Aug. 11, 1964 F. J. L. TURNER 3,144,205

PERFORATING APPARATUS

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Fig.1.

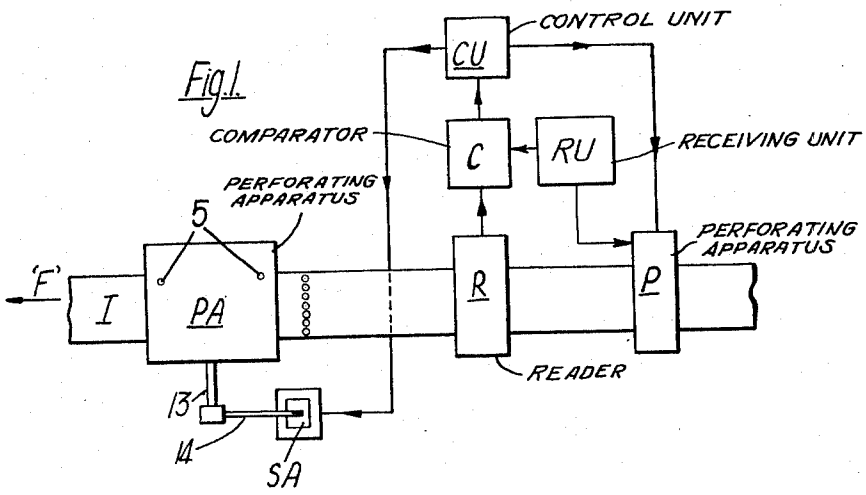

Fig.2.

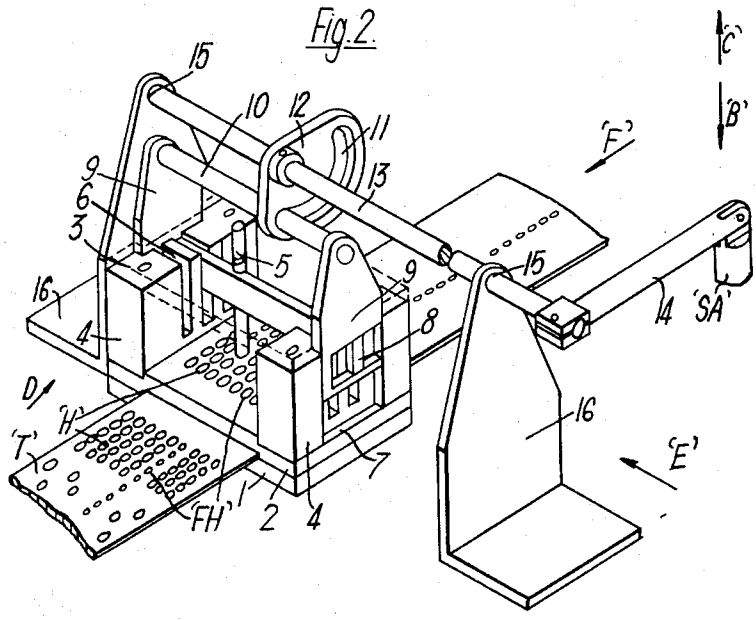

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Fig. 3.

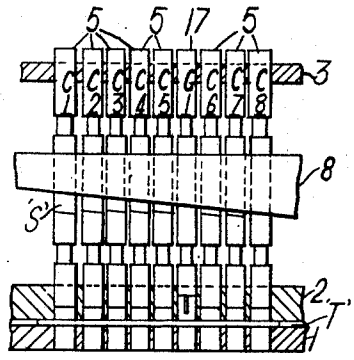

Fig. 4.

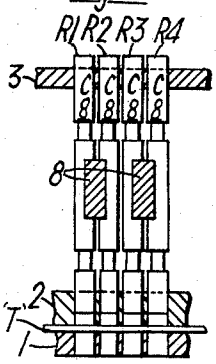

Fig. 5.

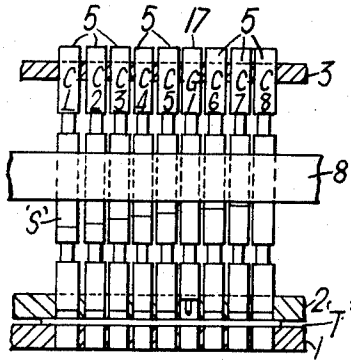

Fig. 6.

