

Feb. 17, 1948.

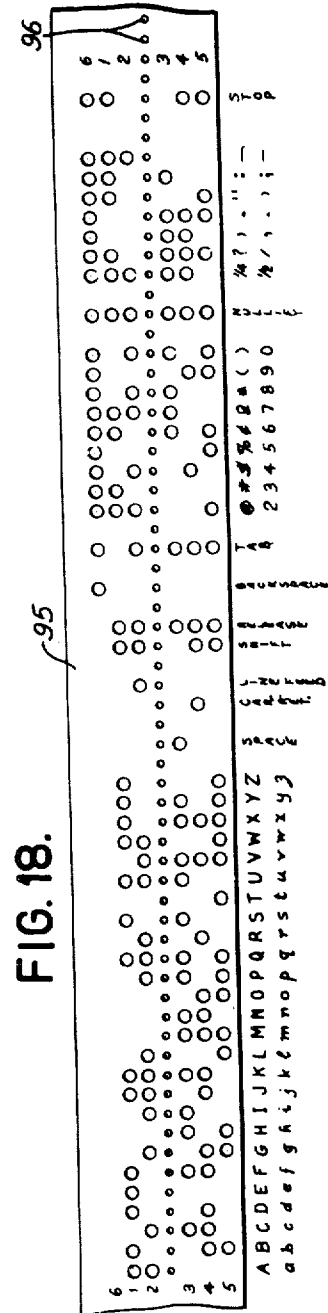
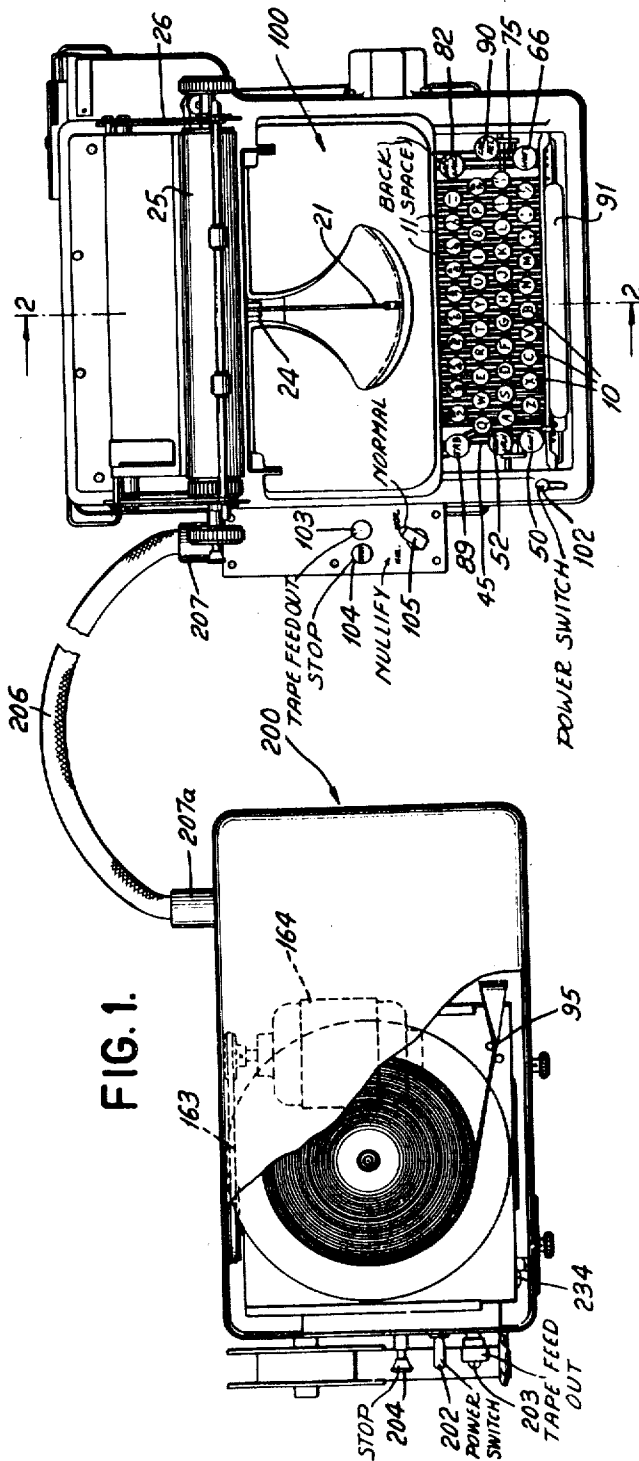
H. L. THOLSTRUP

2,436,126

APPARATUS FOR RECORDING OR TRANSMITTING INTELLIGENCE

Filed June 30, 1943

11 Sheets-Sheet 1



INVENTOR
Henry L. Tholstrup
 BY
W. M. Wilson
 ATTORNEY

Feb. 17, 1948.

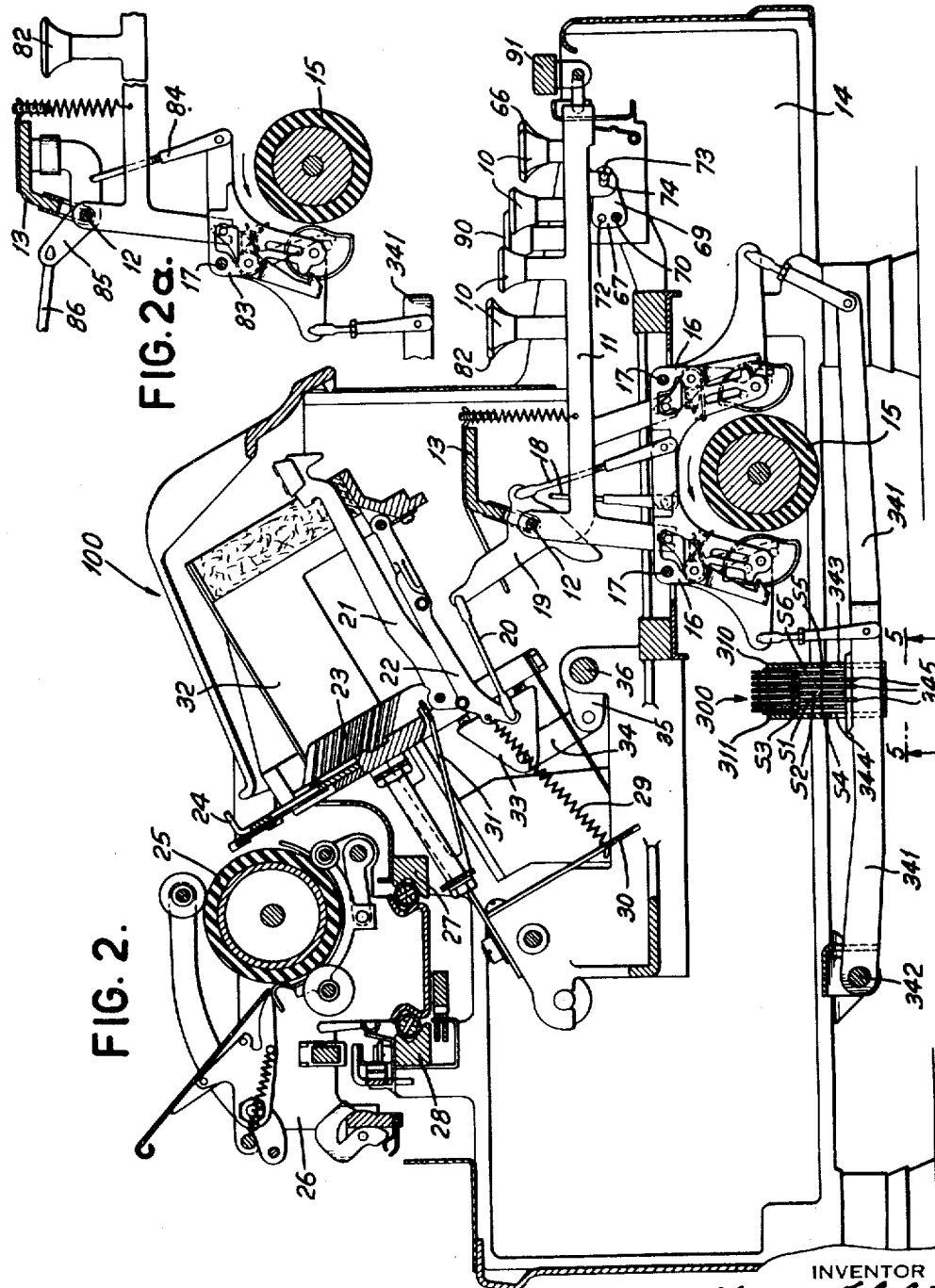
H. L. THOLSTRUP

2,436,126

APPARATUS FOR RECORDING OR TRANSMITTING INTELLIGENCE

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11 Sheets-Sheet 2



INVENTOR

Henry L. Tholstrup

BY

W. M. Wilson

ATTORNEY

Feb. 17, 1948.

