May 9, 1950 C. CHISHOLM 2,506,702

VARIABLE FEED MECHANISM FOR TYPEWRITERS OR THE LIKE

Original Filed July 20, 1946 15 Sheets-Sheet 1

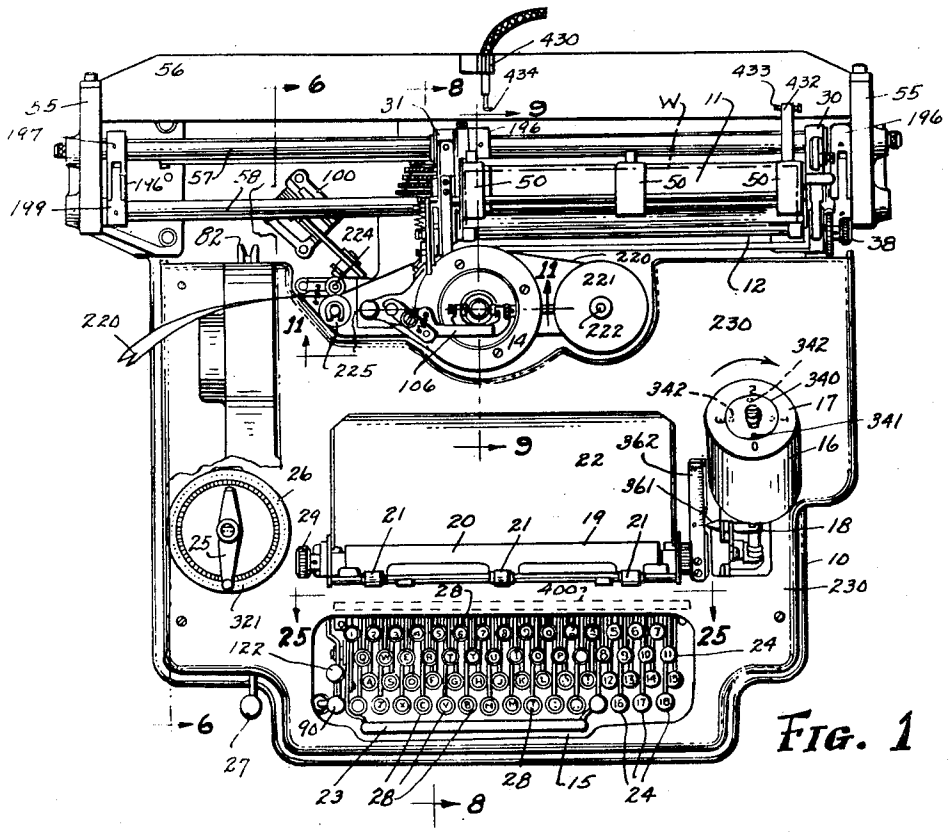

FIG. 1

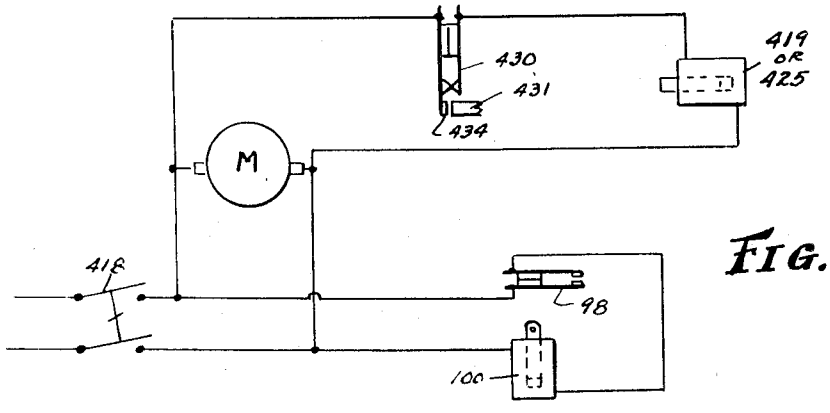

FIG. 26

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May 9, 1950 C. CHISHOLM 2,506,702