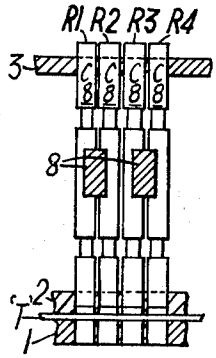

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Fig. 7

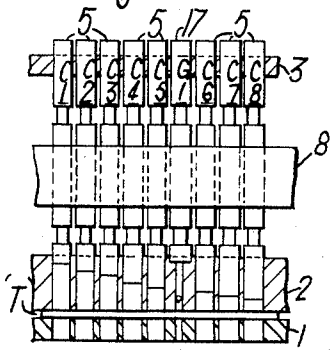


Fig. 8

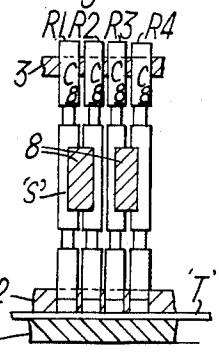


Fig. 9

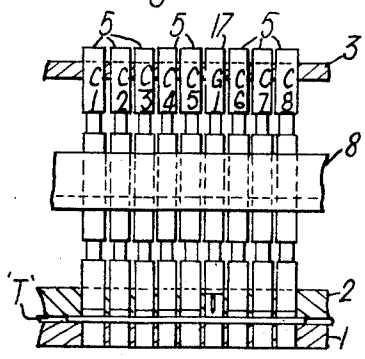
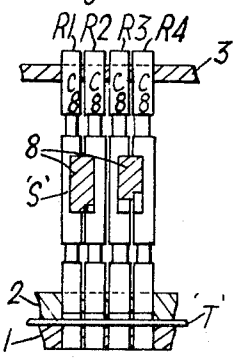


Fig. 10



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3,144,205

PERFORATING APPARATUS

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Claims priority, application Great Britain Nov. 3, 1961
10 Claims. (Cl. 234—34)

This invention relates to perforating apparatus, and more particularly to such apparatus for erasing errors in data perforated in a recording medium as code elements of a signal combination.

It is known in perforating apparatus to provide means for reading a character perforated in a recording medium such as tape, for example, some three or four character positions after perforation has been effected. On detection of an error in the character, the perforator is caused to stop whereafter the tape is fed in a reverse direction until the character in error is beneath the perforating punches of the apparatus. During movement of the tape in the reverse direction, all the characters brought beneath the perforator are "overpunched" to erase the character by producing an all-mark condition at each of those character positions. Thereafter the tape is fed in the normal direction and the elements of "overpunched" characters are perforated in succeeding character positions.

With present day high speed perforating apparatus, stoppage, reversal of direction, and re-feeding of the tape in the normal direction results in loss of time, and complication of the mechanism required to effect these functions. It is one object of the present invention to provide perforating apparatus which will permit erasure of a character or characters without undue loss of time.

According to one aspect of the invention therefor there is provided perforating apparatus including a die-plate, a plurality of punches arranged in rows and columns, means for supporting said punches for movement toward the die-plate and thereafter to cause said punches to perforate the recording medium row-by-row or column-by-column in succession.

According to another aspect of the invention there is provided perforating apparatus including a die-plate, a plurality of punches arranged in rows and columns, means for supporting said punches for movement toward the die-plate and thereafter to cause said punches to perforate the recording medium in a selected order.

The invention is now to be described with reference to the accompanying drawings in which:

FIG. 1, shows a block schematic of a data processing system in which perforating apparatus according to the present invention is employed.

FIG. 2, shows a pictorial view of one embodiment of the perforating apparatus according to the present invention.

FIGS. 3 and 4, 5 and 6, 7 and 8, and 9 and 10 show, in part section, different arrangements of punches and punch operating bars employable in the apparatus of FIG. 2.

Referring now to FIG. 1, the block P is representative of well-known apparatus for perforating the elements of, for example, an 8-unit code combination, plus a feed hole perforation by which the tape is fed in the direction indicated by the arrow F. The block R is representative of photo-electric reading means arranged to read the elements of a character code combination perforated in the tape T by the apparatus P. A non-limiting example of such a photoelectric reading means is disclosed in U.S. Patent No. 2,382,251 to R. D. Parker et al. The centre line of the photo-electric reading means is a distance of three character positions in advance of the centre line of the punches of the apparatus P. Block RU represents