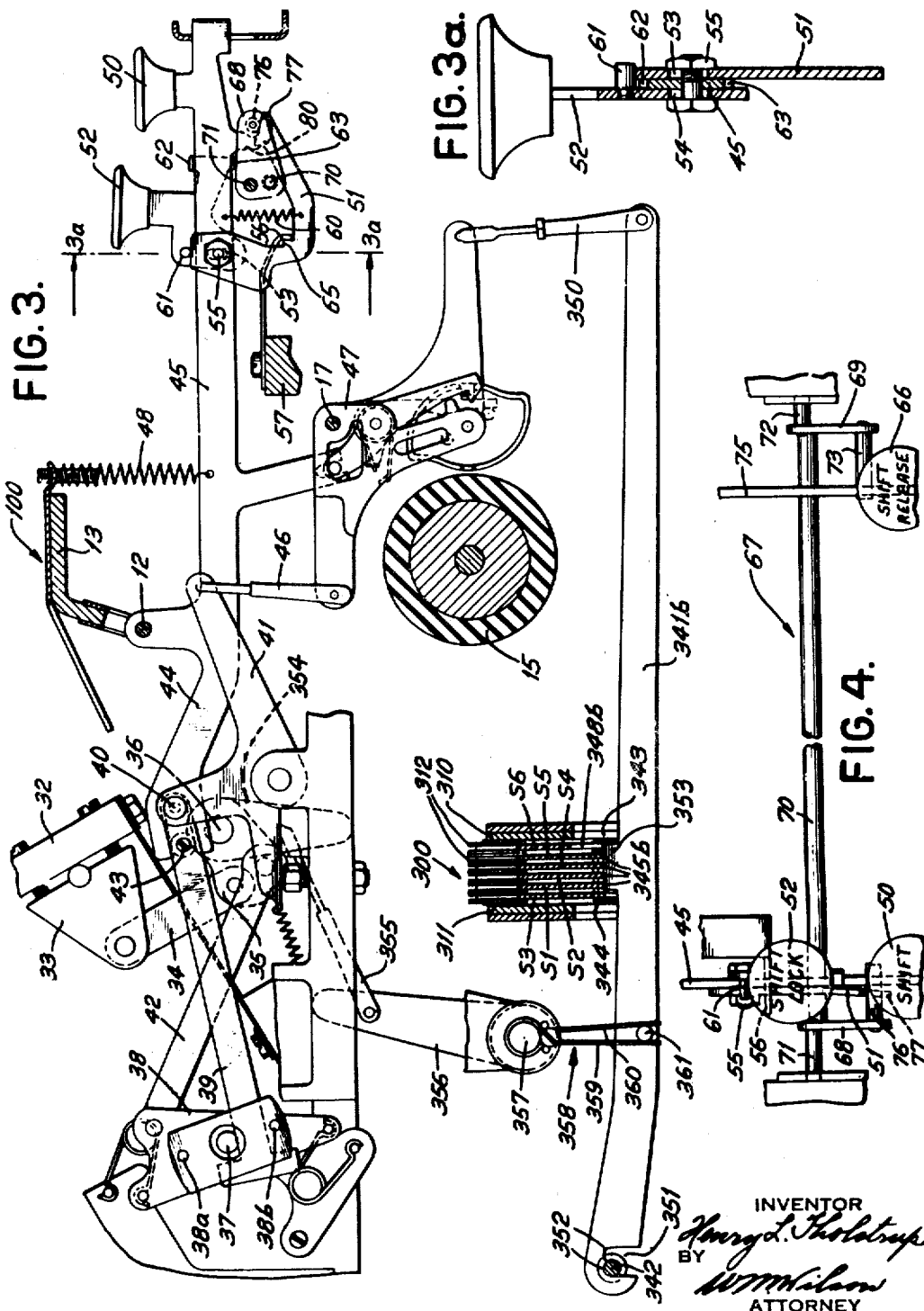
H. L. THOLSTRUP

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APPARATUS FOR RECORDING OR TRANSMITTING INTELLIGENCE

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11 Sheets-Sheet 3



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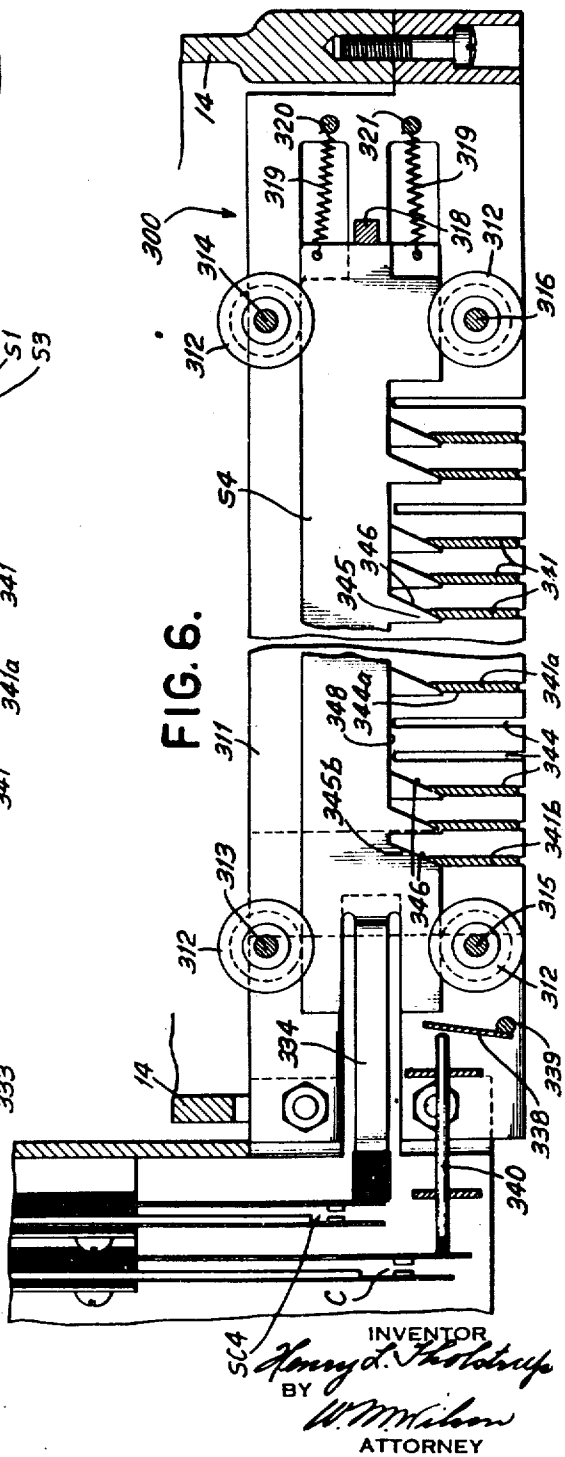
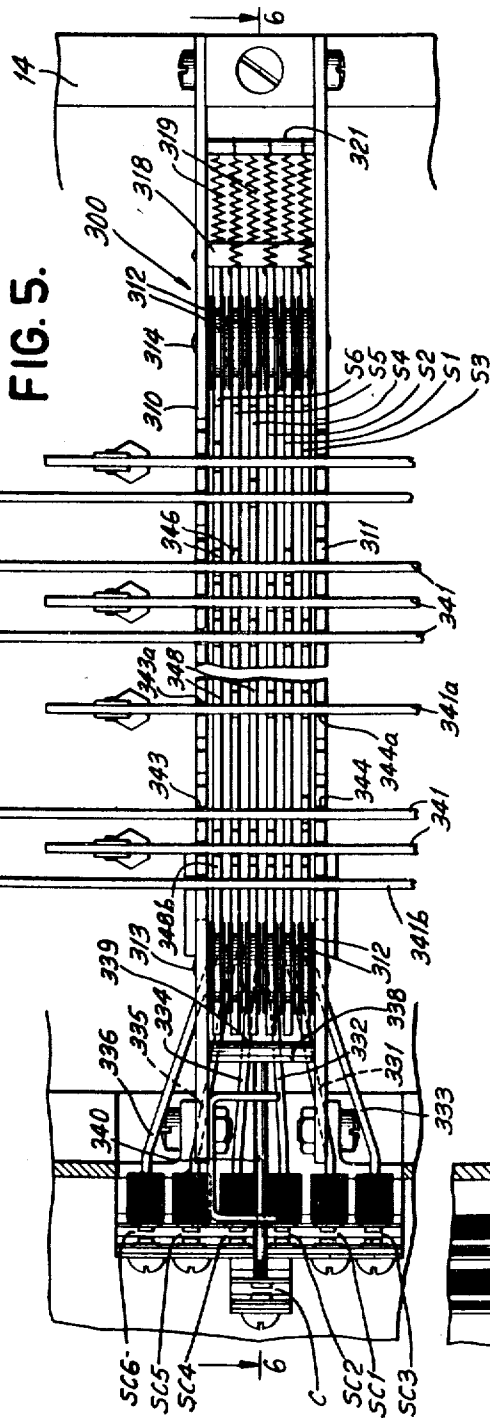
H. L. THOLSTRUP

2,436,126

APPARATUS FOR RECORDING OR TRANSMITTING INTELLIGENCE

Filed June 30, 1943

11 Sheets-Sheet 4



INVENTOR
Henry L. Tholstrup
BY
W. M. Wilson
ATTORNEY

Feb. 17, 1948.

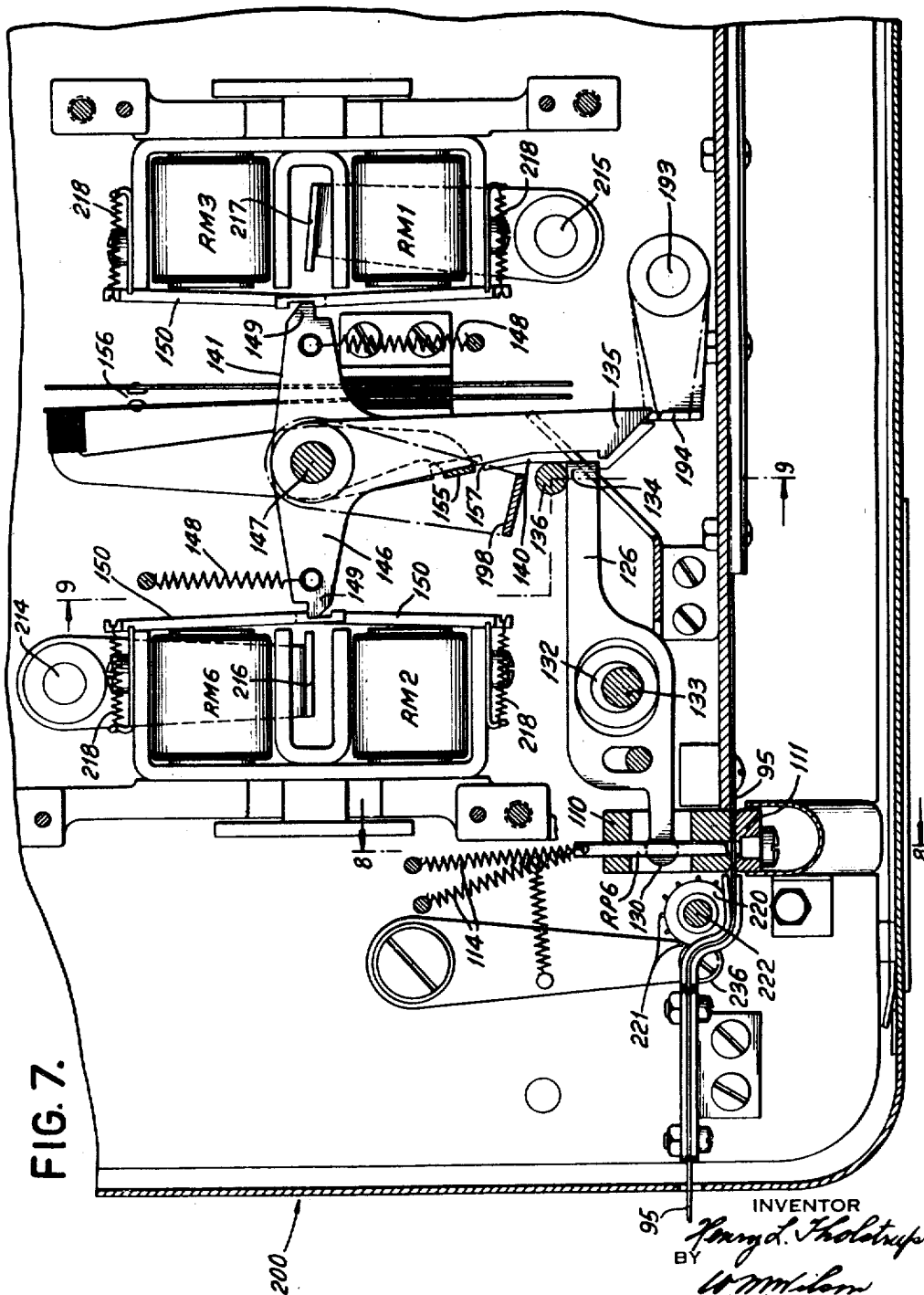
H. L. THOLSTRUP

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APPARATUS FOR RECORDING OR TRANSMITTING INTELLIGENCE

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2,436,126

11 Sheets--Sheet 6



INVENTOR
Herold Tholstrup

INVENTOR
Henry L. Tholstrup
BY *W. M. Wilson*
ATTORNEY

Feb. 17, 1948.

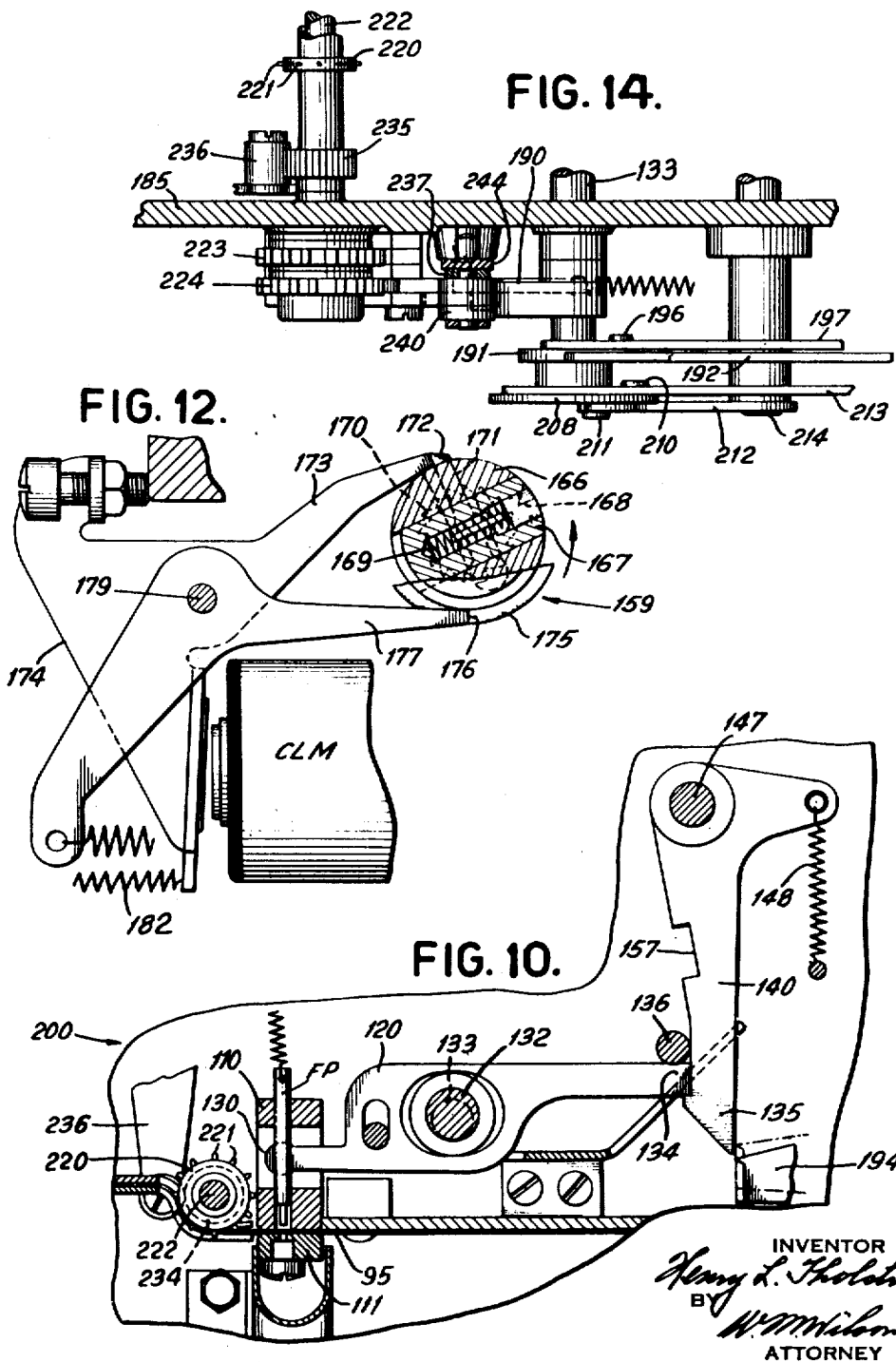
H. L. THOLSTRUP

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APPARATUS FOR RECORDING OR TRANSMITTING INTELLIGENCE

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H. L. THOLSTRUP

APPARATUS FOR RECORDING OR TRANSMITTING INTELLIGENCE

Filed June 30, 1943

11 Sheets-Sheet 8

INVENTOR

INVENTOR
Henry L. Tholstrup
BY *W. M. Wilson*
ATTORNEY

Feb. 17, 1948.

