Dec. 31, 1957 R. D. SALMON ET AL 2,818,116

TELEGRAPH CODE PERFORATING APPARATUS

Filed Sept. 15, 1955 3 Sheets-Sheet 1

FIG. 1.

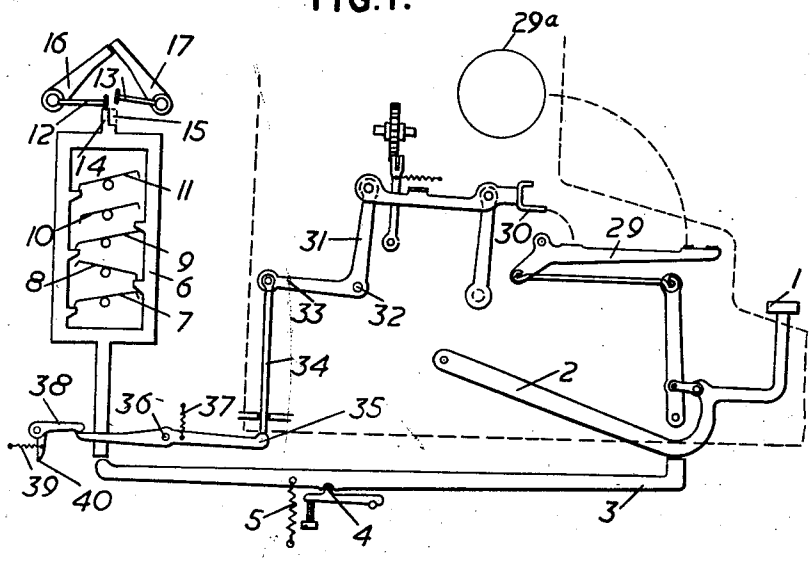
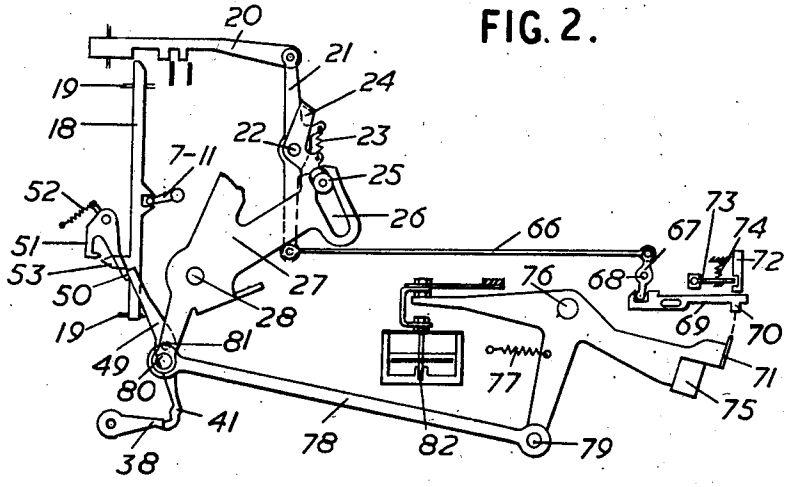


FIG. 2.



Inventors
R. D. SALMON-
F. J. L. TURNER,
By
Attorney

Dec. 31, 1957 R. D. SALMON ET AL 2,818,116

TELEGRAPH CODE PERFORATING APPARATUS

Filed Sept. 15, 1955 3 Sheets-Sheet 2

FIG. 3.

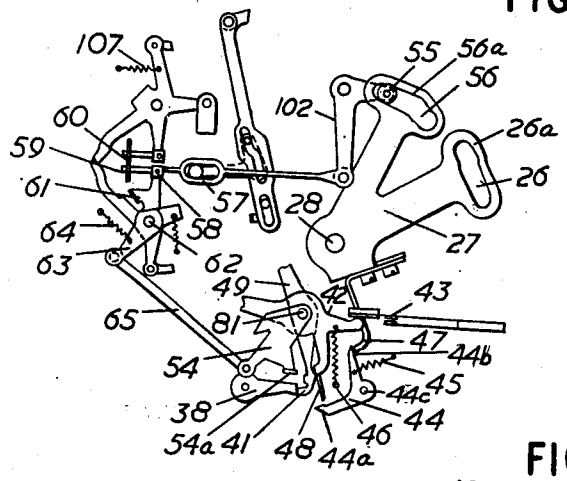


FIG. 4.

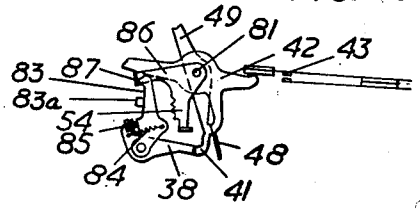


FIG. 5.

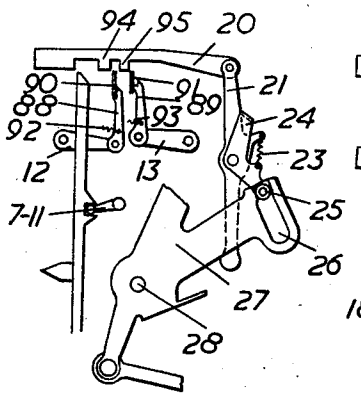


FIG. 5a.