well known receiving apparatus for receiving incoming signals representative of code combinations and applying said signals to perforating apparatus P which perforates tape T in accordance with the received code combinations. An example of receiving apparatus and tape perforating apparatus for performing these functions is a Friden Teledata Tape Transmitter-Receiver as disclosed in the brochure "Friden Communications Systems and Equipment" published 1960, U.S.A. The block C is representative of a well-known type of comparator, the purpose of which is to check that the elements of a character code combination, read by the photo-electric reading means, are in accordance with the elements of the character code combination received by receiving unit RU. The comparator may include well known delay means for delaying the signal received from the receiving unit RU so that they may be compared with the signals produced by the reader as it checks the elements of the character code combination punched in response to the stored or delayed signal. A control unit is represented by the block CU and is employed to respond to electric current signals from the comparator C to control the operation of the perforating apparatus P, and also the perforating apparatus according to the present invention. This latter mentioned apparatus is represented by the block PA. A non-limiting example of a control circuit which is capable of controlling two separate tape perforators such as P and PA is the Friden Model FPC–5, 3-Bank Programatic disclosed in the brochure "Friden Communications Systems and Equipment" published 1960, U.S.A. The perforating apparatus PA may be disposed any desired number of character positions in advance of the centre line of the photo-electric reading means R; however in the presently described embodiment of the apparatus, it may be considered that the centre line of a first row, of four rows, of perforating punches is disposed three character positions in advance.

Referring now to the pictorial view of the apparatus of FIG. 2, represented in FIG. 1 by the block PA, this apparatus comprises a die-plate 1 and a stripper-plate 2 between which the tape T is fed in the direction indicated by the arrow F during perforating operations. These plates incorporate a number of complementary holes such as H and FH arranged in a co-ordinate array of four rows of nine holes per row, the complementary holes of the different rows constituting columns. The holes such as H of a row are positioned to be co-incident with perforations punched in the tape T by the perforating apparatus shown as block P in FIG. 1. The holes such as FH, smaller in diameter than holes H, are arranged in alignment with the feed holes in the tape T, which feed holes are designated by the same reference letters. It will readily be understood that since there are four rows of coincident and complementary holes in plates 1 and 2, four character positions are embraced by the coordinate array of these holes. For each hole such as H, in the plate 2 there is provided a punch such as 5 and for each hole such as FH there is provided a guide pin (FIG. 3), later to be described. These punches and guide pins are arranged for vertical movement with respect to the tape T, in the plates 1, 2, 3, the latter plate being shown dotted in FIG. 2 for the sake of clarity. The upper ends of the punches and guide pins are located in holes in the plate 3 which holes are drilled co-incident with the complementary holes in plates 1 and 2. The plate 3 is, in turn, supported in fixed relationship to the plates 1 and 2 by blocks such as 4. The blocks are slotted, as at 6, aud recessed, as at 7, to respectively accommodate for vertical movement therein punch operating bars, such as 8, and carriers 9 therefor. The carriers 9 are rigidly coupled one to the other by a rod 10 disposed therebetween. Rod 10 engages in cam-track

11 in a cam-plate 12, which cam-plate is accommodated on and affixed to a rod 13. The rod 13 is coupled to an operating lever 14 and pivotally supported in holes 15 of brackets 16 which are affixed to the apparatus frame (not shown). The operating lever, is in turn, coupled to, for example, a solenoid armature SA for movement therewith in the directions indicated by the arrows B and C.

Referring now to FIGS. 3 and 4, these figures show respectively part sectioned front and side views of one arrangement of punches 5 and punch operating bars 8, viewed in the directions indicated by the arrows D and E of FIG. 1. It will be seen in FIG. 3 that one side of the punch operating bar 8 tapers toward the other side, i.e. the lower side tapers toward the upper side. The slots S in the punches 5 are of equal width, and the punches are supported on the punch operating bar particular thereto through the engagement of the upper complementary sides of slots with the side of the punch operating bar opposite to the tapering side. Referring now to FIG. 4 it will be seen the punches of row R1 and R2 are supported on one punch operating bar, whilst the punches of rows R3 and R4 are supported on the next punch operating bar. Column-by-column perforation of the tape T is effected through movement of the punch operating bars 8 downward. In this downward movement all the punches are permitted to move simultaneously toward the tape T and, the tapered end portions of the guide pins 17 of the rows first engage in the feed holes FH (FIG. 2) which are always present in the tape. This engagement corrects minor misalignments between the punches and the code element positions of the characters previously perforated in the tape. The punches therefore will pass cleanly through holes perforated in the tape at these code element positions. Thereafter, in the movement of the punch operating bars, the faces of the punches 5 simultaneously come into contact with the upper surface of the tape T, and the lower complementary sides of the slots S in the punches of columns C1 to C8 are engaged successively, by the tapered sides of the punch operating bars 8 particular thereto, to effect column-by-column perforation of the tape T.