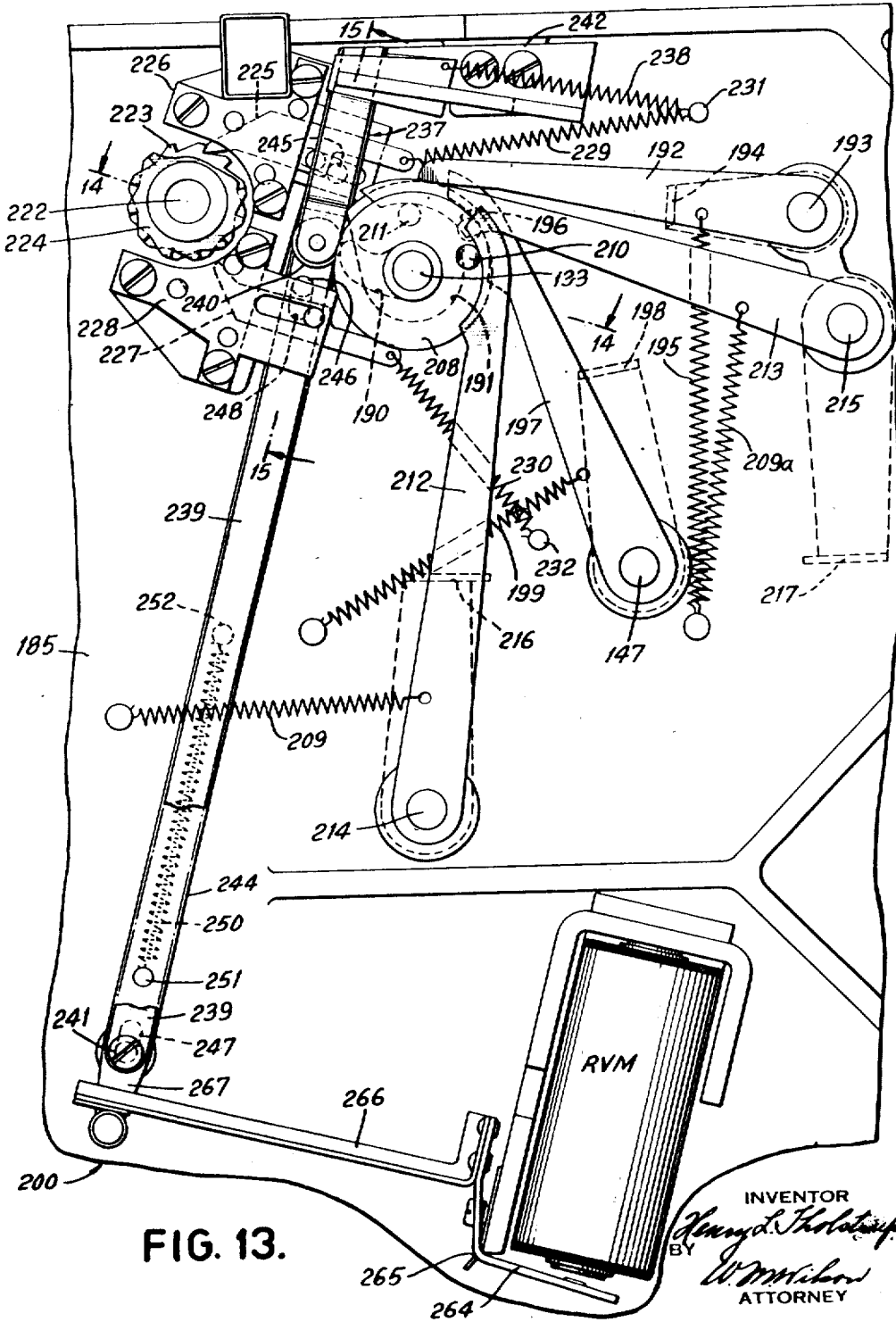
H. L. THOLSTRUP

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APPARATUS FOR RECORDING OR TRANSMITTING INTELLIGENCE

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FIG. 16.

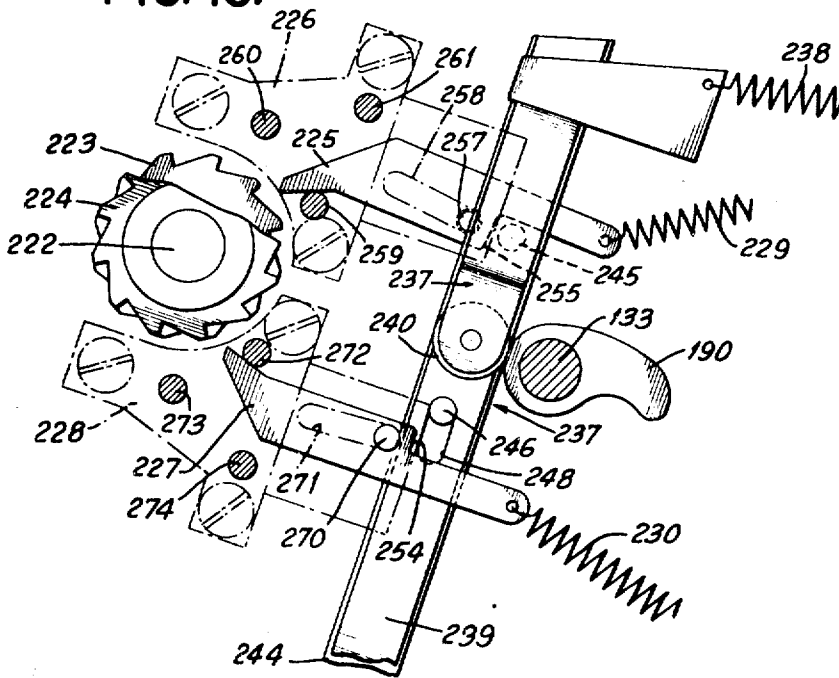
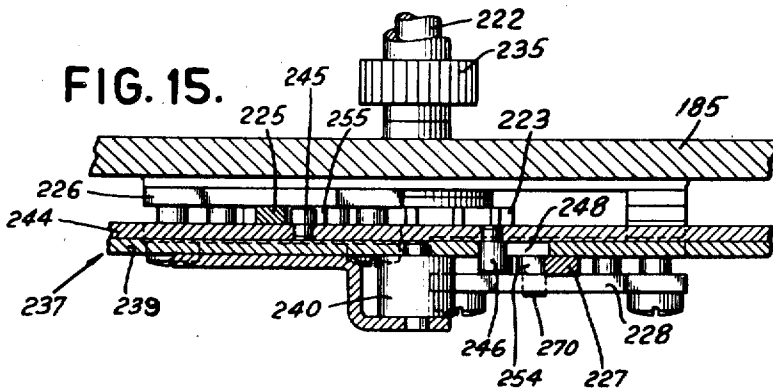


FIG. 15.



INVENTOR
Lenny D. Holstrup
BY
W. M. Milburn
ATTORNEY

Feb. 17, 1948.

H. L. THOLSTRUP

2,436,126

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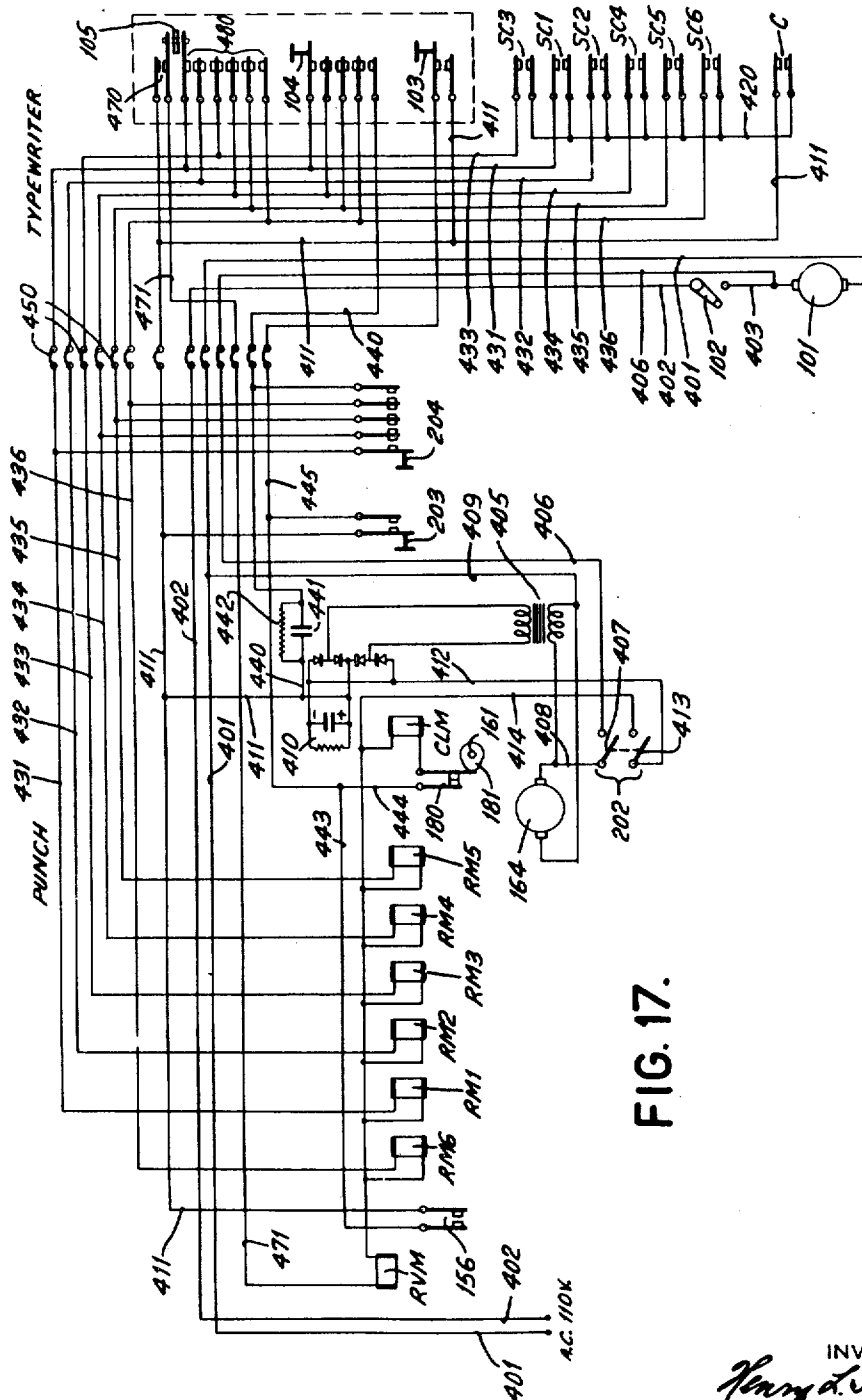


FIG. 17.

INVENTOR
Henry L. Tholstrup
BY
W. M. Mahan
ATTORNEY

UNITED STATES PATENT OFFICE

2,436,126

APPARATUS FOR RECORDING OR TRANSMITTING INTELLIGENCE

Henry L. Tholstrup, Rochester, N. Y., assignor to International Business Machines Corporation, New York, N. Y., a corporation of New York

Application June 30, 1943, Serial No. 492,895

20 Claims. (Cl. 164—113)

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This invention considered in its broader aspects, relates generally to apparatus for recording or transmitting intelligence, and it has for a broad object to provide apparatus of this type which is of improved construction and arrangement of parts.

A further and more specific object is to provide a new and improved form of typewriter-recorder apparatus wherein, in response to the actuation of each typewriter key, a code designation representing the key actuated is recorded in a record strip.

A further object is to provide in an apparatus for recording data on a record strip, a new and improved means for nullifying previously recorded data.

A further object is to provide in a typewriter-recorder apparatus a new and improved means which operates under the control of the back space key of the typewriter to nullify data previously recorded in a record strip and which also feeds the record strip backward while back spacing the typewriter carriage.

A further object is to provide in a recording apparatus, a new and improved means for feeding a record strip.

A further object is to provide in apparatus of the character first stated, a new and improved means which, in response to a single actuator in one condition of adjustment, provides for the transmitting of a certain selected data and when in another condition of adjustment transmits other selected data.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose, by way of example, the principle of the invention and the best mode, which has been contemplated, of applying that principle.

In the drawings:

Fig. 1 is a plan view showing, as one preferred embodiment of this invention, a typewriter-recorder apparatus;

Fig. 2 is an enlarged vertical sectional view taken on the line 2—2 of Fig. 1, and illustrating a power-operated typewriter as controlling a permutation unit in response to the actuation of the typewriter keys;

Fig. 2a is a fragmentary vertical sectional view of a portion of the typewriter and illustrating partly the mechanism controlled by the back space key;

Fig. 3 is an enlarged fragmentary vertical section of the typewriter shown in Figs. 1 and 2, and illustrating the mechanism for shifting to

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upper and lower case, and the means for controlling the operation of the permutation unit when shifting to upper case and when the shift key is released to return to lower case;

Fig. 3a is a detail sectional view taken on the line 3a—3a of Fig. 3;

Fig. 4 is a fragmentary plan showing the operation of the shift keys, the shift-lock button or key, and the means for releasing the shift key when locked;

Fig. 5 is an enlarged fragmentary sectional view through the lower part of the typewriter and showing the permutation unit in bottom plan, the plane of the section being indicated by the line 5—5 on Fig. 2;

Fig. 6 is a fragmentary vertical sectional view taken on the line 6—6 of Fig. 5;

Fig. 7 is an enlarged fragmentary plan section of the code recorder shown in Fig. 1, the plane of the section being indicated by the line 7—7 of Fig. 8;

Fig. 8 is a fragmentary vertical section showing the punch elements of the recorder, the section being indicated on the line 8—8 of Fig. 7;

Fig. 9 is a fragmentary vertical section taken on the broken line 9—9 of Fig. 7 and showing the relative arrangement of the latch levers for controlling the operation of the punch actuating levers of the recorder;

Fig. 10 is an enlarged fragmentary plan section showing the detail construction of the mechanism for punching the feed holes in the tape, the plane of the section being indicated by the line 10—10 of Fig. 9;

Fig. 11 is a fragmentary plan section through the tape punch at a higher plane than Fig. 7 and showing the drive mechanism and the clutch, which operate the punch elements and the tape feeding mechanism, the plane of the section being indicated by the line 11—11 of Fig. 8;

Fig. 12 is an enlarged detail section taken on the line 12—12 of Fig. 11 and showing the clutch and a portion of the clutch magnet;

Fig. 13 is an enlarged fragmentary bottom plan view and showing the mechanism for feeding the tape and for restoring and resetting the several armatures, latch levers, etc., the parts being shown in the position they occupy at the end, or high point, of a feed stroke of the advancing pawl;

Fig. 14 is a fragmentary sectional view taken on the line 14—14 of Fig. 13;

Fig. 15 is a fragmentary sectional view taken on the line 15—15 of Fig. 13, the view having

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been transposed approximately 90° counterclockwise from the position it would normally occupy on the sheet so as to facilitate comparison with Fig. 14;

Fig. 16 is a fragmentary bottom plan showing the tape feeding mechanism with the bottom guide plates for the feed pawls removed to show the construction and operation more clearly, the parts being shown in the home position, i. e., the position they occupy between tape feeding strokes;

Fig. 17 is a wiring diagram illustrating the operation of the various component parts of the illustrated preferred embodiment; and

Fig. 18 is a view illustrating a portion of a record tape having punched therein, all of the code hole designations of a preselected combinational code.

For the purposes of description, the illustrated embodiment of the invention may be considered generally as comprising a typewriter 100 having the usual character and functional keys; a code recorder in the form of a tape punch 200 having punching elements corresponding in number to the positions of a preselected combinational hole code and also having a feed hole punching element; and a permutation unit 300 including a plurality of longitudinally movable bars or slides also of the same number as the code positions and controlling, respectively, the operation of the punching elements.

When the typewriter keys are operated in the usual manner to effect typing on a record sheet and to control the necessary functional operations of the typewriter, they also provide for the selective movement of the permutation slides to control the operation of their respective punching elements to punch code hole designations in the tape which, in each instance, represents the particular character or function of the key actuated.