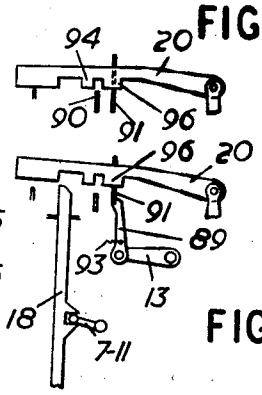


FIG. 5b.

Inventors
R. D. SALMON-
E. J. L. TURNER
By R. P. Morris
Attorney

Dec. 31, 1957 R. D. SALMON ET AL 2,818,116

TELEGRAPH CODE PERFORATING APPARATUS

Filed Sept. 15, 1955 3 Sheets-Sheet 3

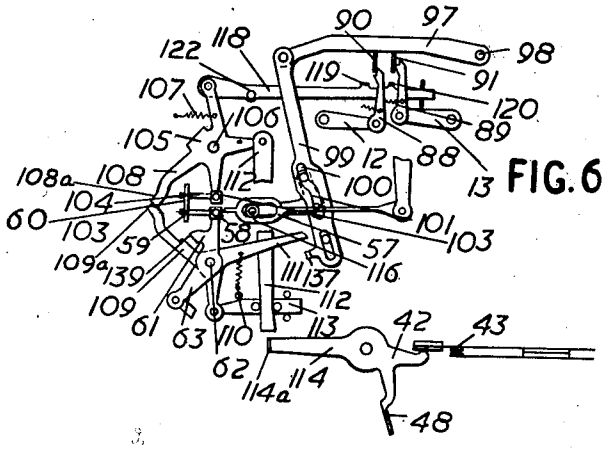
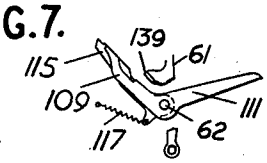


FIG. 6.

FIG. 7.



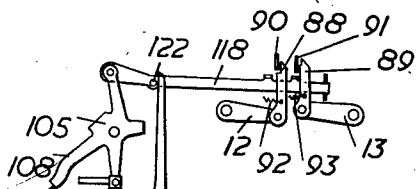
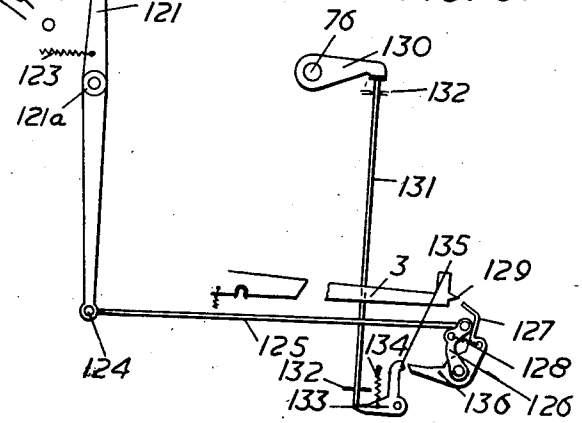


FIG. 8.



Inventors
R. D. SALMON-
F. J. L. TURNER
By
Attorney

United States Patent Office 2,818,116 Patented Dec. 31, 1957

2,818,116

TELEGRAPH CODE PERFORATING APPARATUS

Reginald Dennis Salmon and Frederick James Leslie Turner, Croydon, England, assignors to Creed & Company Limited, Croydon, England, a British company

Application September 15, 1955, Serial No. 534,562

Claims priority, application Great Britain September 23, 1954

10 Claims. (Cl. 164—112)

This invention relates to perforating apparatus for perforating a tape according to a code combination of perforations, more particularly, but not exclusively, for perforating a tape according to a telegraph code.

The present invention is an improvement in and modification of the invention described and claimed in the copending application No. 399,860 of R. D. Salmon, F. J. L. Turner, and A. F. Burr, filed December 23, 1953, hereinafter referred to as the parent specification.

In that specification there was described and claimed perforating apparatus in which key bars when actuated positively move type bars to print a character and also control a mechanism for perforating a tape in accordance with a code combination of perforations.

There was also described and claimed perforating apparatus comprising a frame carrying perforator key bars, means for controlling the perforation of a tape in accordance with a code combination of perforations by operation of said key bars, means in said frame to position therein a typewriter and means for causing the actuation of the keys of the typewriter to actuate the said perforator key bars.

In the specific embodiment described in the parent specification the key bars of the typewriter are arranged to operate on corersponding key bars of the perforator to raise code bars, on each of which there are provided projections in combinations representing a code. The projections on each code bar support a combination of code vanes which rest by gravity on the projections and each of which, in its lowermost position, closes a pair of contacts. Each pair of contacts controls an electromagnet which positions an interposing member to determine whether a punch is actuated to perforate the tape or not.

In the arrangement described in the parent specification, when a typewriter keybar is operated the corresponding code bar is raised and a combination of code vanes is raised with it. The pair of contacts associated with each raised code vane is therefore opened. When the next typewrite key bar is operated, another combination of code vanes is raised and any code vane, which was raised by the operation of the first key bar and is not raised by the operation of the second key bar, will be allowed to fall under gravity to close its associated contacts. There is thus positive actuation of the code vanes in one direction only.

