plane, a mounting block located in a plane in parallel juxtaposition with the plane of said stepped code lever projections and having slots located therein, each in substantial horizontal alignment with a lateral projection of a different one of said code levers, and a flat tape longitudinally slidably housed in each of said slots, each of said tapes having a notch therein in constant communication with a lateral projection of a different one of said code levers, whereby said code levers are pivotally operated in response to the longitudinal movement of their corresponding tapes.

6. In combination, a code-sensing device comprising a group of selectively operable code levers, a plurality of reperforators each comprising a group of code levers corresponding in number to the number of code levers in said sensing device, and each provided with an integral lateral projection, and means mechanically coupling each of the code levers of said sensing device with a corresponding code lever in each of said reperforators comprising a continuous flat metal tape fixed at one end to a code lever of said sensing device and extending therefrom through all said reperforators, said tape having one notch per reperforator in which the lateral projection of a corresponding code lever in each reperforator is recessed, whereby the operation of any of the code levers of said sensing device is communicated to a corresponding code lever in each of said reperforators by said continuous tape, and means for operating the code levers of said sensing device.

7. In combination in a tape perforator, a plurality of perforating levers adapted to be operated from a normal position to a tape perforating position, each of said perforating levers having a horizontally disposed arm carrying an integral vertical projection, a plurality of parallelly disposed code levers occupying a plane vertical to the plane of the horizontal arms of said perforating levers, an interponent member integrally formed on each of said code levers normally occupying a position in superposed alignment with a vertical projection on a corresponding perforating lever whereby said perforating levers are normally inhibited against operation to tape-perforating positions, a lateral projection on each of said code levers, and means for selectively operating said code levers to remove the interponent members thereof out of alignment with corresponding vertical projections of said perforating levers to enable corresponding perforating levers, comprising a slidably mounted longitudinally movable flat metal tape for each of said code levers having a notch therein in cooperative engagement with the said lateral projection of a corresponding code lever.

8. In combination in a tape perforator, means for enabling the perforator to perform a perforating operation, a select lever having a multiplicity of code holes, two of which simulate a particular code pattern, a code lever corresponding to each

of said select lever code holes and each having a code pin, means pivotally mounting said code levers relative to said select lever so that the code pins of two thereof are normally out of vertical alignment with the select lever code holes simulating the said particular code pattern and the code pins of all other code levers are in individual vertical alignment with the remaining select lever code holes, means for selectively actuating said code levers to vertically align the code pins of two thereof with the select lever code holes simulating the said particular code pattern, means effective subsequent to this alignment for operating said select lever to cause the code holes thereof to register with the code pins of said code levers, and means responsive to the operation of said select lever for operating said perforator enabling means.

9. In combination in a tape perforator, means for enabling the perforator to perform a perforating operation, a plurality of select levers each having a multiplicity of code holes, two code holes in each of which simulate the same particular code pattern, a group of code levers for each select lever, each code lever having a code pin, means pivotally mounting the code levers of each group thereof relative to its corresponding select lever so that the code pins of two code levers in each group are normally out of vertical alignment with the two code holes of the corresponding select lever simulating the said particular code pattern and the code pins of the remaining code levers are in individual vertical alignment with the remaining select lever code holes, means for selectively actuating the code levers of all of said groups to vertically align the code pins of two in a particular group thereof with the code holes simulating the said particular code pattern in a corresponding select lever, manually operable means for selectively enabling the corresponding one of said select levers, means effective subsequent to the alignment of the code pins of two of a group of code levers with the code holes of the manually enabled select lever for operating said enabled select lever to cause the code holes thereof to register with the code pins of the corresponding group of code levers, and means responsive to the operation of said select lever for operating said perforator enabling means.

10. In a tape perforator, a group of pivotally mounted vertically disposed code levers each carrying at one end a code pin and at the other end a corresponding interponent member, a plurality of rotatably operable normally disabled perforating levers each provided with a code projection, means mounting each of said perforating levers horizontally relative to a corresponding code lever so that the interponent member of the latter is normally disposed in the line of travel of the code projection of the corresponding perforating lever, a select lever for said group of code levers having code holes therein corresponding in number to the number of code levers in said group, means pivotally mounting said select lever relative to said group of code levers so that all but two of the code lever code pins are in vertical alignment with coresponding code holes in said select lever, means for pivotally operating the two code levers whose code pins are normally out of vertical alignment with their corresponding

select lever code holes to bring the code pins thereof into vertical alignment with their corresponding select lever code holes and to simultaneously remove the interponent members thereof from the line of travel of the code projections of corresponding perforating levers and thereby enable said perforating levers, means effective subsequent to the operation of said code levers for operating said select lever to effect the registry of the code lever code pins with their corresponding select lever code holes, and means effective incident to the registry of said code lever code pins with corresponding select lever code holes for operating the enabled perforating levers.

11. In combination in a tape perforator, means for enabling the perforator to perform a perforating operation, a plurality of perforating levers rotatably mounted in horizontal alignment on a common shaft, each of said levers having an integrally formed code projection on one end thereof and a perforating punch on the other end and adapted, when rotated to a perforating position to move its associated code projection vertically upwardly, a plurality of pivotally mounted code levers arranged in parallel alignment with their longitudinal axes in a common vertical plane, each of said code levers provided with a laterally projecting interponent member at one end and a vertically projecting code pin at the other end, said code levers being so disposed relative to said perforating levers that the interponent member of each of said code levers occupies a position in the vertical line of travel of a code projection of a corresponding perforating lever, a select lever disposed at right angles to the longitudinal axes of said code levers and having code holes therein, certain of said code holes being located in vertical alignment with a corresponding number of code lever code pins and certain others of said code holes simulating a predetermined code pattern and normally out of alignment with a corresponding number of other code lever code pins, means for selectively actuating a combination of code levers corresponding to the code pattern simulated by the said certain other code holes of said select lever whereby the code pins thereof are moved into alignment with the code pattern simulating code holes of said select lever and the interponent members thereof are removed from the line of travel of the code projections of corresponding perforating levers to enable said perforating levers, means effective subsequent to the alignment of the code pins with the select lever code holes simulating the said predetermined code pattern for actuating said select lever, and means responsive to the operation of said select lever for operating said perforator enabling means whereby the enabled perforating levers are operated to perforating positions.

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REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
2,112,951	Carpenter	Apr. 5, 1938
2,204,957	Carpenter	June 18, 1940