Tape feeding mechanism is also provided and may, or may not, be considered as a part of the tape punch. The tape feeding mechanism provides for spacing the tape for each recording operation and may include a means for adjusting the feed so that the tape may be fed either forward or backward at the will of the operator. Normally, the tape is fed forward for each operation of a typewriter key and for the corresponding operation of the tape punch. However, as will appear more fully hereinafter, under certain conditions, such for example as when it is desired to nullify a previously recorded code hole designation, the tape feed may be adjusted to feed the tape backward for each nullifying operation.

Insofar as certain of the broader aspects of the present invention are concerned, the typewriter 100 may be of any desired construction. However, in the illustrated embodiment of the invention there is included a commercially known form of power-driven typewriter, the principles of which are fully disclosed in a number of United States patents, among which is Patent No. 1,777,055, granted September 30, 1930, which discloses the general principles of operation of the key levers and how they control through related cam units the operation of the type bars. In view of the detail description of the structure and operation of the parts given in the patent just identified, only a brief description will be given herein which will be sufficient to enable the present invention to be understood. Refer-

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ence may be made to the aforementioned patent for further details.

The typewriter is disclosed herein in Figs. 1, 2, 2a, 3, 3a, and 4. The numeral 10 designates the usual character keys which are mounted on key levers 11, the latter being pivoted on a rod 12 which is supported by a cross frame 13 rigidly mounted in the base 14. Rotatably mounted in the base 14 is the power roller 15 which is rotated in the direction of the arrow (Fig. 2) by means of an electric motor, not shown in Fig. 2, but indicated diagrammatically as 101 in Fig. 17. When the machine is in use, the power roller 15 rotates continually.

Cooperating with the power roller 15 are the cam units 16 which are pivotally mounted on rods 17 extending parallel with the power roller 15. There is a cam unit 16 associated with each of the key levers 11, and each of the cam units which is operated by a character key 10, is connected by a link 18 with a sub-lever 19 pivoted on rod 12. The sub-levers 19 are connected by links 20 to type bars 21 through the medium of toggles 22. The type bars 21 are pivoted in the usual type bar segment 23 and the latter is provided with a type guide 24 located in front of the platen 25. As is customary, the platen is adapted to support a work sheet and is rotatably mounted in the carriage 26, and the latter is supported for lengthwise movement on front and rear rails 27 and 28, respectively, by means of suitable anti-friction roller trucks. Springs 29 connected to a curved spring anchoring member 30 and to toggles 22, provide means for locking the toggles in their normal or inactive position shown in Fig. 2.

When any character key 10 is depressed, its related cam unit 16 is caused to operatively engage the power roller 15 in a well known way, thereby rocking the cam unit 16 clockwise or counterclockwise, according to whether the operative cam unit is pivoted on the left hand or right hand rod 17, respectively, as viewed in Fig. 2. The rocking of the cam unit causes its link 18 to be drawn downwardly, thereby rocking the corresponding sub-lever 19 in a clockwise direction. This movement of the sub-lever 19, through the corresponding link 20 and toggle 22, causes the type bar associated with the selected key to rock in a counterclockwise direction to effect the impression of the type upon the work sheet wrapped around the platen 25. The type bar, near the end of its operating stroke, engages the usual universal bar 31 and causes the universal bar to move rearwardly and downwardly in Fig. 2 to space the carriage forward in a manner not disclosed in detail herein, but which is well known to those skilled in the art.

The segment 23 is mounted in a frame 32 which forms part of the type basket. The type basket is movably mounted in the framework of the machine for case shifting movement in a well known way and normally occupies an elevated position shown in Figs. 2 and 3 for the typing of the lower case characters. The shift mechanism for drawing the type basket 32 downwardly to permit the printing of upper case characters is described in United States Patent No. 1,945,097, granted January 30, 1934, and is partly shown in Fig. 3.

Secured, respectively, to the back of the type basket frame 32 and on opposite sides thereof, are two brackets 33. The brackets 33 are connected by links 34 to the outer ends of lever arms 35, the latter being fixed, respectively, on

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the ends of a transverse shaft 36 journaled in the framework of the machine. Pivoted on a stud 37 at one side of the machine is a lever 38 having two pins 38a, 38b, engageable by the short arms of a T-shaped lever 39 which is pivotally mounted at 40 on one arm of a three-armed lever 41. The lever 38 is connected by a link 42 to the outer portions of one of the lever arms 35 and at points spaced from the connection of such arm 35 and its link 34. The T-lever 39 has a stud 43 projecting into a slot formed in an arm 44 comprising an extension of the left-hand shift key lever 45 as viewed in Figs. 1 and 4. One arm of lever 41 is connected by a link 46 to a cam unit 47 which is controlled by the shift key lever 45 in substantially the same manner as cam units 16 are controlled by the key levers 11, described above.

The type basket is shifted downward to upper case position when the shift key 50 mounted on key lever 45 is depressed, and is returned to lower case position when the key is released. It is, therefore, customary to hold the key depressed, either by hand or by a shift lock, while writing upper case characters.

When the shift key lever 45 is depressed, the T-lever 39 is elevated to bring one of the short arms thereof to a position to the left of the pin 38a, this movement taking place before the cam unit 47 controlled by the shift key 50 is operatively connected to the power roller 15. When the cam unit controlled by the shift key is operated, the link 46 is drawn downwardly thereby rocking lever 41 in a clockwise direction. This draws the T-lever 39 to the right in Fig. 3, thereby, through the engagement of said T-lever with the pin 38a, rocking the lever 38 clockwise. Through the link connection 42, the levers 35 connected thereto and the shaft 36 are rocked in a counterclockwise direction, thereby pulling downward the links 34 which result in the type basket being drawn downward to upper case position.

As disclosed fully in the aforementioned U. S. Patent No. 1,945,097, when the key 50 is released so that it is returned upward to its normal position by the spring 48, the cam unit 47 is again actuated by the power roller 15 so that the cam unit rocks in a counterclockwise direction, as before. When the key 50 is released and before the cam unit 47 is actuated, the arm 44 of the lever 45 moves downward and thereby permits the T-lever 39 to move downward to bring the lower of its short arms to a position to the left of the lower pins 38b. Consequently, when the cam unit 47 is rocked counterclockwise as just stated, the cam unit 47 through the link 46, rocks the lever 41 clockwise; and the lever 41 through the T-lever 39 and pin 38b, rocks the lever 38 counterclockwise; and, the latter through the link 42, rocks the arms 35 and shaft 36 clockwise to return through the links 34, the type basket to the lower case position shown in Figs. 2 and 3.

As stated previously, a keylock is provided for holding the key lever 45 down when it is desired to type a substantial number of capital or upper case characters. In the illustrated embodiment an improved form of keylock and shift release is disclosed (see Figs. 3, 3a, and 4). The keylock comprises a shift latching lever 51 and a lock down button 52 arranged on opposite sides of the lever 45 and provided, respectively, with vertical slots 53 and 54, receiving opposite ends of a stud 55 secured within an opening in the lever 45. A detent 56 is fixed to a stationary

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portion 57 of the typewriter frame and cooperates with the lever 51 in locking the key lever 45 down in shifted position. The parts are shown in their normal lower case position in Fig. 3, with the detent 56 engaging the lowermost inner surface of the lever 51. A tension spring 60 connects the latch lever 51 with the shift key lever 45 and serves to hold the lever 51 in this position, the stud 55 extending from the lever 45 occupying the lower part of the slot 53. The lock down button 52 is provided with a pin 61 which extends over the lever 45 and engages the top of latching lever 51. As shown in Fig. 3a with the parts in normal position, the lever 51 supports the button 52 through the pin 61 and the stud 55 also occupies the lower part of the slot 54 in the button 52. The button 52 is also provided with spaced tabs 62 and 63, engaging, respectively, the upper and lower sides of the lever 45 which aid in holding the button 52 in an upright position. When the button 52 is depressed it moves the latching lever 51 downward by means of the pin 61 until the top of the slot 53 in lever 51 engages the stud 55 on lever 45 and then the lever 45 will move down with the lever 51 a distance sufficient to actuate the cam unit 47. When the latter occurs, the detent 56 will have cleared a ledge portion 65 on the lever 51 and the spring 60 will then move the lever 51 to the right or counterclockwise as viewed in Fig. 3, until the ledge 65 is under the detent 56, thus locking the latch lever 51 down and also holding the key lever 45 down in its shifted position because of the engagement of the top of slot 53 with the stud 55.

The shift lock is released by depressing the right-hand shift key 66, as viewed in Figs. 1 and 4. To this end, a bail lever 67 is provided which comprises a pair of end plates 68 and 69 connected by a bail rod 70. The bail lever 67 is mounted for pivotal movement by studs 71 and 72 extending outwardly from the plates 68 and 69 and journaled, respectively, within opposite sides of the typewriter frame. A stud 73 extends inwardly from the end plate 69 and within a notch 74 formed in a downwardly extending projection of key lever 75 on which the key 66 is mounted (see Fig. 2). A second stud 76 extends inwardly from the end plate 68 and over the outer end 77 of latching lever 51. Thus, upon depressing the key 66 and lever 75 the bail lever 67 is rocked about its pivotal support and the stud 76 engages the end 77 of latching lever 51 and thereby rocks the latter downward to move the ledge portion 65 out from under the detent 56 which unlatches the lever 51. When the lever 51 is thus released, the lever 45 is permitted to move up under the force of its spring 48 to the normal lower case position shown in Fig. 3.

It is noted that the stud 76 also extends over a downwardly projecting hook portion 80 formed on the lower part of lever 45. This construction permits the actuation of lever 45 and the cam unit 47 by the key 66 and lever 75, through the bail lever 67. It is, therefore, noted that the depression of either key lever 45 directly, or through the key 75 and bail lever 67, results in sufficient movement of lever 45 to actuate the cam unit 47; but such movement of lever 45 is not enough to effect latching engagement of the lever 51 and detent 56. Thus, the cam unit 47 can be operated to shift the type basket to upper case position and operated to return the type basket to lower case by the depressing and releasing of either key 50 or 66; but, if it is desired

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to lock down the shift key lever 45, the button 52 must be depressed. The shift lever 45 is unlatched by depressing the key 86 in the manner previously explained.

From an examination of Fig. 2a, it is noted that the depression of the back space key 82 results in the operation of a cam unit 83, which is the same in construction and operation as the cam unit 16 shown in Fig. 2 at the left, or at the rear, of the power roller 15. When the cam unit 83 operates, it pulls down a link 84 which is pivoted to one end of a rock lever 85 pivotally supported by the rod 12. The other end of rock lever 85 is pivoted to a link 86 and each time the lever 85 is rocked clockwise, as viewed in Fig. 2a, by the operation of the cam unit 83 and link 84, the link 86 operates the usual mechanism (not shown) for back spacing the carriage provided in power-driven typewriters of the type disclosed. The detail construction and operation of the back spacing mechanism has not been shown as it is well known to those skilled in this art. If desired, reference may be had to U. S. Patent No. 1,873,553, granted August 23, 1932, which contains a full disclosure of the back spacing mechanism. The link 86 referred to above, is the same as the link "18" of the patent.

The other functional keys on the typewriter shown in the illustrated embodiment are the tab key 89, the carriage return key 90, and the space key or bar 91. The depression of either of these functional keys results in the actuation of a related cam unit similar to the units 16 previously described, and in the operation by the related cam unit through suitable lever linkage, etc., of the typewriter to perform the function corresponding to the key actuated. The particular manner in which each of the typewriter functions corresponding to the keys 89, 90 and 91 is performed in the particular typewriter disclosed, is well known by those skilled in this art and a detail showing and description thereof is believed to be superfluous. A full and detailed disclosure of how the actuation of the tab key 89 effects tabulation operations of the carriage is disclosed in U. S. Patent No. 1,955,436, granted November 14, 1933. A detail disclosure of the means for effecting the return of the carriage by depressing the carriage return key 90 is fully disclosed in U. S. Patent No. 2,104,559, granted January 4, 1938. A detail disclosure of the manner in which the carriage is spaced as a result of depressing the space bar or key 91 is found in a number of granted patents, among which is U. S. Patent No. 1,945,847, granted February 6, 1934.

Referring now to Fig. 18, it is noted that there is shown a portion of a record strip or tape 95, in which is punched all of the code hole designations of a combinational six-hole code which has been selected for use in illustrating one application of the present invention. It will be readily understood that the apparatus disclosed may be modified to record data designations in a wide variety of ways. Furthermore, any code may be devised which will suit the desires of the particular designer and the particular problem to which the apparatus is to be applied. For example, the code selected may have a greater or lesser number of code positions than the one shown, and the code designations representing the various characters and functions may be changed, if desired.

In order that the particular code which has been selected will be readily understood the six

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code positions are indicated in Fig. 18 by the reference numerals 1, 2, 3, 4, 5, and 6, respectively. Also, below the bottom edge of the tape 95 and opposite each field, or vertical column in the tape, there appears the particular typewriter character or function which is represented by the code designation punched in such field. The tape feed holes are indicated at 98 and are disposed between code positions 2 and 3.

Before considering in detail the permutation unit 300 and the means for actuating the unit by the typewriter keys, it is thought best to describe the construction and operation of the code recorder which, as stated above, is shown herein as being in the form of the tape punch 200. The tape punch 200 is disclosed in Figs. 7, 8, 9, 10, 11, and 12, and comprises six recording punch elements RP1, RP2, RP3, RP4, RP5, and RP6, corresponding, respectively, to code positions 1, 2, 3, 4, 5, and 6 of the tape 95, and also comprises one feed hole punch element FP. As shown in Fig. 8, the punch elements are arranged in vertical alignment and are respectively mounted to reciprocate within horizontal guide passages formed in a guide block 110 and into aligned die openings in a die plate 111. The die plate 111 is machined to provide a slot in the face thereof which is adjacent the member 110, through which the tape 95 is fed horizontally past the punching elements in a manner which will be described hereinafter. The recording punch elements are arranged in the same relative positions as the code positions shown in Fig. 18, i. e., with the element RP6 at the top and the elements RP1, RP2, RP3, RP4, and RP5 in order therebelow. The feed punch element FP punches a smaller hole than the recording punch elements and is disposed between elements RP2 and RP3.