The operation of each perforator key bar also lifts a trip bar, thereby energising the punch electromagnet and moving a locking bar against the action of a spring to hold the code bars in their respective positions, the operated one raised and the remainder in their lowered positions. Having once been brought into its locking position, the locking bar is held there by another arm until freed as a result of the return stroke of the electromagnet armature. The typewriter keyboard is thus locked until the combination corresponding to the operated typewriter key has been perforated.

In this arrangement the code vanes must be heavy enough to ensure that the contacts associated with any

code vane make proper electrical contact when that vane is in its lower position. However the weight of the code vanes necessary to ensure reliable operation of the contacts adds a considerable load to the typewriter key. In addition, the pull of the locking bar spring has to be overcome by each depression of a typewriter key, with the result that the touch of the keyboard is adversely affected, and a typist accustomed to a normal typewriter finds typing difficult.

Furthermore, the speed of operation of the perforator arrangement described in the parent specification is limited by the time taken for the code vanes to return to their lower position under gravity. It is the object of the present invention to overcome these defects and to provide perforating apparatus which may be operated from the keyboard of a typewriter at the maximum speed at which the typewriter is capable of working, and with negligible additional load on the typewriter keyboard.

According to the present invention code members, one for each element of the combination, are actuated positively in both directions when a typewriter key bar is operated. There is therefore no question of any time lag in the position of the code vanes, and if a particular key bar has been operated the code vanes must occupy positions corresponding to the signal combination for that keybar.

The setting of the punch interposing members is determined in the present invention by a direct mechanical link which reads the position of code bars associated with the code vanes. The necessity for the code vanes to have sufficient weight to maintain proper contact pressure is therefore removed, and the code vanes may be made as light as possible. Furthermore, all the movements of the perforating apparatus, other than the setting up of the combination on the code vanes, are associated with movements of the punch electromagnet. Strains such as that applied by the locking bar spring are therefore removed from the key bars, and the touch of the typewriter when associated with the perforator is practically indistinguishable from that of the typewriter alone.

Other modifications of the apparatus described in the parent specification, which will be described in the present specification, include means for ensuring that the shift insertion bar is restored to its rest position after a shift signal has been perforated and before the ensuring character combination is perforated, means for locking the selected combination instead of the bar which selects the combination, means for locking the keyboard only on automatic case insertion, and means for operating the punch electromagnet at the almost identical instant that the typewriter carriage is released, thereby providing that each perforated combination is recorded by at least a space on the printed record made by the typewriter.

The invention will now be described with reference to the accompanying drawings which show schematically one embodiment of the invention. The way in which the apparatus is assembled as a perforator is similar to that shown in Fig. 1 of the parent specification, and may be readily understood from that figure.

Of the accompanying drawings,

Figs. 1 to 4 show the basic mechanism of a perforator according to the invention,

Figs. 5 to 7 show the automatic case shift insertion arrangement, and

Fig. 8 shows the operation of a locking arrangement during the automatic case shift insertion.

Referring to Fig. 1, which shows how the depression of a key on the typewriter causes a combination to be set up on the perforator, all the parts shown inside the broken lines are typewriter parts, while all those outside these lines are perforator parts. There is shown in Fig. 1, a

typewriter key 1, its key bar 2 and a perforator key bar 3, situated immediately below the typewriter key bar 2. Each typewriter key bar 2 has a corresponding perforator key bar 3. The perforator key bar 3 is pivoted at 4, this pivot being adjustable to obtain the desired movement of the perforator key bar 3 in response to the operation of key 1. The depression of key 1 thus moves the key bar 2 into contact with perforator key bar 3, which pivots about the point 4 against the action of spring 5 and raises the particular combination bar 6 corresponding to key 1.

Five code vanes 7, 8, 9, 10 and 11 are centrally disposed to the combination bars 6 and pivoted so that they can be rotated by the code projections on the combination bars when any combination bar is operated by a key depression. Thus key 1, representing the letter "Y," actuates combination bar 6 to rotate the code vanes 7–11 clockwise and anticlockwise to represent the combination M. S. M. S. M. For the letter "Y" the code vanes 7, 9, 11 will be rotated clockwise and vanes 8, 10 anticlockwise.

Above the combination bars 6 are provided a letter shift bail 12 and a figure shift bail 13. Letter shift bail 12 may be raised by projection 14 which is present on all combination bars corresponding to typewriter letter keys. The combination bars corresponding to typewriter figure keys have no projection 14, but instead have a projection 15 which is arranged to operate on figure shift bail 13. The bails 12 and 13 have respective latching projections 16, 17, which operate in a flip-flop manner, so that, after a combination bar such as 6 associated with a letter key on the typewriter has been operated, member 17 latches member 16 to hold the letter shift bail 12 against the pull of its out-of-balance weight. Conversely, after a combination bar associated with a figure key on the typewriter has been operated, member 16 latches member 17 and holds the figure shift bail 13 against the pull of its out-of-balance weight.

Referring now to Fig. 2, each of the code vanes 7–11 has attached to it a code bar such as 18 which runs in grooves 19. When the code vane associated with a particular code bar 18 is rotated clockwise, the code bar 18 is raised in its grooves 19. In the raised position, the upper ends of code bars 18 engage the under side of five reading bars such as 20. The engagement of code bar 18 with reading bar 20 takes place for a "marking" condition of the code vane, while there is no engagement for a "spacing" condition. The significance of this arrangement will be apparent later from the description of the automatic case shift insertion.