An alternative arrangement of punches 5 and punch operating bars 8 to effect column-by-column perforation is shown in the part-sectioned front and side elevations of FIGS. 5 and 6 respectively. In FIG. 5, the punches 5 are of equal length and the punch operating bars 8 are substantially parallel along their lengths. However the slots S in the punches of one column i.e. column C1 are wider than those in the next adjacent column C2 and so on. The punches 5 are supported on the punch operating bar particular thereto through engagement of the upper complementary sides of the slots with one side i.e. the upper side, of the punch operating bar. Column-by-column perforation of the tape T is effected through movement of the punch operating bars 8 downward to permit all the punches to move downward simultaneously to engage the recording medium and to cause (lower) sides thereof to engage the other (lower) complementary sides of the slots of the punches of one column after another in succession.

It will readily be understood that row-by-row perforation of the tape T can be effected by making the slots S in row R1 wider than those of the punches in the row R2 and so on. Row-by-row perforation of the tape T is effected by movement of the punch operating bars 8 downward and the engagement of the other (lower) sides thereof with the other (lower) complementary sides of the slots of the punches of one row after another in succession.

Another alternative arrangement of punches 5 and punch operating bars 8 to effect column-by-column perforation of the tape T is shown in the front and side elevations of FIGS. 7 and 8 respectively. In FIG. 7 it will be seen that the length of the punches in the first one of the columns i.e. column C1, are shorter than the punches in the next adjacent column and so on. The

slots in the punches of the rows are of equal width and are supported on the punch operating bars particular thereto through engagement of the upper complementary sides of the slots with one side i.e., the upper side, of the punch operating bar. Column-by-column perforation of the tape T is effected through movement of the punch operating bars downward to permit all the punches to move down simultaneously to engage the recording medium and to cause the other (lower) sides thereof to engage the other (lower) complementary sides of the slots of the punches of one column after the other in succession. Row-by-row perforation of the tape T can be effected by making the punches of each row of equal length and by making the punches in row R4 shorter than the punches in the row R3 and so on. Row-by-row perforation of the tape T being effected by movement of the punch operating bars downward and the engagement of the other (lower) sides thereof with the other (lower) complementary sides of the slots of the punches of one row after another in succession.

A further alternative arrangement of punches 5 and operating bars 8 to effect row-by-row perforation of the tape T is shown in the front and side views of FIGS. 9 and 10 respectively. In FIG. 9 it will be seen that the punches are of equal length as are the slots S (FIG. 10) therein. The punch operating bars 8 however, are stepped on their lower sides and are of different depths. The punch operating bar 8, particular to rows R1 and R2, closely engages the upper and lower sides of the slots S in the punches of row R1, and incorporates a stepped face which clears the lower sides of the slots S of the punches in the row R2 by a distance a little in excess of the thickness of the tape T. The overall depth of the punch operating bar 8, particular to the punches of rows R3 and R4, is less than the overall depth of the punch operating bar 8 particular to the punches of rows R1 and R2 by an amount a little in excess of twice the thickness of the tape T. This punch operating bar is also stepped to clear the lower sides of the slots S in the punches of row R4, and by an amount a little in excess of three times the thickness of the tape T. On movement of the punch operating bars together all the punches move simultaneously to engage the tape T, and thereafter the punches of row R1 first engage and perforate the tape followed by the punches of rows 2, 3 and 4 in succession, the lower sides of the slots S of which punches are engaged in turn by those portions of the undersides of the punch operating bars 8 operatively associated therewith. Thus perforation of the tape is effected by the punches row-by-row. With any of the foregoing described arrangements of punches 5 and punch operating bars 8 "overpunching" is achieved by moving operating lever 14 in the direction indicated by the arrow B either manually or through movement and solenoid armature SA. This movement via rod 13, cam-track 11 in cam plate 12, carriers 9, and bars 8, causes the punches 5 and guide pins 17 to move downward with respect to the plates 1, 2 and 3 and the tape T. Movement of the operating member, in the direction indicated by the arrow C, withdraws the punches 5 and guide pins 17 clear of the tape T. Although only four rows of punches 5 have been shown, it will readily be understood that a greater number of rows can be incorporated to suit requirements. A combination of the arrangement of punches 5 and punch operating bars 8 will permit perforation of the recording medium to be effected by rows or columns in any selected order.