Each punch element is held in its normal or retracted position, the position shown in Fig. 8, by a tension spring 114, and as will presently appear, is moved from the position shown toward the left to perforate code designations in the tape, by a punch actuating lever. There are seven punch actuating levers indicated, respectively, by the reference characters 120, 121, 122, 123, 124, 125, and 126, (see also Figs. 7, 9, and 10). The lever 120 operates the element FP, and the levers 121 to 126, inclusive, operate respectively, the elements RP1 to RP6, inclusive. Each actuating lever has an outer end portion 130 which fits within a slot 131 in its related punch element and is rotatably mounted intermediate its ends on an eccentric portion 132 of a cyclically operated drive shaft 133 which, as will presently appear, is rotated one complete revolution for each recording operation. In order for an actuating lever to operate its related punch element, the opposite end 134 thereof is latched and held against a fixed abutment 136, by a hooked end 135 of a related L-shaped latch lever.

There are also seven L-shaped latch levers 140, 141, 142, 143, 144, 145 and 146 which function to latch the ends 134 of the punch actuating levers 120, 121, 122, 123, 124, 125, and 126, respectively. When the end 134 of an actuating lever is latched by the hooked end 135 of a related L-shaped latch lever, a rotation of the shaft 133 and eccentric 132 will rock such actuating lever about its latched end as a fulcrum and thereby move its other end 130 downward as viewed in Fig. 7, or to the left as viewed in Fig. 8, and as a result, its end 130 will move its related punch element to perforate the tape in the corresponding position therein. When the end 134 of any actuating lever is not

latched, the spring 114 connected to its related punch element will hold its end 130 in the normal inactive position shown in the drawings, and the rotation of the shaft 133 will then only cause its other end 134 to move downward, as viewed in Fig. 7.

All of the L-shaped latch levers are rotatably supported on a shaft 147 and each latch lever is constantly urged by a tension spring 148 to move its end 135 clockwise, as viewed in Fig. 7, and into latching engagement with its related punch actuating lever.

During each recording operation, the end 135 of latch lever 140 is held by its spring 148 in latching engagement with the end 134 of its related punch actuating lever 120 (see Fig. 10). Thus, each time the shaft 133 is rotated, the feed punch FP will be actuated to punch a feed hole 96 in the tape.

The hooked ends 135 of remaining latch levers 141 to 146, inclusive, are normally held out of latching engagement with their related punch actuating levers 121 to 126, inclusive, due to the latching engagement of their other ends 149 with related pivoted latching armatures 150. Six latching armatures 150 are provided, one for each of the latch levers 141 to 146, inclusive, and the armatures cooperate, respectively, with six tripping magnets RM1, RM2, RM3, RM4, RM5, and RM6, to control the operation of their related L-shaped latch levers. As will be explained more fully hereinafter, the tripping magnets are respectively energized by the selective closing of related contacts in the permutation unit 300 and under the control of the typewriter keys.

The parts are shown in the home position which is the position they occupy at the beginning of a cycle of operation of the recorder. In the home position, each latching armature 150 is in latching engagement with the end 149 of its related L-shaped lever and thereby serves to hold such related latch lever against the force of its spring 148. When any tripping magnet is energized, its armature 150 is attracted and thereby releases the end 149 of its related L-shaped lever, and the spring 148 connected thereto moves the end 135 thereof into latching engagement with the end 134 of its related punch actuating lever; and, as previously described, when the shaft 133 is later rotated, the related punch lever will be actuated to punch a code hole in the corresponding code position in the tape 95.

When any one of the tripping magnets is energized to release its related latch lever in the manner just explained, such latch lever, in moving under the force of its spring 148 to latch its punch actuating lever, also engages and moves a contact-actuating ball 155, common to all levers 141 to 146, inclusive, and so that the ball 155 closes a pair of normally open spring contacts 156. The ball 155 is rotatably mounted on the shaft 147 and is moved clockwise, as viewed in Fig. 7, to close the contacts 156. The latch lever 140 which controls the operation of the feed hole punch FP is formed with a notch 157 at points adjacent the ball 155 so that the lever 140 will have no effect on the operation of the ball.

The closure of the contacts 156 in the manner just explained, initiates a cycle of operation of the recorder by energizing a clutch magnet CLM to effect engagement of a clutch 159, and thereby connect for one revolution, a constantly rotating power shaft 160 with a second shaft 161, the latter being permanently connected through

worm gearing 162 with the drive shaft 133 (see Figs. 11 and 12). At the end of each revolution, the clutch 159 is automatically disengaged and the shaft 161 and drive shaft 133 held in the home position, which, as stated, is the position of the parts shown in Figs. 7 to 12, inclusive. The power shaft 160 is driven by a belt 163 from the recorder motor 164 which is continuously operated while the apparatus is in use (see Fig. 1).

The clutch 159 may be of any desired construction. The type of clutch shown in the drawings is well known to those skilled in this art and consequently, only a general description of the clutch will be given. For a more complete description of this type of clutch, attention is directed to U. S. Patent No. 2,206,646, granted July 2, 1940. As shown in Figs. 11 and 12 hereof, the clutch 159 comprises a clutch barrel 166 fixed to the shaft 161 and having a diametrically disposed groove receiving a sliding pawl 167 which carries a clutch tooth 168 at its outer end. A spring 169 in the barrel 166, constantly urges the pawl 167 and tooth 168 to move radially inward to effect clutching engagement of the tooth 168 with a toothed clutch disk 170 fixed to the power shaft 160. A clutch disengaging lever 171 is mounted for limited pivotal movement within the barrel 166 and operatively engages the pawl 167 so that when the outer protruding end 172 of the lever 171 is intercepted and held by the outer end of an arm 173 which forms a part of the magnet armature 174, the lever 171 moves the pawl 167 radially outward against the spring 169 to disengage the tooth 168 from disk 170. When the armature arm 173 is moved to release the lever 171, the spring 169 moves the pawl 167 inward to effect clutching engagement of the tooth and disk. The barrel 166 is also provided with a disk 175 having a peripheral notch 176 which cooperates with a spring held detent arm 177 when the lever 171 is moved to disengage the clutch, so as to prevent rebound or reverse rotation of the shaft.

The parts of the clutch and clutch magnet are shown in the home position with the armature arm 174 and detent 177 holding the shaft 161 and drive shaft 133 in that position. When the clutch magnet CLM is energized by the closure of contacts 156, the armature 174 which is pivoted at 179 is attracted and is moved counter-clockwise as viewed in Fig. 12 so that the outer end of arm 173 is moved out of engagement with the outer protruding end 172 of the lever 171. The clutch 159 then becomes engaged in the manner just explained, and the shaft 161 and drive shaft 133 commence a revolution. Connected in series in the circuit which includes the clutch magnet CLM are a pair of contacts 180 (also shown diagrammatically in Fig. 17) which are held closed in the home position by a cam 181 on the shaft 161. After the clutch 159 is engaged, and the shaft 161 rotates approximately 43° of a revolution, the cam 181 opens the contacts 180 which open the energizing circuit for the clutch magnet CLM. The magnet CLM is thereby deenergized and the armature 174 and arm 173 is moved clockwise by the spring 182, so that the outer end of the arm 173 is placed in the path of the outer protruding end 172 of the lever 171 and when the latter engages the arm 173 at the end of the revolution, the clutch is disengaged thereby and the shafts 161 and 133 stopped in the home position as previously explained.

As explained previously, during a revolution of the shaft 161 and drive shaft 133, any of the

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punch actuating levers 120 to 126, inclusive, which have been latched at their ends 134 by their related latch levers 140 to 146, inclusive, will move their related punch elements to punch holes in the tape 95. The feed hole punch element 5 FP will be actuated each time the shaft 133 rotates because the lever 140 latches the end 134 of lever 120 for each cycle of recorder operation. The eccentric 132 is so positioned on the shaft 133, that the punches enter the tape at about 85° after a revolution has begun and leave the tape at about 260° of the revolution.

As can be seen from an examination of Figs. 13 and 14, the drive shaft 133 extends downwardly through a horizontal partition wall 185 and on the lower extension thereof is fixed a plurality of cams and other eccentric devices which function, respectively, during each revolution of the drive shaft, to lock the L-shaped latch levers in the position they occupy just after the beginning of the revolution and while the tape is being punched, to feed the tape after the punch elements have been retracted from the tape, and to restore during the latter part of each revolution the L-shaped latch levers 141 to 146, inclusive, into latching engagement with their related armatures.

A tape feed cam 190 is fixed on the lower end of shafts 133 and the feed mechanism operated thereby will be described hereinafter under a separate heading.

Also, fixed to the lower end of the shaft 133 is a cam 191 which controls through a lever arm 192, shaft 193 and locking ball 194, the holding or locking of the L-shaped levers in their respective positions they occupy just after the beginning of a revolution, so as to prevent their accidental displacement while the tape is being punched. The shaft 193 extends through the wall 185, and the locking ball 194 is fixed to the upper end thereof. One end of the lever arm 192 is fixed to the lower end of shaft 193 and its other end engages the face of the cam 191. A tension spring 195 holds the arm 192 in engagement with the face of cam 191.

Fixed to the upper side of cam 191, is an eccentric stud 196 which is in operative engagement with the outer end of a lever arm 197. The other end of lever arm 197 is fixed to a lower extension of shaft 147 and a ball 198 is fixed to the upper part of shaft 147. The stud 196, through the arm 197 and shaft 147, causes the ball 198 to engage the L-shaped latch levers after a punching operation, and to move the latch levers out of engagement with their related punch actuating levers and into a position where they are again latched by their respective armatures. As there is no armature for latching the lever 140, its spring 148 will return it into latching engagement with its lever 120 as soon as ball 198 is returned to home position. A tension spring 199 holds the arm 197 in engagement with the eccentric stud 196.

Also fixed to the lower end of drive shaft 133 is a disk 208 and projecting from the upper and lower sides, respectively, of the disk are a pair of eccentric studs 210 and 211 which are operatively engaged by a pair of arms 212 and 213 fixed to the lower ends of shafts 214 and 215. The outer ends of the arms 212 and 213 are held in engagement with the studs 210 and 211 by suitable tension springs 209 and 209a, respectively. The shafts 214 and 215 extend upwardly through the wall 185 and armature knock-off balls 216 and 217 are fixed to their upper ends, respectively.

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The balls 216 and 217 are operated after punching of the tape, by their respective eccentric studs 210 and 211 to knock off any armatures which have been energized. A tension spring 218 connected to each armature 150, snaps its armature outward against its related latch lever as soon as the ball disengages the armature from its tripping magnet. As viewed in Fig. 7, the ball 216 coacts with the armatures of the left-hand group of magnets and the ball 217 with the armatures of the right-hand group of magnets.

Figs. 13 and 14 show the relative position of the parts after the punch elements have cleared the tape and at the high point of a tape feeding mechanism. As stated previously, Figs. 7 to 12 inclusive, show the relation of the parts in the home position.

Soon after a cycle of recorder operation has been initiated by the energizing of the clutch magnet CLM, and after the drive shaft 133 has started a revolution, for example, about 7° past home position, the cam 191 moves the locking ball 194 from the full line position shown in Fig. 7 to the dotted line position where it is behind the L-shaped latch levers which have been tripped and are in latching engagement with their related punch actuating levers, and where it is in front of the L-shaped levers which have not been tripped. Thus, the locking ball 194 will prevent accidental movement of the L-shaped levers during a punching operation. The cam 191 will move the ball 194 back to the full line position shown in Fig. 7, at about 214° of drive shaft rotation, at which point the punch elements will have passed the peak of their punching movement and started on their return movement. The eccentric stud 196 will coact with the arm 197 and shaft 147 to move the ball 198 to engage the L-shaped latch levers for restoring the latter at about 238° and will first move the latch levers counterclockwise as viewed in Fig. 7, and beyond the position for latching with their related armatures. The latch levers will move counterclockwise past their latched position shown in Fig. 7, at about 249°. The high point of counterclockwise movement of the ball 198 is at about 260° and the latch levers will return in a clockwise direction to latching position with respect to the armatures at 318°. The armatures 150 which were not previously tripped will be held in engagement with the latch levers due to the action of their springs 218. The knock-off balls 216 and 217 will engage and release the armatures which have been attracted by their magnets at about 235°, and their springs 218 will snap them outward against their latch levers. When the ball returns the L-shaped levers to the latching point at 318°, the armatures 150 will latch their ends 149 and hold them in the latched position shown in Fig. 7 and the ball 198 will then continue its return or clockwise movement until it reaches the home position which is shown.

It is noted at this point that when the levers 141 to 146, inclusive, are moved clockwise in a restoring direction by the ball 198, the spring force inherent in the contacts 156 is enough to move the contact ball 155 along with the L-shaped levers and thereby open such contacts. The contacts 156 will open at about 249° and at this time the contacts 180 under the control of the cam 181 on the shaft 161 will still be open. The cam 180 again closes the contacts 181 at about 313° of rotation and the contacts 181 will remain closed until the parts reach home position and until they are again opened by the cam

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180 in the manner described above, during the next cycle of operation.

As stated, mechanism is provided for spacing the tape for each recording operation and the mechanism is adjustable so that it will space the tape either forward or backward at the selection of the operator. Normally, the mechanism is adjusted to space the tape forward and such is the position of adjustment shown in the drawings; but, as will appear more fully hereinafter, under certain special conditions of operation, the mechanism can be readily adjusted so that it will space the tape backward. An example of such a special operating condition is when it is desired to nullify a previously recorded code designation.

The tape feeding mechanism is shown in Figs. 13, 14, 15 and 16, and as stated previously, is operated by the cam 190 fixed to the lower end of the drive shaft 133. In Figs. 13, 14, and 15 the parts are shown in the position they occupy at the high point of a tape feeding operation. Fig. 16 shows the position of the parts when the feeding elements are fully retracted. It will be readily appreciated that while in the illustrated embodiment, the tape feeding mechanism is advantageously disclosed as a structural part of the recorder 200, the invention is not in all of its aspects limited thereto, for insofar as certain of the broader aspects of the invention are concerned, the tape feeding mechanism may be separate from the recorder.