The five reading bars 20 are pivotally connected to five selector levers such as 21. The selector levers are themselves pivoted on member 22 and connected through five springs 23 to a common frame 24, which is also pivotally mounted on member 22. An arm of the common frame 24 carries a cam roller 25. This cam roller 25 is arranged to run in a cam track 26 on a swinging frame 27, pivotally mounted on member 28.

Swinging frame 27 is caused to oscillate about member 28 whenever the electromagnet is energised or deenergised, as will be described later.

In Fig. 1 there is also shown the operation of a trip bar 38 by the typewriter, while the way in which the trip bar causes the contacts of the electromagnet to be closed is shown in Figs. 3 and 4.

The depression of key 1 (Fig. 1) causes the type bar 29 to rise to print a character against paper disposed about platen 29*a*. As the printing action takes place the type bar 29 also strikes member 30 which lies in its path and moves it to the left in Fig. 1, turning arms 31 and 33 of a bell crank anticlockwise about pivot 32 and initiating the letter feed or "spacer" on the typewriter. The members 29, 30, 31, 32 are parts of a standard typewriter. Arm 33 carries a member 34 which extends vertically through the base of the typewriter and co-operates with

a lever 35 on the perforator. As the typebar prints a character, arm 33 moves anticlockwise forcing member 34 down to rock lever 35 clockwise about its pivot 36 against the action of spring 37.

In contact with the opposite end of lever 35 is trip bar 38 which is normally held by spring 39 against stop 40. As lever 35 rocks, however, trip bar 38 is moved anticlockwise against the action of spring 39. Resting against the end of trip bar 38 in its lower position is locking latch 41 (Figs. 3 and 4). Locking latch 41 is urged in a clockwise direction about its pivot 81 by spring 46 (Fig. 3) through arm 48 which is also pivoted at 81. Therefore, when trip bar 38 is raised, locking latch 41 moves clockwise about 81 and latches trip bar 38 in its operated position.

Also urged in a clockwise direction by spring 46 is another arm 42 integral with arm 48. Arm 42 normally holds the electromagnet contacts 43 open, but when trip bar 38 is raised and arm 42 is able to move in a clockwise direction, the contacts 43 close and the electromagnet is energised.

Locking latch 41 has an opposite arm 49 (Fig. 2) which, in the rest position, engages an arm 50 of locking frame 51. The locking frame 51 is urged in an anticlockwise direction by spring 52, but is unable to make any movement in this direction until trip bar 38 allows locking latch 41 and its associated arm 49 to move clockwise. Locking frame 51 then moves to co-operate with the wedge-shaped portions 53 on the code bars 18, thus holding the code bars in the combination of upper and lower positions which they have assumed as a result of the depression of key 1 until the punching action of the electromagnet has been completed.

It will be noted that the energisation of the electromagnet as a result of the movement of trip bar 38 occurs at the instant that the typewriter "spacer" mechanism operates. The adjustment is such, that, if the typewriter key is not depressed sufficiently to operate the "spacer" mechanism on the typewriter, the trip bar 38 will not be operated and no character will be perforated on the perforator tape. Thus, for every character which is perforated, there will be a record on the typed copy.

As the contacts 43 close and the electromagnet is energised, the magnet armature 75 (Fig. 2) starts to make an anti-clockwise rotation about pivot 76 against the action of spring 77. Link 78 is pivotally connected at 79 to the armature and is thus drawn to the right (as seen in Fig. 2) during the forward movement of electromagnet armature 75. Link 78 is also pivotally connected at 80 to swinging frame 27 which is therefore rotated in an anticlockwise direction about its pivot 28 during the forward swing of armature 75.

Swinging frame 27 carries two cam tracks 26 and 56 as shown in Fig. 3. In these tracks run cam rollers 25 and 55 which impart rotational movements to their associated members 24 (Fig. 2) and 102 (Fig. 3) when the rollers meet the shaped portions, 26*a* and 56*a* respectively of the cam tracks. It will be seen that these shaped portions 26*a* and 56*a* are so placed that the rotational movement imparted by portion 26*a* of cam track 26 and roller 25 occurs in the initial stages of the forward swing of the armature, while the movement resulting from portion 56*a* of cam track 56 and roller 55 occurs later in the armature swing.

The shaped portion 26*a* of cam track 26 causes a movement of cam roller 25 and common frame 24 (Fig. 2) in a clockwise direction about member 22 immediately swinging frame 27 commences its anticlockwise movement about member 28. This motion of frame 24, through the springs 23, tends to turn selector levers 21 in a clockwise rotation about member 22, thus urging reading bars 20 to the right (as seen in Fig. 2). The movement of reading bars 20 is then dependent upon the combination set up by the code vanes 7–11 and code bars 18. The

reading bars 20 associated with code bars 18 set in a "marking" condition (i. e. raised) will be restrained and those associated with a "spacing" condition will be free to move. In the former case springs 23 will be extended. In the latter case the movement of a reading bar 20 is transferred via a link 66, and a bell crank 67 pivoted at 68 to an interposing member 69. A link 66, a bell crank 67 and an interposing member 69 is provided for each of the five reading bars.