Operation on this perforating apparatus in a data processing system is now to be described with reference to FIG. 1. The tape T is fed in the direction indicated by the arrow F to permit perforation of the tape T in successive character positions, by the perforating apparatus P in accordance with information received by receiver unit RU. The elements of successively perforated characters are scrutinised by photo-electric reading means R

three character positions on from the perforating apparatus P. Electric current signals, indicative of the "mark" or "space" conditions of elements of a previously perforated character, are applied to the comparator unit C from reading means R where they are compared, by well known means, with those of the character intended to occupy that particular character position which are fed to comparator unit C from receiving unit RU. In the event of an error being detected, an electric current signal is generated, and applied to the control unit CU, by the comparator unit C. The control unit CU likewise generates electric current signals which are fed to the operating mechanism associated with the perforating apparatus P. As a result, perforating apparatus P ceases, temporarily, to perforate the tape with elements of succeeding characters, and proceeds to feed blank tape in the direction indicated by the arrow F. When the element positions of the character in which the error has been detected, and the character last perforated by perforating apparatus P are beneath the punches 5 of the first and last rows of punches R1 and R4, an electric current signal is applied to a solenoid the armature SA of which is operatively connected to the lever 14 of the perforating apparatus PA. In consequence, this solenoid is momentarily energised to pivot operating lever **14** (FIG. 2) in the directions indicated by the arrows B and C. In its pivoting movement, in the direction indicated by the arrow B, it causes guide pins 17 to engage feed holes FH in the tape and punches 5 of the rows R1 to R4 to "overpunch" the elements of the last four characters perforated by the perforating apparatus P in any one of the manners as previously described. After this "overpunching" operation, perforating apparatus P is caused to perforate the elements of the four characters in succeeding character positions on the tape T. It will readily be understood that the punches of perforating apparatus P will have been set to ensure that the condition of the elements of the first character of the four are correct. It may well be that another one or all of the three other characters are in error. In such circumstances the punches of the perforating apparatus P will be set to ensure that the condition of the elements of the character or characters concerned are correct.

It is to be understood that the foregoing description of specific examples of this invention is not to be considered as a limitation on its scope.

What I claim is:

1. In equipment for perforating a tape in accordance with received information, the combination of:

(*a*) means for receiving information;

(*b*) first perforating means operatively associated with said receiving means and adapted to perforate the tape in transverse rows in accordance with the received information, said first perforating means including means for feeding the tape through said first perforating means in a first direction;

(*c*) means for reading the perforated tape, said reading means being disposed adjacent said tape beyond said first perforating means in said first direction;

(*d*) means operatively associated with said receiving means and said reading means for comparing the incoming information with the information read by said reading means;

(*e*) second perforating means for overpunching a desired amount of information contained on said tape while said tape is being fed in said first direction, said second perforating means being disposed adjacent said tape beyond said reading means in said first direction; and

(*f*) control means operatively associated with said comparing means and said first and second perforating means for disabling said first perforating means and operating said second perforating means for a predetermined time after the receipt of incoming information which differs from the information contained on said tape whereby said desired amount of information is overpunched.

2. Equipment according to claim 1 wherein said received information consists of coded characters, each transverse row representing one character, and wherein the first overpunched transverse row corresponds to the first dissimilar information detected by said comparing means.

3. Equipment as claimed in claim 1 wherein said second perforating means comprises a plurality of punches arranged in columns and rows, and means for selectively operating rows of said punches sequentially.

4. Equipment as claimed in claim 1 wherein said second perforating means comprises a plurality of punches arranged in rows and columns, and means for selectively operating columns of said punches sequentially.

5. Equipment as claimed in claim 1 wherein said second perforating means comprises a plurality of punches arranged in rows and columns, and means for selectively operating said punches in a desired order.

6. Equipment as claimed in claim 5 wherein said selecting means comprises:

(*a*) at least one punch operating bar, each said punch operating bar supporting two adjacent rows of said punches; and

(*b*) cam means for moving said punch operating bars in a desired manner.

7. Equipment as claimed in claim 6 in which each said punch comprises a transverse slot disposed intermediate the ends thereof.

8. Equipment as claimed in claim 7 in which one side of each said punch operating bar tapers toward the opposite side thereof, said slots in said punches are of equal width and said punches are supported on the punch operating bar associated therewith through engagement of the side of said slots adjacent said opposite side of said punch operating bars.

9. Equipment as claimed in claim 7 in which the lengths of the punches in a first one of said columns are shorter than the punches in the next adjacent column, said slots in said punches are all of equal width and said punches are supported on the punch operating bar particular thereto through engagement of complementary sides of the slots with one side of the punch operating bar associated therewith.

10. Equipment as claimed in claim 7 in which the slots in a first one of said rows of punches are wider than the slots in the next adjacent row of punches and so on and said punches are supported on the punch operating bar particular thereto through engagement of complementary sides of said slots with one side of the punch operating bars.

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