The tape feeding mechanism includes a feed wheel 220 having radial feeding pins 221 spaced so as to engage the feed holes 96 of the tape 95. The wheel 220 is fixed on the upper part of a feed shaft 222 and the latter extends downward through the partition wall 185 and on the lower end of the shaft is fixed an advancing ratchet 223 and a reversing ratchet 224. An advancing pawl 225 is mounted to slide between spaced guide plates 226 and for each normal recording operation of the recorder is moved to engage and rotate the advancing ratchet 223, the shaft 222, and feed wheel 220 in an advancing direction a sufficient distance to space the tape 95 the width of a recording field or vertical column. A reversing pawl 227 is mounted to slide between spaced guide plates 228 and when the mechanism is adjusted to feed the tape backward, is moved during each recording operation to engage and rotate the reversing ratchet 224, shaft 222 and wheel 220 in a reversing direction a sufficient distance to space the tape backward one field.

In Fig. 16, the lower of the guide plates 226 and 228 have been removed to expose the two pawls 225 and 227 and illustrate more clearly their construction and operation. Tension springs 229 and 230 connecting, respectively, the pawls 225 and 227 with fixed studs 231 and 232, serve to urge the pawls constantly in a retracting direction. When the recorder is in home position, both pawls 225 and 227 are fully retracted and are out of engagement with their respective ratchets. A knurled hand-feed wheel 234 is fixed to the upper end of the feed shaft 222 and protrudes partially through a slot in the front wall of the recorder 200 (see Figs. 1, 8 and 11). Thus, with the parts of the recorder and feed mechanism in home position, the feed shaft 222 may be readily rotated by hand to feed the tape 95 in either direction. A toothed wheel 235 is also fixed to the feed shaft 222 and a spring pressed detent 236 cooperates therewith to assure proper positioning of the recording fields of the tape with respect to the punch elements.

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Cooperating with the tape feed cam 190 is a cam follower 237 which is held against the face of the cam by a suitable tension spring 238. The cam follower comprises an arm 239 having a roller 240 on one end thereof engaging the face of the feed cam and being pivotally supported at its other end to move about a fixed axis by a fixed stud 241 depending from the wall 185. The movable end of the arm 239 is supported by a suitable bracket 242 depending from the wall 185.

A tape feeding motion is selectively transmitted from the cam 190 and follower 237 to either of the feed pawls 225 and 227 by a selector plate 244 movable to either of two positions and interposer pins 245 and 246 carried by and movable with the selector plate 244. The selector plate 244 is in overlying engagement with the follower arm 239 and extends for the full length of the latter and beyond the end thereof which is pivoted to the stud 241. The selector plate 244 is formed with a longitudinal slot 247 receiving the pivot stud 241 (see Fig. 13) and the interposer pin 246 extends downward from the plate 244 and within a longitudinal slot 248 formed in the follower arm 239. Thus, the plate 244 may be adjusted lengthwise with respect to the follower within limits determined by the length of the slots 247 and 248.

A tension spring 250 connecting a stud 251 extending upward from the selector plate 244 and a stud 252 extending downward from the partition wall 185, constantly urges the selector plate 244 to move upward as viewed in Figs. 13 and 16, which are bottom plan views, and toward the left as viewed in Fig. 15. Thus, the spring 250 tends to maintain the interposer element 246 at a position where it engages the upper end of slot 248 in Figs. 13 and 16 and the left-hand end of the slot as it appears in Fig. 15. This is the normal operating position for feeding the tape forward.

In Fig. 16, the parts are shown in their normal operating position with the roller 240 on the base of the cam 190. In this position, the interposer element 246 clears an operating face 254 formed on the rear of the reversing pawl 227 and the interposer element 245 is aligned with a similar operating face 255 formed on the advancing pawl 225. Thus, when the cam 190 moves the follower 237 forward, the interposer pin 246 and selector plate 244 will also move forward and the interposer pin 245 will engage the rear face 255 of the pawl 225 and move the latter into engagement with its ratchet 223. The pawl 225 is guided in its forward movement by a stud 257 on the pawl 225 moving within a slot 258 formed in one of the guide plates 226 and by studs 259, 260, and 261 extending between the two guide plates 228. Due to the angle at which the spring 229 extends, when the pawl 225 begins to move toward its ratchet the spring 229 tends to move the pawl counterclockwise about the pin 257, as viewed in Fig. 16, and thereby effects engagement with the ratchet 223. Fig. 13 shows the position of the parts at the high point or end of the feeding movement of the advancing pawl 190.

A reverse feeding movement of the tape is effected by energizing a reversing magnet RVM in a manner which will be more fully explained hereinafter. The reversing magnet RVM has an armature 264 pivoted at 265 and including an arm 266 engaging the outer end 267 of the selector plate 244. Thus, when the magnet RVM is energized, its armature 264 is attracted and the arm 266 moves the selector plate downward, as viewed in Fig. 13, against the force of the spring 250 until the interposer element 246 occupies the

lower end of slot 248, as viewed in Figs. 13 and 16, or the right-hand end of the slot 248 as viewed in Fig. 15. The interposer pin 246 will then occupy a position behind the face 254 of the reversing pawl 227 and the interposer pin 245 will clear the face 255 of the advancing pawl 225. With the selector plate held in this position by the magnet RVM, when the cam 190 moves the follower 237 forward it will also move the interposer element 246 forward into engagement with the rear face of reversing pawl 227 and thereby move the pawl into engagement with its ratchet 224 to feed the tape backward the space of one recording field. The pawl 227 is guided in its movement by a stud 270 projecting therefrom and moving within a slot 271 formed in one of the guide plates 228 and by fixed studs 272, 273 and 274 extending between the guide plates 228. The direction of extent of spring 230 is such that after a feeding movement of reversing pawl 227 has begun, the spring will urge the nose of the pawl into engagement with the ratchet.

As shown in Fig. 16, the cam 190 is so shaped as to provide a relatively rapid retraction of the follower 237 and the feed pawls, after a feeding stroke is completed. The cam 190 is so positioned on the shaft 133 that the tape feed shaft 222 does not start movement until after the punch elements have cleared the tape. As stated above, the eccentrics 132 are so positioned on the shaft 133 that the punch elements leave the tape at about 260° of each revolution. The cam 190 is shaped and positioned so that the tape feed shaft will start moving at about 280° and complete its movement at about 324°.

The permutation unit 300 is shown in Figs. 2, 3, 5, and 6 and comprises a pair of parallel side frame members 310 and 311 extending between and rigidly connected at their ends, respectively, to opposite sides of the typewriter base 14. The unit 300 also comprises six permutation bars or slides S1, S2, S3, S4, S5 and S6 corresponding, respectively, to the six code positions 1, 2, 3, 4, 5, and 6 in Fig. 18. The slides S1 to S6, inclusive, are mounted in spaced parallel relation between the frame members 310 and 311 and are individually supported for lengthwise movement by guide rollers 312 mounted on shafts 313, 314, 315, and 316 extending between and fixed at their ends in the frame members 310 and 311. The shafts 313 and 315 are arranged at the left-hand end of the unit 300 as viewed in Fig. 6 and the shafts 314 and 316 at the right-hand end thereof. Each permutation slide is supported and guided at its top and bottom and at its two ends by a set of four guide rollers mounted, respectively, on the four shafts. The guide rollers are free to rotate on their respective shafts and the rollers on each shaft are spaced apart slight distances to prevent binding of adjacent slides. A fixed abutment in the form of a bar 318 joins the frame members 310 and 311 at the right-hand end thereof, and the right-hand ends of all slides are held, respectively, against the bar 318 in their normal or inactive positions, by six tension springs 319. Three of the springs 319 connect, respectively, the upper right-hand ends of slides S6, S4, and S1 with a rod 320 joining the two members 310 and 311, and the other three springs 319 connect the lower right-hand ends of slides S5, S2 and S3 with a rod 321 also joining the two members 310 and 311. The six slides S1 to S6 inclusive, are provided, respectively, at their left hand ends, with code contact actuators 331, 332, 333, 334, 335, and 336 which control, respectively, the six sets of code

contacts SC1, SC2, SC3, SC4, SC5, and SC6. The six sets of code contacts SC1 to SC6 control, respectively, the energizing circuits for the six tripping magnets RM1, to RM6, inclusive, previously described. As will be apparent, when each of the slides is moved to the left as viewed in Fig. 6 in a manner to be presently described, it will close its related set of code contacts. Also, when any one of the slides is moved to the left, the lower left-hand end thereof engages and moves to the left a bail member 338 common to all of the slides and mounted on a pivot shaft 339 supported at its ends by the two frame members 310 and 311. The bail 338 when moved to the left by any one of the slides, engages and moves a slidable rod 340 which in turn, engages and closes a pair of contacts C which as will presently appear, connect the plus (+) side of a D. C. control circuit with six parallel circuits containing, respectively, the six code contacts and the six tripping magnets. All of the contacts SC1 to SC6 and C are normally open spring contacts and when the slides are retracted to the right by their respective springs 319, the contacts will open. The contacts are so positioned and adjusted that the contacts C close after and break before the closing and opening of the code contacts SC1 to SC6, inclusive; the main purpose of the latter being to provide for simultaneously energizing the tripping magnets so that all of the L-shaped latch members which are to be released, will be released as near as possible at the same time.

In accordance with the present invention, means is provided for differentially operating the slides S1 to S6, inclusive in response to the actuation of each typewriter key, so that the code contacts closed thereby and the related tripping magnets energized will effect the punching of code hole designations in the tape corresponding to the key actuated. As pointed out previously, Fig. 18 discloses the code hole designations corresponding to each of the typewriter keys in accordance with a selected combinatorial code.

The differential operating means for the permutation slides comprises a plurality of actuating links 341 corresponding, respectively, to the typewriter keys, and each link being pivotally connected at its forward end (see also Fig. 2) to the cam unit operated by its related typewriter key and pivotally connected at its rear end to a fixed rod 342 extending between and connected at its ends to opposite sides of the typewriter frame 14. The actuating links extend transversely of the permutation unit and through pairs of aligned slots 343 and 344 formed in the lower parts of frame members 310 and 311, respectively, there being a pair of slots for each link. The plurality of pairs of aligned slots receiving, respectively, the actuating links, may be considered as actuating stations of the permutation unit.

When a typewriter key is depressed and its related cam unit operated by the power roller 15 in the manner previously described, operative movement of such cam unit will move the actuating link 341 which is connected thereto in an upward direction in its pair of slots 343 and 344, and such actuating link will engage and move to the left as viewed in Figs. 5 and 6, the permutation slide, or combination of slides, which correspond to the code designation of the key actuated.

Upward movement of a link in its respective pair of slots 343 and 344 effects a movement to the left of a slide when that slide is provided with an actuating projection 345 having an inclined

cam surface 346 located so that it will be engaged by the link when moved upward. The actuating projections 345 with their cam surfaces 346 are provided on the slides in accordance with the selected code illustrated in Fig. 18. For example, the link 341a (see Figs. 5 and 6) fits within the pair of slots 343a and 344a providing its corresponding actuating station, and the link 341a is moved upward as a result of the depression of the typewriter key 10 corresponding to the letter "Q" and of the resulting operation of its related cam unit 16. For an examination of Fig. 18, it is noted that the code designation for "Q" is a hole in each of code positions 1, 2, 3, and 5 on the tape. Thus, the corresponding slides S1, S2, S3 and S5 are provided with the necessary actuating projections 345 and cam surfaces 346 and the remaining slides S4 and S6 at this actuating station are provided with notches 348 so that they will not be actuated by an upward movement of the link 341a by its related cam 16.

It will be apparent from the foregoing that a depression of the typewriter key marked with the letter "Q" will result in the slides S1, S2, S3, and S5 being moved simultaneously to the left as viewed in Fig. 5 to close the corresponding code contacts SC1, SC2, SC3, and SC5 which will energize the related tripping magnets RM1, RM2, RM3, and RM5. The energizing of these magnets will release the related latch levers 141, 142, 143, and 145 to latch up their related punch actuating levers 121, 122, 123 and 125, and close the bail contacts 156 to initiate a cycle of recorder operation which will result in the actuation of punch elements RP1, RP2, RP3, and RP5 to punch code holes in the positions 1, 2, 3, and 5 in the tape. As there is no provision for latching the lever 140 by the armature of a tripping magnet, its spring 148 will cause its end 135 to engage and latch the end 134 of its lever 120, and when the recorder goes through a cycle of operation the element FP will also be actuated to punch a feed hole 96.

With the exception of the shift keys, the depression of any of the character keys or any of the other functional keys will result in the recording of a corresponding code hole designation in a field of the tape in the same manner as described above in connection with the character key corresponding to the letter "Q."

Referring to Fig. 3 of the drawings, it is noted that an actuating link 341b is pivotally connected at its forward end to the cam unit 47 by a short connecting link 350, and is provided at its rear end with an elongated downwardly facing notch 351 receiving the transverse supporting rod 342. The intermediate portion of the link 341b is provided with an upstanding actuating projection 353 wide enough to overlap five of the permutation slides when moved upward. The notch 351 is long enough to permit the link 341b to be shifted lengthwise between its normal forward position (shown in Fig. 3), where the projection 353 overlaps the five forwardly located slides, and a rearward position where the projection 353 will overlap the five rearwardly located slides. The bottom of the notch 351 is formed with a pair of juxtaposed recesses 352 for restraining the link in its forward and rearward positions, respectively.

Considered in the direction extending from the front to the rear of the typewriter, the permutation slides are arranged in the following order: S6, S5, S4, S2, S1, and S3. At the actuating station corresponding to the link 341b, all of the

slides are provided with actuating projections 345b and cam surfaces 346b with the exception of the forward slide S6 which is notched out as indicated at 348b. Thus, when the link 341b occupies its forward position, the position shown in Fig. 3, and is moved upward by the operation of its cam unit 47, the slides S5, S4, S2 and S1 will be actuated (S6 being notched out); and, when the link occupies its rearward position and is moved upward by the actuation of the cam unit 47, the slides S5, S4, S2, S1, and S3 will be actuated.

As shown in Fig. 3, the link 341b occupies its forward position when the type basket is in lower case position. Means is provided for shifting the link 341b to its rearward position when the type basket is shifted to upper case position and for shifting the link back to its normal forward position when the type basket is again returned to lower case position. To this end, a downwardly extending lever arm 354 is fixed to the transverse shaft 36, on which is also fixed the two arms 35 which shift the type basket. The lower end of arm 354 is connected by a link 355 to the outer end of one arm 356 of a bell crank rotatably mounted on a shaft 357 which is suitably supported by the typewriter frame. Another arm 358 of the bell crank extends downwardly and is formed by a pair of spaced leaf spring members 359 and 360, having their lower ends arranged on opposite sides, respectively, of a stud 361 projecting from the side of the link 341b.