The cam track 26 is shaped to move roller 25 in approximately one third of the radial movement of swinging frame 27, and, as these movements are directly coupled to the electromagnet, the interposing members 69 will be positioned before the hammer 71 strikes them to perforate the tape. In the case of a "marking" condition, interposing member 69 will not have moved from the position shown in Fig. 2, so that hammer 71 will strike projection 70 to operate punch 72 which is later returned in well known manner by member 73 and spring 74. In the case of a "spacing" condition, projection 70 on interposing member 69 will have moved out of the path of hammer 71 and the tape (not shown) will not be perforated.

The cam track 56 (Fig. 3) imparts a rotational movement to member 102 through roller 55 at approximately the same time as the punching operation is taking place. Member 102 rotates in a clockwise direction about its pivot and thus causes push rod 57 to move to the left (as seen in Fig. 3). Push rod 57 therefore strikes a block 58 on bellcrank 61, turning bellcrank 61 anticlockwise about its pivot 62 against the action of spring 64. Projecting from and fixed to the block 58 is a rod 59 which is allowed to slide in guide rack 60. The arrangement of block 58, rod 59 and guide rack 60 is made to reduce the wear due to the continued operation of push rod 57. Cam track 56 is used to derive the push rod movement from the armature movement in order to ensure that the push rod movement is constant, which would not be the case if it were derived directly from the armature movement.

Bellcrank 61 has a second arm 63 which is connected via link 65 to the reset lever 54. Reset lever 54 is pivoted at 81 and moves in an anticlockwise direction about pivot 81 when push rod 57 operates on block 58. Portion 54*a* of reset lever 54 thus comes into contact with locking latch 41 and forces locking latch 41 and arm 48 in an anticlockwise direction against the action of spring 46. Trip lever 38 is thus disengaged from locking latch 41 and is free to move downwards again under the action of its own spring 39 (Fig. 1), provided that the operator has released the typewriter key.

As arm 48 is moved anti-clockwise, its associated arm 42 is brought back to the position shown in Fig. 3, in which the control contacts 43 of the electromagnet are again opened and the electromagnet is de-energised and free to begin its return swing. At the same time arm 49 is rotated anticlockwise to bear against arm 50 of locking frame 51, thus disengaging locking frame 51 from code bars 18 (Fig. 2).

There is provided a timing latch 44 (Fig. 3) which is designed to prevent the contacts 43 from closing again until the electromagnet armature 75 has completed its return swing, even though the trip bar 38 is in an operated position. In the rest position of the perforator, timing latch 44 is held, as shown in Fig. 3, by an arm 47 attached to swinging frame 27, so that projection 44*a* is out of the path of arm 48. When the contacts 43 are closed and the swinging frame 27 starts to move as the result of the energisation of the electromagnet, arm 47 disengages from arm 44*b* of the timing latch which is then free to move in a clockwise direction about its pivot 44*c* under the action of spring 45. Arm 48 is not at this time in a position to be engaged by projection 44*a*, and only assumes such a position under the action of the reset lever 54 which abuts against locking latch 41 and which in turn abuts against arm 48. The engagement of projection 44*a* with arm 48 causes arm 42 to hold the contacts 43 open until swinging frame 27 has returned to its rest position and the engagement of arm 47 with arm 44*b* of the timing latch releases arm 48 from projection 44*a*.

The cycle time of the perforator electromagnet is designed to be such that the perforator can work at a speed of 200 words per minute. This is the fastest speed at which a standard typewriter can operate and therefore trip bar 38 should not have been already operated for the next character before timing latch 44 releases arm 48, as just described. However, if for any reason, such as a drop in the voltage applied to the electromagnet, the cycle time of the electro-magnet should be longer than that intended, and the key for the next character has been operated before the end of the return swing of the electromagnet, then the timing latch 44 prevents contacts 43 from closing again until the end of that return swing, even though trip bar 38 is in an operated condition.

There is also the possibility that the operator has not released the key 1 for the character just perforated by the time that the timing latch 44 releases arm 48. In order to prevent the electromagnet being energised a second time in this event, there is provided a latch 83 (Fig. 4) which is mounted on the same pivot as the trip bar 38 and which is normally held in contact with a stop 85 on the trip bar 38 by a spring 84. Therefore, when the trip bar 38 is operated, latch 83 moves anticlockwise with it. If the trip bar 38 is still in the operated position when the reset lever 54 moves anticlockwise, projection 87 on lever 86, which is integral with reset lever 54, will be latched with latch 83. Thus reset lever 54 will be held down in contact with locking latch 41 as long as trip bar 38 remains operated. The contacts 43 will remain open for the same period. The distances are so arranged that, when the trip bar 38 is eventually allowed to move down by the release of the key 1, trip bar 38 moves into the path of locking latch 41 before this latch 41 moves back into its locking position.

There is provided, external to the typewriter, a run-out perforator key, which is used for running a quantity of blank tape out of the perforator. This is done by depressing the run-out key and keeping it depressed until the required quantity of tape has been passed out of the perforator. There is provided, therefore, a lever (not shown) which is operated by the run-out key to move stop 83*a* into the path of lever 83. Lever 83 is thus held by stop 83*a* in the rest position shown in Fig. 4, and spring 84 is extended when the trip bar 38 is operated as long as the run-out key is depressed.