As explained previously, in the portion of the description relating to the shifting of the type basket to upper case position and back to lower case position, the cam unit 47 is actuated when the key lever 45 is moved downward as a result of depressing the shift keys, and the cam unit 47 is again actuated when the key lever 45 is released and moves upward. Therefore, when the cam unit 47 is operated to shift the type basket to upper case position, the link 341b is moved upward and actuates the slides S5, S4, S2, and S1 which as previously explained, effect the punching of holes in the corresponding code positions of the tape. From an examination of Fig. 18, it will be noted that holes in code positions 1, 2, 4, and 5 of a tape field comprises the "shift" code designation.

When the cam unit 47 was first operated, the type basket shifted to upper case position and as a result the arm 354 moved counterclockwise as viewed in Fig. 3. The counterclockwise movement of the arm 354 resulted, due to the connecting link 355, in the arms 356 and 358 of the bell crank being moved clockwise. Such clockwise movement will cause the forward spring 360 to be flexed; but the spring can not shift the link 341b to its rearward position until the cam unit 47 is returned to normal position. The reason for the latter is because as soon as the cam unit 47 was actuated, the link 341b moved upward and engaged the permutation slides which resulted in a distinct downward pressure of the rear end of the link 341b on the rod 342 and, as the rod occupies the rear recess 352 in the bottom of the notch, sufficient resistance is offered thereby to prevent the lengthwise shifting of the link 341b. When the cam unit 47 returns to normal or inactive position, the pressure of the rear end of the link 341b on the rod is relieved and the forward leaf spring 360 can then shift the link 341b to its rearward position. With the link in the rearward position and

the cam unit 47 operated for the second time by the releasing of key lever 45, the link will be moved upward thereby and will actuate the slides S5, S4, S2, S1 and S3 to effect punching of code holes in positions 1, 2, 3, 4, and 5 of a recording field, which as indicated in Fig. 18, is the code designation marked "Release." The second actuation of the cam unit effected the return to lower case position and the movement of arm 354 and arms 356 and 358 of the bell crank back to the normal position shown in Fig. 3; and, when the cam unit 47 returns to inactive position after its second operation, the rear leaf spring 359 will shift the link 341b back to its normal forward position.

In Fig. 1 of the drawings, the typewriter 100 is shown as being provided with four control switches indicated at 102, 103, 104 and 105, respectively. As will presently appear, the switch 102 is the power switch for the typewriter which controls the flow of A. C. current thereto and also controls the flow of A. C. current to the recorder 200. The switch 103, when closed, provides for the feeding out of the tape and for the punching of feed out holes 96 therein. The switch 104, when closed, provides for the recording of a "Stop" code designation in the tape and for spacing the tape. The switch 105 when in "Nor" or normal position, permits normal operation of the apparatus and when in "Nul" or nullify position modifies the action of the permutation means to record a nullify code of 1-2-3-4-5-6 over the top of a previously recorded code designation. The recorder 200 is shown as having mounted thereon a plurality of control switches indicated at 202, 203, and 204, respectively. The switch 202 is the power switch for the recorder and, as will presently appear, is a double pole single throw switch with one blade connected in series with the switch 102 and the other blade of switch 202 controls the flow of the D. C. current in the apparatus. The switch 203 is a tape feed out switch like the switch 103, and the switch 204, like 104, provides for the recording of a "Stop" code designation. An electrical cable 206 containing a plurality of separate control wires and having terminal plug connectors 207 and 207a at opposite ends thereof is shown as electrically connecting the typewriter and the recorder.

In Fig. 17 there is shown a simplified circuit diagram including all of the power and control circuits of the apparatus. The circuit wires and switches contained within the typewriter 100 and permutation unit 200 which, as described above, is mounted in the base of the typewriter, are shown at the right of the diagram and the circuit wires and switches within the recorder or tape punch 200, are shown at the left of the diagram. The individual wires within the cable 206 and connecting, respectively, circuit wires in the typewriter and recorder are indicated by the reference character 450. For the purpose of simplifying the description, the circuit wires connected by the individual wires 450 will be considered in each instance as one wire.

In Fig. 17, the wires 401 and 402 are indicated as being connected to an available source of 110 volt A. C. current. When the typewriter power switch 102 is closed, A. C. current will flow through the typewriter motor 101 as follows: from the wire 402, through the switch 102, wire 403 and motor 101 to wire 401. As described previously, the motor 101 operates the power roller 15 of the typewriter. As stated above, the re-

corder control switch 202 is a double pole, single throw switch, and when closed, A. C. current will flow through the recorder motor 164 and the primary of a rectifier transformer 405 as follows: from the wire 402 through the typewriter power switch 102, wire 403, wire 406, blade 407 of the switch 202, wire 408 to the motor 164 and to the transformer 405 in parallel, and from the motor 164 and transformer 405 through a wire 409 to the wire 401. Thus, when the switches 102 and 202 are closed, the typewriter and recorder motors will be operated and the transformer 405 energized.

The secondary of the transformer 405 is the A. C. power source for a conventional type of rectifier 410. The current for the control circuits in the apparatus is direct current and is supplied by the rectifier 405. The D. C. plus (+) wire leading from the rectifier 405 is indicated at 411 and the D. C. minus (-) wire at 412. The blade 413 of the recorder switch 202 when closed, connects the minus wire 412 with a wire 414 which is connected to the return side of the clutch magnet CLM, the return sides of the six tripping magnets RM1 to RM6, inclusive, and the return side of the reversing magnet RVM. The D. C. plus wire 411 is connected to the right-hand one of the ball control contacts 156 as appearing in Fig. 17, to the upper contact of the pair of D. C. common contacts C, to the lower contact of the tape feed out switch 103 on the typewriter, to the left-hand contact of the tape feed out switch 203 on the recorder punch, and to the top contact of the nullify switch 105.

The lower contact, as appearing in Fig. 17, of each of the pairs of code contacts SC1 to SC6, inclusive, is separately connected to a wire 420 which is in turn connected to the lower contact of the pair of D. C. common contacts C. The upper contacts of the pairs of code contacts SC1 to SC6, inclusive, are individually connected to the supply side of their related tripping magnets RM1 to RM6, inclusive, by wires 431 to 436 inclusive.

The D. C. plus wire 411 is connected to a wire 440 in which is connected a condenser 441 and a resistor 442 in parallel, and the wire 440 is connected at the output side of the condenser and resistor to the right-hand contact of the "Stop" code switch 204 and to the lower contact of the "Stop" code switch 104.

The direct current control circuits for the apparatus are traced as follows. During normal operation, the nullify switch 105 is in the full line position shown in Fig. 17, and the typewriter keys are actuated in the normal manner to type a letter or other data on the master copy held on the platen 25. The depression of the typewriter keys results in the selective closing of the code contacts SC1 to SC6, inclusive, in accordance with the combinational code, and in the closing of the D. C. common contact C in the manner fully described previously. Each time the D. C. common contact C is closed after the selected code contacts are closed, current will flow from wire 411, through the contacts C and through wire 420 to the code contact or contacts which have been closed and from the closed code contacts through their related wires 431 to 436, inclusive, to their related tripping magnets RM1 to RM6, inclusive, and from the magnets to the minus side of the rectifier through the wire 414, blade 413 of switch 202 and wire 412.

As explained previously, the energizing of one or more of the tripping magnets results in the closure of ball contacts 156 and when the latter

happens, current flows from plus wire 411 through the contacts 186, wire 443, wire 444, to the contacts 180 and from there through the clutch magnet CLM, wire 414, blade 413, and wire 412 back to the minus side of the rectifier. The energizing of the clutch magnet initiates the cycle of operation of the recorder and soon after the shaft 161 shown in Fig. 11, starts rotating, the cam 161 opens the contacts 180 to deenergize the clutch magnet so as to provide for stopping the shaft 161 at the end of a revolution. Thus, the code designation corresponding to each particular typewriter key depressed is recorded in the tape and the tape is spaced forwardly one recording field along with the forward spacing of the typewriter carriage.

When it is desired to feed out the tape without recording code designations, either the switch 103 on the typewriter or the switch 203 on the recorder may be closed. When either of these switches is closed, current will flow from the D. C. plus wire 411 through the closed tape feed out switch and to a wire 445 which connects with the wire 444 and through the latter, the closed contacts 180, clutch magnet CLM, wire 414 and blade 413 back to the minus side of the line. The clutch magnet will then be energized directly to provide a cycle of operation of the recorder which, as none of the tripping magnets have been energized, will only result in the punching of a feed hole 96 in the tape and in the spacing of the tape the distance of a recording field. As long as either switch 203 or 103 is held closed, the magnet CLM remains energized and the recorder will continue to punch the feed out holes and to space the tape.

A tape bearing code designations recorded in the manner previously described is adapted for use in an apparatus which will sense the code designations in the tape and control the operation of a copy typewriter to reproduce therein the data originally prepared on the master copy in the typewriter 100. An example of such a combined reader copy-typewriter unit is found in my copending application Serial No. 492,896, filed concurrently herewith, Patent 2,378,371, granted June 12, 1945. In the practical operation of apparatus of the type disclosed herein in connection with the apparatus of the type disclosed in the just mentioned copending application, it is often desirable to insert certain data on the copy produced by the copy typewriter, such for example, as a special paragraph for different individuals to whom the final copy will be mailed. In order to provide for this operation, provision is made herein for recording a "Stop" code designation in the tape which, when sensed by the reader, will stop the operation of the reader and the copy typewriter so that the desired matter may be inserted. The switches 104 and 204 when closed provide for the recording of the "Stop" code designation in the tape for the purpose just outlined. When either of the switches 104 or 204 is closed, an instantaneous current flow will be had from the condenser 441 which will cease as soon as the condenser is charged. This single impulse of current will flow from the wire 440 to the closed "Stop" code switch and from there through parallel wires to the wires 436, 435, 434, and 431 and through the latter to the corresponding tripping magnets RM6, RM5, RM4, and RM1 which will result in the recording of the "Stop" code designation which is 1-4-5-6, in the tape.

When it is desired to nullify previously recorded data, the nullify switch 105 is moved from the full line position shown in Fig. 17 to the dotted

line position. The switch 105, when thus moved, provides for the closure of two electrically separate sets of contacts 470 and 480, respectively. The closure of contacts 470 causes current to flow from the D. C. plus wire 411 through the contacts 470, a wire 471 to the reversing magnet RVM and from there through the wire 414 and switch blade 413 to the minus side of the line. The energizing of the reversing magnets will provide for the shifting of the selector plate 244 and interposer elements 245 and 246 which, as fully described hereinabove, provides for the backward spacing of the tape for each recording operation. The set of contacts 480 comprises six separate contacts which, as is obvious from the diagram, are all electrically connected when the switch 105 is in the dotted line or nullify position. As shown, the six contacts comprising the set 480 are connected, respectively, by six separate wires to the six wires 431 to 436, inclusive, which connect the code contacts with the tripping magnets.

The nullifying of previously recorded data is accomplished as follows. When a mistake has been made in the typing of the master copy on the typewriter 100, and consequently in simultaneously recording a corresponding erroneous code designation in the tape 95, the switch 105 is turned to the dotted line position shown in Fig. 17 and the back space key 32 of the typewriter is actuated a sufficient number of times to return the typewriter carriage to a position where the last correct character before the error was made is in typing position. Each time the back space key is actuated, the permutation unit, as in normal operation, will close the code contact 6, but instead of only energizing the corresponding tripping magnet RM6, the closed set of contacts 480 connects the wire 436 with the remaining wires 431 to 435, inclusive, and as a result, tripping magnets RM1 to RM5 will also be energized. Thus, with the switch 105 in nullify position, each time the back space key 32 is depressed, a code hole is punched in each of the six code positions in the tape. In the particular embodiment of recorder disclosed herein, the tape is first punched and then the tape is spaced to present a new field for recording. Consequently, the first depression of the back space key will record the nullify code 1-2-3-4-5-6 in a blank field. However, for each succeeding depression of the back space key the nullify code will be recorded in a field of the tape bearing a previously recorded code designation and will thereby nullify the latter. When the back space key has been actuated the required number of times to return the master copy to a position where the last correct letter typed is again in typing position, the field of the tape bearing the code designation corresponding to the last correct letter is then in data recording position. At this time the switch 105 is returned to the normal or full line position shown in Fig. 17, which results in deenergizing the reversing magnet and in opening the series of contacts 480. The key corresponding to the last correct letter printed is depressed which merely results in typing over the top of the correct letter and in punching again in the field already having the code hole designation for the correct letter. Then the character key "X" is actuated a sufficient number of times to cancel out the error and the rest of the typing after the error. In view of the fact that when the back space key was first depressed during the nullifying operation, a nullify code designation was recorded in a blank field in the tape, it

is, therefore, necessary to actuate the X-key one additional time so as to bring a blank field of the tape into recording position. After this, the normal typing operation can be continued.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a single modification it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art, without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. In apparatus for recording data on a record strip, the combination of a recorder; means for feeding the record strip past a data-recording position and being selectively adjustable to feed the strip either forward or backward; a typewriter comprising a carriage for holding a work copy and a plurality of character and functional keys; control means operable during normal operation of said typewriter and in response to the actuation of said keys to effect operation of said recorder to record data on said strip corresponding to the keys actuated; means effective during such normal operation to provide for a forward feeding operation of said strip feeding means; means operable at the selection of said operator for modifying said control means so as to provide for nullifying previously recorded data and to adjust the strip-feeding means to provide for feeding the strip backward; and means operable upon an operation of said modifying and adjustment changing means and in response to the actuation of a selected typewriter key to effect the backward feeding of said strip feeding means and the backward feeding of said typewriter carriage and to effect the nullifying of previously recorded data on said strip.