The trip bar 38 is operated from the perforator run-out key in the way described in the parent specification. The key causes a combination bar such as 6 to be raised, the combination bar having code projections which position the vanes 7 . . . 11 in a particular manner thereby causing an "all space" signal to be perforated, and operating, in its raised position, trip bar 38. Contacts 43 are then allowed to close, as described, reset lever 54 causes them to open again and is almost immediately withdrawn, lever 83 being held out of the latching position even though the trip bar 38 remains operated by the continued depression of the run-out key, the timing latch 44 holds the contacts open until the end of the return swing of the electromagnet armature 75, when the contacts immediately close again. This cycle of operations is continued until the run-out key is released when a sufficient quantity of tape has been passed out of the perforator.

Automatic case shift insertion

In the five unit telegraph code, all combinations following a "letters" case combination are interpreted as letter characters, while combinations following a "figures" case combination are interpreted as figures. However, there are no letter shift or figure shift keys on a typewriter and it is not desired to modify the typewriter for use with the

perforator by the introduction of further keys which would mean training typists specially to use extra keys with a perforator. It is therefore necessary that provision be made for automatic case shift insertion.

It has already been explained in connection with Fig. 1 that a letter shift bail **12** may be operated by a combination bar **6** corresponding to a letter key on the typewriter when the letter key is operated after a figure key. Alternatively, if, after transmission of several letter signals, a figure key is operated, the figure shift bail **13** will be raised. The manner in which the operation of either of the bails **12**, **13**, is used to insert a shift signal before the particular combination, and in which the electromagnet is arranged to do two cycles and no more under these conditions will now be explained with reference to Figs. 5 to 7.

Referring to Fig. 5, where the figure shift bail **13** is shown raised, the bails **12** and **13** have respective latches **88** and **89** which can engage the under side of a letter shift insertion bar **90** and a figure shift insertion bar **91** respectively. Latches **88** and **89** are urged to the left (as seen in Fig. 5) by respective springs **92** and **93**.

The insertion bars **90** and **91** are pivotally mounted at right angles to the five reading bars, such as **20**, and can be raised by an upwards movement of the shift bails to engage projections on the underside of the five reading bars. The reading bars **20** associated with elements Nos. 1, 2, 4 and 5 of the five unit code are provided with projections **94** and **95**, as shown in Fig. 5, while the reading bar **20** associated with element No. 3 of the code has projections **94** and **96**, as shown in Figs. 5*a* and 5*b*.

Referring to Fig. 5, the figure shift bail **13** is shown raised, indicating that a figure signal was the last one to be sent. If a letter key is now operated on the typewriter, the letter shift bail **12** will be raised, causing latch **88** to engage letter shift insertion bar **90** and raise it into engagement with reading bars **20** immediately to the right of projection **94**. Thus, when the electromagnet is operated and the selector levers **21** attempt to draw the reading bars **20** to the right, no reading bars **20** will be moved by levers **21** and the letter shift signal of "all mark" will be perforated.

If the position of the bails **12**, **13** in Fig. 5 is reversed and a key on the typewriter corresponding to a figure is depressed, then bail **13** will be raised, causing latch **89** to force figure shift insertion bar **91** upwards into engagement with the reading bars **20**. For the reading bars corresponding to code elements Nos. 1, 2, 4 and 5, the figure shift insertion bar **91** will come into engagement with reading bars **20** immediately to the right of projections **95** on these bars. For the reading bar **20** corresponding to code element No. 3, which is shown in Fig. 5*a*, the figure shift insertion bar **91** will strike projection **96** and lift the bar **20** to the position shown in Fig. 5*b*. Now when the electromagnet is energised and selector levers **21** attempt to draw reading bars **20** to the right, bars **20** corresponding to code elements Nos. 1, 2, 4, 5, will be restrained by figure shift insertion bar **91**, irrespective of whether they are engaged by code bars **18** or not. Thus a "figure" signal will be perforated for these elements. For element No. 3, on the other hand, code bar **20** has been tilted by insertion bar **91** at such an angle (see Fig. 5*b*) that is not restrained by its code bar **18**, even if this code bar is in the raised or "marking" condition. Reading bar **20** for code element No. 3 is therefore always drawn to the right when a figure key is operated after a letter key and the figure shift signal M. M. S. M. M. is perforated.

The way in which the electromagnet is arranged to perform two cycles and no more, when a shift signal is to be inserted, and the means for ensuring that the second cycle is not commenced until the shift insertion mechanism is clear of the reading members, thus guaranteeing no mutilation of the second code, will now be described with reference to Figs. 6 and 7.

Referring to Fig. 6, a member **97** is pivotally mounted at **98** so that it rests on the two shift insertion bars **90** and **91**. Coupled to the free end of member **97** is a vertical bar **99** which is guided to slide vertically when either of the shift insertion bars **90**, **91**, is raised. Attached to bar **99** is a cam track **100** in which a cam roller **101***a* on bellcrank **101** engages, in such a manner that bellcrank **101** is rotated clockwise when bar **99** is raised.