2. In apparatus for recording code designations in successive fields of a record tape in accordance with a combinational code, the combination of a code recorder; tape feed mechanisms operable to space said tape for each recording operation and being adjustable to feed the tape forward during normal operation and to feed the tape backward during a nullifying operation; a typewriter including character and functional keys; control means normally operable in response to the actuation of said keys for effecting operation of said recorder to record code designations corresponding, respectively, to the keys actuated; and nullifying means operable to modify the operation of said control means and to adjust said tape feed mechanism to feed the tape backward so that for each actuation of a selected functional key a nullify code designation is recorded in the tape and the tape is spaced backward.

3. In apparatus for recording code designations in a tape according to the combinational code, the combination of a code recorder; adjustable tape feeding means operable between successive recording operations for feeding the tape forward when in a normal condition of adjustment and backward when in a second condition of adjustment; a typewriter comprising character keys and a back space key; control means normally operable in response to the actuation of the character keys for effecting operation of said recorder to record code designations in the tape corresponding, respectively, to the character keys actuated,

and normally operable in response to the actuation of the back space key to record a back space code designation in the tape; and nullifying means operable to change said tape feeding means to its second condition of adjustment and to modify said control means so that for each actuation of said back space key a nullify code designation is recorded in the tape and the tape is fed backward along with the typewriter carriage.

4. In apparatus for recording code designations in successive fields of a record tape, a code recorder; tape feeding means operable between successive recording operations to space said tape and being adjustable to space the tape forward during normal recording operations and to space the tape backward when it is desired to nullify a recorded code designation; a typewriter including character keys and a back space key; control means operable during normal recording operations and acting in response to the actuation of said character and back space keys for effecting operation of said code recorder to record in successive fields code designations corresponding, respectively, to the particular keys actuated; and nullifying means selectively operable to change the adjustment of said tape feeding means and to modify the operation of said control means so that upon actuation of said back space key the tape is spaced backward and the previously recorded code designation is nullified.

5. In apparatus for perforating a record tape according to a combinational hole code, the combination of a code perforator; adjustable means for feeding the record tape between successive perforating operations and being operable in a normal condition of adjustment to advance the tape and in a second condition of adjustment to feed the tape in a reverse direction; a typewriter comprising character keys and a back space key; permutation means normally acting in response to the actuation of said character and back space keys to effect operation of said code perforator to produce code hole designations in the tape corresponding, respectively, to the particular keys actuated; and nullifying means for changing said tape feeding means to its second condition of adjustment and modifying the action of said permutation means so that for each actuation of said back space key a nullify code hole designation is produced in the tape and the tape is spaced in a reverse direction.

6. In apparatus for recording code designations in successive fields of a record tape in accordance with a combinational code, the combination of a code recorder; feed mechanism operable to space said tape for each recording operation and adjustable to feed the tape either forward or backward; a typewriter comprising a plurality of character and functional keys; control means normally operable in response to the actuation of said keys for effecting operation of said recorder to record code designations corresponding, respectively, to the keys actuated; means effective during normal operation for adjusting said feed mechanism to feed said tape forward; nullifying means operable to modify said control means so that for each actuation of a selected functional key a nullify code designation is recorded in the tape; and means operable with said nullifying means for adjusting said feed mechanism to feed said tape backward.

7. In apparatus for recording code designations in successive fields of a record tape according to a combinational code, the combination of a code recorder; adjustable means for feeding successive

fields of the tape into recording position and being operable to feed the tape forward when in a normal condition of adjustment and backward when in a second condition of adjustment; a typewriter comprising character keys and a back space key; control means normally operable in response to the actuation of the character and back space keys for effecting operation of said code recorder to record in successive fields code designations corresponding, respectively, to the particular keys actuated and being also normally operable in response to the actuation of each key to feed the tape forward to present a new field for recording; and nullifying means operable to modify the operation of said control means and to change said tape feeding means to said second condition of adjustment so that for each operation of the back space key the code recorder operates to record a nullify code designation and the tape is fed backward.

8. In apparatus for perforating a record tape in successive fields according to a combinational hole code based on a predetermined number of code hole positions, the combination of a code perforator; means for feeding the record tape between successive perforating operations and being operable when in a normal condition of adjustment to advance the tape and when in a second condition of adjustment to feed the tape backward; a typewriter comprising character keys and a back space key; permutation means operating normally and in response to the actuation of said character and back space keys to effect operation of said code perforator to produce code hole designations in the tape corresponding, respectively, to the keys actuated; and nullifying means for changing said tape feeding means to said second condition of adjustment and for modifying the operation of said permutation means so that in response to each actuation of said back space key, said code perforator is operated to punch all code positions to produce a nullify code hole designation in the tape, and so that said tape feeding means is operated to feed the tape backwards.

9. In apparatus for recording code designations in a record tape according to a combinational code, a code recorder; tape feeding means for spacing said tape for each recording operation and adjustable to feed said tape either forward or backward; a typewriter comprising character and functional keys and including a back space key; permutation means normally operable in response to the actuation of said keys to effect operation of said recorder to record a code designation corresponding to the particular key actuated and including means for normally recording a back space code designation in response to the operation of said back space key; nullifying means operable to modify the action of said permutation means to effect the recording of a nullify code designation in response to the actuation of said back space key; and means for adjusting said tape feeding means to feed said tape forward during normal operation and to feed said tape backward during the operation of said nullifying means.

10. In apparatus for recording code designations in successive fields of a record tape according to a combinational code, the combination of a typewriter comprising a carriage and a plurality of character and functional keys including a back space key; a code recorder operable to record selectively code designations in the fields of said tape; tape feeding means nor-

mally operable between recording operations and in response to the actuation of said typewriter keys to advance the tape to present a new field for recording; permutation means responsive to the actuation of said keys for effecting operation of said recorder to record in different fields code designations corresponding, respectively, to the keys actuated, and including means normally acting in response to the actuation of said back space key to record a back space code designation; and nullifying means selectively operated to modify the action of said tape feeding means and said permutation means so that in response to the actuation of said back space key a nullify code designation is recorded and the tape is spaced backward, along with the typewriter carriage, to bring a preceding field into recording position.

11. In apparatus for perforating successive fields of a record tape to produce selectively in each field in accordance with a combinational code, one or more code holes representing by number and position different characters and functional operations of a typewriter, the combination of a typewriter comprising a carriage and a plurality of character and functional keys including a back space key; a plurality of punching elements operable to punch the code holes in the fields of the record tape; tape feeding means normally operable between succeeding punching operations and in response to the actuation of the typewriter keys to advance the tape to present a new field for punching; permutation means responsive to the actuation of the typewriter keys for effecting operation of the proper punching elements to produce in the tape the code hole designation of the key actuated, and including means normally acting in response to the actuation of the back space key for producing a back space code in the tape; and manually selective means for modifying the action of said permutation means and said tape feeding means so that in response to the actuation of the back space key the tape is spaced backward along with the typewriter carriage and a nullify code designation comprising all hole position of the code is punched in the tape.

12. In apparatus for recording code designations in successive fields of a record tape in accordance with a combinational code, the combination of a code recorder; feed mechanism for spacing said tape for each recording operation and comprising an element operable to space said tape forward a second element operable to space the tape backward, and means including a selector movable to either of two positions and being operable when in one position to effect operation of said forward spacing element and when in a second position to effect operation of said backward spacing element; a typewriter comprising a plurality of character and functional keys; control means operable normally in response to the actuation of said keys for effecting operation of said recorder to record code designations corresponding, respectively, to the keys actuated; nullifying means operable to modify said control means so that for each actuation of a particular one of said functional keys a nullify code designation is recorded in the tape; and means for maintaining said selector in its said one position during normal operation and acting in response to the operation of said nullifying means for maintaining said selector in its said second position.

13. In apparatus for recording code designa-

tions in successive fields of a record tape in accordance with a combinational code, the combination of a code recorder; feed mechanism for spacing said tape for each recording operation and comprising a first element operable to space said tape forward, a second element operable to space the tape backward, and means including a selector movable to either of two positions and being operable when in one of such positions to effect operation of said first element and when in the other of such positions to effect operation of said second element; means for constantly urging said selector to occupy its said one position; a typewriter comprising a plurality of character and functional keys; control means normally operable in response to the actuation of said keys for effecting operation of said recorder to record code designations corresponding to the keys actuated; and nullifying means operable to modify said control means and to move said selector to its said second position so that upon actuation of a selected functional key a nullify code designation is recorded in the tape and the tape is spaced backward.

14. In apparatus for recording code designations in successive fields of a record tape, the combination of a code recorder, mechanism for feeding the tape for each recording operation comprising a first element operable to space the tape forward, a second element operable to space the tape backward, a source of power, and means for transmitting the power from said source to said first and second elements including selector means movable to either of two positions and operable when in one position to transmit power to said first element for operating the same and operable when in its other position to transmit power to said second element for operating the latter; a typewriter including character and functional keys; control means normally operable in response to the actuation of said keys to effect operation of said recorder to record code designations corresponding to the keys actuated; means operable during normal operation to maintain said selector means in its said one position; nullifying means operable to modify said control means so that upon actuation of a selected one of said keys a nullify code designation is recorded; and means for shifting said selector means to its said second position when said nullifying means is operated.

15. In apparatus for recording code designations in successive fields of a record tape in accordance with a combinational code, the combination of a code recorder; feed mechanism for spacing said tape for each recording operation and including a feed shaft, an advancing ratchet on said shaft, a reversing ratchet on said shaft, an advancing pawl, a reversing pawl, power means including a movable selector operable in one position to effect operative engagement of said advancing pawl and ratchet, and operable in a second position to effect operative engagement of said reversing pawl and ratchet; means constantly urging said selector element toward its said one position; a typewriter comprising a plurality of character and functional keys; control means normally operable in response to the actuation of said keys for effecting operation of said recorder to record code designations corresponding, respectively, to the keys actuated; and nullifying means operable to modify said control means and to move said selector element to its said second position so that upon actuation of a

selected key a nullify code designation is recorded in the tape and the tape is spaced backward.

16. In apparatus for recording code designations in successive fields of a record tape in accordance with a combinational code, the combination of a code recorder; mechanism for spacing said tape for each recording operation comprising a feed shaft, a feed wheel on said shaft adapted to engage said tape, an advancing ratchet on said shaft, a reversing ratchet on said shaft, an advancing pawl, a reversing pawl, a power operated shaft, a cam on said power shaft, a cam follower, power transmitting means including a selector movable to two positions and interposer elements carried by said selector and movable therewith and being operable in one position to engage said advancing pawl and transmit a feeding motion from said cam follower to said advancing pawl and operable in a second position to engage said reversing pawl and transmit a feeding motion from said cam follower to said reversing pawl; means for holding said selector and said elements in said one position during normal operation; a plurality of movable actuating keys; control means normally operable in response to the actuation of said keys to effect operation of said recorder to record code designations corresponding to the keys actuated and to effect rotation of said power shaft; and nullifying means operable to modify said control means and to move said selector means into its said second position so that upon actuation of a selected key a nullify code designation is recorded and the tape is fed in a reverse direction.

17. In apparatus for recording data on a record strip, a recorder operable normally to record data in said strip; strip feeding mechanism comprising a feed shaft, means for transmitting motion from the shaft to the record strip, an advancing ratchet on said shaft, a reversing ratchet on said shaft, an advancing pawl adapted to operate said advancing ratchet, a reversing pawl adapted to operate said reversing ratchet, a power shaft, a cam on said power shaft, a cam follower, a selector movable to either one of two positions, a pair of interposer elements fixed to said selector and being so positioned that when the selector is in one position one of said elements engages said advancing pawl and transmits motion thereto from said cam follower and when the selector is in its other position the other of said elements engages said reversing pawl and transmits motion thereto from the cam follower; means for holding said selector in its said one position during normal operation of said recorder; and means for nullifying recorded data and including means for moving said selector to its said other position for feeding the strip backward.

18. In apparatus for recording code designations in successive fields of a record tape according to a combinational code, the combination of a typewriter including character keys and a back space key; a code recorder comprising recording elements movable when conditioned to record code designations in the tape, tape feeding means adjustable to feed the tape either forward or backward, and cyclically operated means for effecting during each cycle of operation a recording movement of the conditioned recording elements and a feeding operation of said tape feeding means; permutation means operable in response to an actuation of the character and back space keys for conditioning the particular recording elements re-

quired to record the code designation corresponding to such character and back space keys and for initiating a cycle of operation of said cyclically operated means; and selective switch means movable to two positions and operable when in one of such positions to adjust said tape feeding means to feed the tape forward, and operable when in a second position to adjust said tape feeding means to feed the tape backward and to modify the action of said permutation means so that an actuation of the back space key will condition the recording elements to record a nullify code designation instead of the normal back space code designation.

19. In apparatus for recording data on a record strip, the combination of a recorder; adjustable strip feeding means operable between successive recording operations for spacing the record strip forward when in a normal condition of adjustment and backward when in a second condition of adjustment; a typewriter comprising a carriage for holding a work copy and a plurality of character and functional keys including a back space key operable when actuated to space the carriage backward; control means normally operable in response to the actuation of said keys in typing on said work copy and effecting functional operations of the typewriter, to effect operation of said recorder to record data successively on said record sheet representing, respectively, the keys actuated; means operable at the selection of the operator to change said strip feeding means to its said second condition of adjustment; and means conditioned by the operation of said last-named means and in response to the actuation of said back space key for concurrently spacing backward both said carriage and said record strip and providing for the nullifying of previously recorded data representations in said record strip.

20. An apparatus for recording code designations in successive fields of a record tape in accordance with a combinational code, the com-

5 bination of a code recorder; tape feeding mechanism for spacing said tape for each recording operation and comprising an element operable to space said tape forward, a second element operable to space the tape backward, and means including a selector movable to either of two positions and being operable when in one position to effect operation of said forward spacing element and when in a second position to effect operation of said backward spacing element; a typewriter comprising a carriage for holding a work copy and a plurality of character and functional keys including a back space key operable when actuated to space the carriage backward; control means normally operable in response to the actuation of said keys in typing on said work copy and effecting functional operations of the typewriter, to effect operation of said recorder to record code designations on said record tape corresponding, respectively, to the keys actuated; means for maintaining said selector in its said one position during the normal typing operation of said typewriter; means operable at the selection of the operator for changing said selector to its said second position; and means conditioned by the operation of said last named means and in response to the actuation of said back space key for concurrently spacing backward both said carriage and said record tape.

HENRY L. THOLSTRUP.

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