Bellcrank **101** carries on another arm a roller **116** which runs in a parallel slot near the free end of push rod **57**. The vertical position of the free end of push rod **57** is therefore dependent on the position of the vertical bar **99** and ultimately on whether either of shift insertion bars **90**, **91** is raised.

The operation of push rod **57** from swinging frame **27** has already been described in connection with Fig. 3. When a shift insertion bar is raised, the action of push rod **57** is similar, but at a higher level. The push rod **57** therefore operates on block **103** to slide rod **104** in guide rack **60** and turn bellcrank **105** clockwise about its pivot **106** against the action of spring **107**.

Fixed to bellcrank **105** are members **112** and **118**. As bellcrank **105** moves clockwise, member **112** moves downwards, guided by pins **138** on lever **113**, and makes contact with the turned over end **114***a* of arm **114**. Arm **114** is integral with arm **42**, and the action of member **112** on arm **114** causes arm **42** to pivot anticlockwise and to open the contacts **43**, thus de-energising the electromagnet and allowing the armature **75** to start its return swing.

Member **118** is moved to the right by the clockwise movement of bellcrank **105** about its pivot **106**. This causes overturned projections **119** and **120** to engage latches **88** and **89** and hold them out of contact with the shift insertion bars **90** and **91**.

Mounted side by side on pivot **62** are two independent bellcranks **109** and **115** (Fig. 7). When bellcrank **105** (Fig. 6) rotates clockwise under the action of push rod **57**, arm **108** is moved sufficiently to disengage its end **108***a* completely from the corresponding end **109***a* of bellcrank **109** and to latch in the notched portion of bellcrank **115**. Bellcrank **109** (Fig. 6) is thus free to rotate in a clockwise direction under the action of its spring **110** and a second arm **111** on this bellcrank comes into contact with projection **137** on vertical bar **99**, which projection extends into the path of arm **111**. The bar **99** at this time is raised from the position shown in Fig. 6. Arm **111** therefore tries to draw bar **99**, member **97** and the raised shift insertion bar **90** or **91** downwards. When arm **111** comes into contact with projection **137**, however, the raised shift insertion bar **90** or **91** is frictionally engaged with four or five of the reading bars **20**, and the pull of arm **111** exerted by its spring **110** is not sufficient to overcome this frictional effect. The bar **99**, member **97** and the raised shift insertion bar **90** or **91** therefore remain in the upper position until selector levers **21** cease their efforts to draw reading bars **20** to the right. This happens almost at the end of the return swing of the electromagnet armature **75**.

When bar **99** is drawn down by arm **111** under the action of spring **110**, arm **111** and bellcrank **109** are able to continue their clockwise rotation. During this continuation of their movement, their associated lever **113** is drawn to the left (as seen in Fig. 6) with the result that member **112** is drawn toward the left off the end **114***a* of arm **114**. The associated arms **114**, **42**, **48** are therefore free to move once more under the action of their spring **46** (Fig. 3) and the contacts **43** close again. By this means the shift insertion bar **90** or **91** is completely lowered out of the path of the reading bars **20** before the controls are allowed to close for the second time. The electromagnet is then energised a second time for the one key depression on the typewriter and the character combination is perforated, as already described in connection with Figs. 1 to 4.

The operation of the push rod **57** in the lower position resets bellcranks **108**, **109** and **115**. As bellcrank **61** turns anticlockwise about its pivot **62**, the projection **139** on it strikes bellcranks **109** and **115** and forces them anticlockwise about pivot **62** against the action of their springs **110** and **117**, until arm **108** of bellcrank **105** is unlatched from bellcrank **115** and moves under the action of spring **107** into the path of bellcranks **109** and **115**, i. e. into the position shown in Fig. 6. As bellcrank **105** moves, it draws with it into the normal rest position its associated members **112** and **118**.

It has already been mentioned that the perforator is designed to work at a speed of 200 words per minute which is the fastest speed that a typewriter is mechanically capable of reaching. During the perforation of successive letter or figure characters, there is therefore little likelihood of a typewriter key being operated before the perforator has completed its cycle of operations and is ready to perforate the next character. However when a figure character is perforated immediately after a letter character, or vice versa, the perforator has to perforate a shift combination in addition to a character combination, and the speed of the perforator is therefore effectively halved for this character. A probability therefore arises of the next key operation on the typewriter occurring before the perforator has punched its two combinations. The perforator is therefore provided with a locking bar which engages the perforator keybar and prevents it being operated again until two combinations have been punched every time that a change from a letter key to a figure key, or vice versa, is made on the typewriter. The operation of this locking bar will now be described with reference to Fig. 8.

When member **118** is moved to the right (as already described in connection with Fig. 6) a projection **122** (Fig. 8) extending outwardly from the side of member **118** causes lever **121** to turn on pivot **121***a* in a clockwise direction against the action of spring **123**. Pivotally connected to lever **121** at point **124** is a link **125** which is also connected to bellcrank **126**. As lever **121** is moved by projection **122** on member **118**, so it moves bellcrank **126** to the left (as seen in Fig. 8), and locking bar **127** is also drawn to the left by spring **128**. Locking bar **127** is thus drawn under projection **129** on perforator keybar **3** and prevents the operation of another key on the typewriter. Locking bar **127** is drawn forward in a permissive manner by spring **128** in order to prevent damage to the locking bar **127** or perforator keybar **3** by jamming owing to the accidental operation of two keys almost simultaneously.

Member **118** is moved to the right, as already described, towards the end of the forward swing of the electromagnet armature **75** for the perforation of a shift signal. It remains in this position until the same time in the next forward swing of the electromagnent armature **75** which is the swing during which the character combination is perforated. When member **118** is returned to its rest position, lever **121**, link **125** and locking latch bar **127** are free to move back to their rest positions under the action of spring **123**. In order to prevent this happening until the electromagnet armature **75** has completed its return swing, an arrangement consisting of items **130** to **136** is provided.

Mounted integrally with the armature **75** on pivot **76** is an arm **130** which, in the rest position, bears down on rod **131** which runs in guides **132**. When the electromagnet is energised and the armature **75** starts to swing, arm **130** will raise from the position shown in Fig. 8, and rod **131** will be urged upwards by bellcrank **133** and spring **134**. During a normal character perforation, locking bar **127** and its associated arm **136** will not be moved from their rest positions, so that latch **135** on the second arm of bellcrank **133** will rest on arm **136** and this will be the limit of the movement of bellcrank **133**. When the armature **75** has completed its return swing, arm **130** bears again on rod **131** and bellcrank **133** is returned to the position shown.

However, if a shift perforation is being made, bellcrank **126** and locking bar **127** will move anticlockwise as the electro-magnet armature **75** nears the end of its forward swing, and this movement enables latch **135** to engage the arm **136** associated with locking latch bar **127** and holds it until the end of the return stroke of the armature. Member **118** is not withdrawn to its rest position until a time near the end of the second forward swing of the electromagnet, so that, when latch **135** is released at the commencement of the second forward swing, it engages arm **136** and thereby holds the locking latch bar **127** in the locking position. Locking bar **127** therefore remains in the locking position after member **118** has been returned to the rest position, in fact it remains in the locking position until latch **135** is withdrawn at the end of the second return swing of the electromagnet armature and the perforator is ready for the next signal combination.

Other features, for example, the carriage return feature, back spacer and prevention of actuation of certain keys, may be provided as described in the parent specification.

While the principles of the invention have been described above in connection with specific embodiments, and particular modifications thereof, it is to be clearly understood that this description is made only by way of example and not as a limitation on the scope of the invention.

What we claim is:

1. Perforating apparatus for perforating a recording medium adapted to be operated by a standard typewriter having a plurality of key bars, a plurality of type bars, each adapted, when moved, to print a character, a plurality of perforating elements, one for each element of a code, a plurality of settable code members, each associated with and adapted to control a different one of said perforating elements, said code members adapted to be moved and positioned in opposite directions, in accordance with given code combinations, and further adapted to effect positive control of said perforating elements when moved in a first direction, and first means under control of said key bars for selectively actuating each of said code members in either of said directions depending upon the code combination to be perforated.

2. Perforating apparatus as claimed in claim 1, further comprising additional means for actuating said perforating elements, interponent members coupling each of said code members with its associated perforating element and reading means for reading the positions of said actuated code members, said reading means under control of said first actuating means, said interponent members under control of said reading means whereby said perforating elements may be selectively brought under control of said additional actuating means.

3. Perforating apparatus as claimed in claim 2, further comprising mechanical linkage between said reading means and said interponent members.

4. Perforating apparatus as claimed in claim 2, further comprising locking means for locking said code members in either of said positions, said locking means adapted to become effective after actuation of said code members, said key bars remaining free for actuation independent of said locking means.

5. Perforating apparatus as claimed in claim 4, wherein said locking means comprises spring means for normally urging said locking means into locking engagement, and trip means for tripping said locking means, said trip means under control of said key bars, and restoring means under control of said additional actuating means for restoring said locking means to an unlatching position after operation of said perforating elements.

6. Perforating apparatus as claimed in claim 1, further comprising means to actuate a shift insertion bar

immediately after operation of a key bar representative of a character in one case of said code, said shift insertion bar coupled to said perforating elements to cause recording of a case shift signal in said recording medium between perforations representing characters immediately after operation of a second key bar representing a character in another case of said code, and means for restoring said shift insertion bar to its unoperated position prior to operation of said actuating means.

7. Perforating apparatus as claimed in claim 6, wherein said additional actuating means comprises an electromagnet and a cooperating armature, and means, operative after actuation of said first key bar, for locking all of said key bars until said armature has returned to its rest position following actuation of said perforating elements and perforations made in said medium of the code combination corresponding to said first key bar.

8. Perforating apparatus as claimed in claim 5, further comprising means under control of said trip means for controlling operation of said additional actuating means, and means under control of the spacing mechanism of said typewriter for actuating said trip means.

9. Perforating apparatus as claimed in claim 5, wherein said means under control of the spacing mechanism of said typewriter comprises a linkage member linking said trip means with said spacing mechanism.

10. Perforating apparatus as claimed in claim 5, further comprising reading means for reading the position of said code members, a movable frame member, means to control said additional actuating means including a cam track and a cam follower associated with said frame member, said follower adapted to cause release of said actuating means after movement thereof.

No references cited.