VARIABLE FEED MECHANISM FOR TYPEWRITERS OR THE LIKE

Original Filed July 20, 1946 15 Sheets-Sheet 2

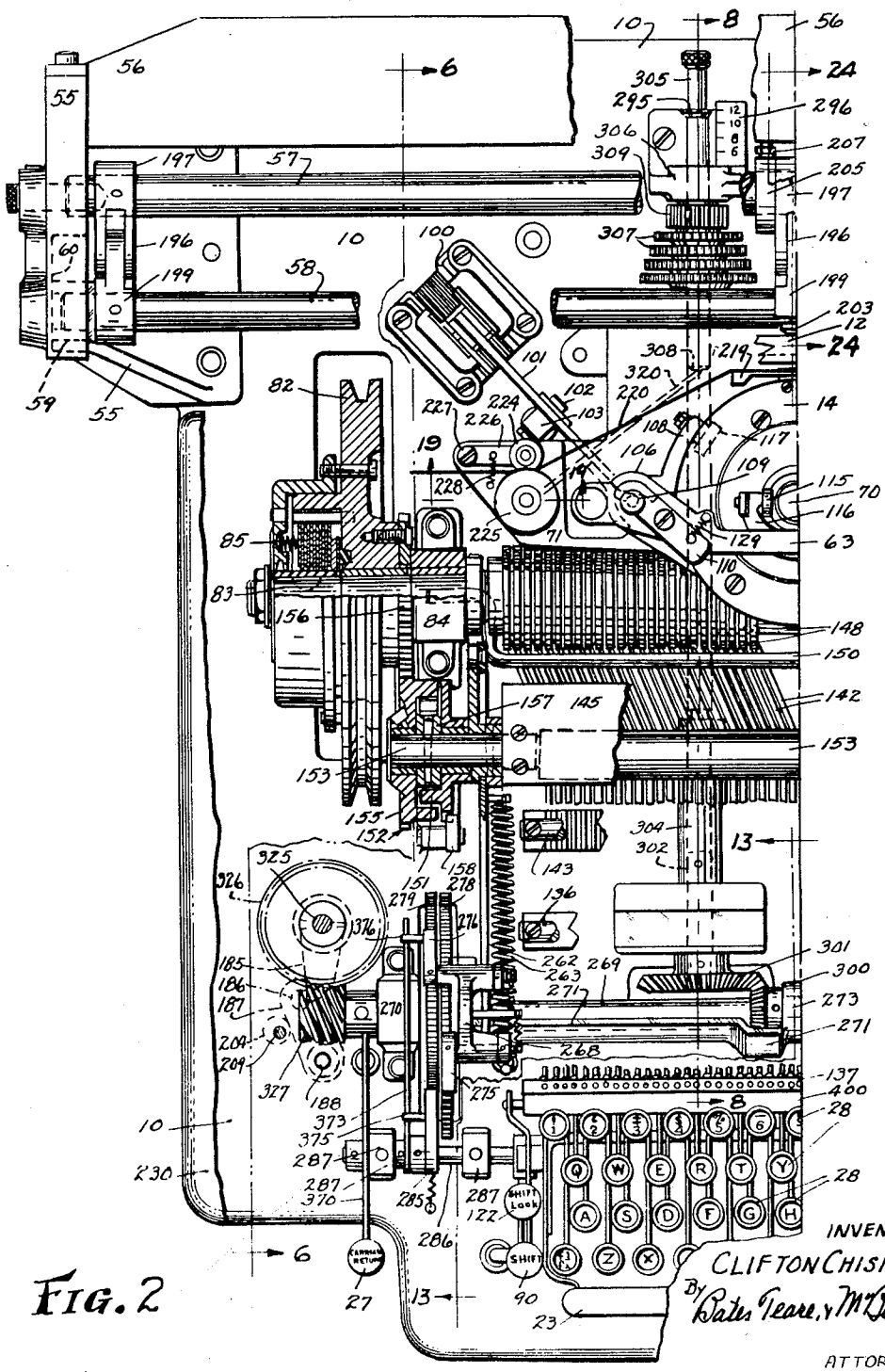

FIG. 2

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VARIABLE FEED MECHANISM FOR TYPEWRITERS OR THE LIKE

Original Filed July 20, 1946 15 Sheets-Sheet 3

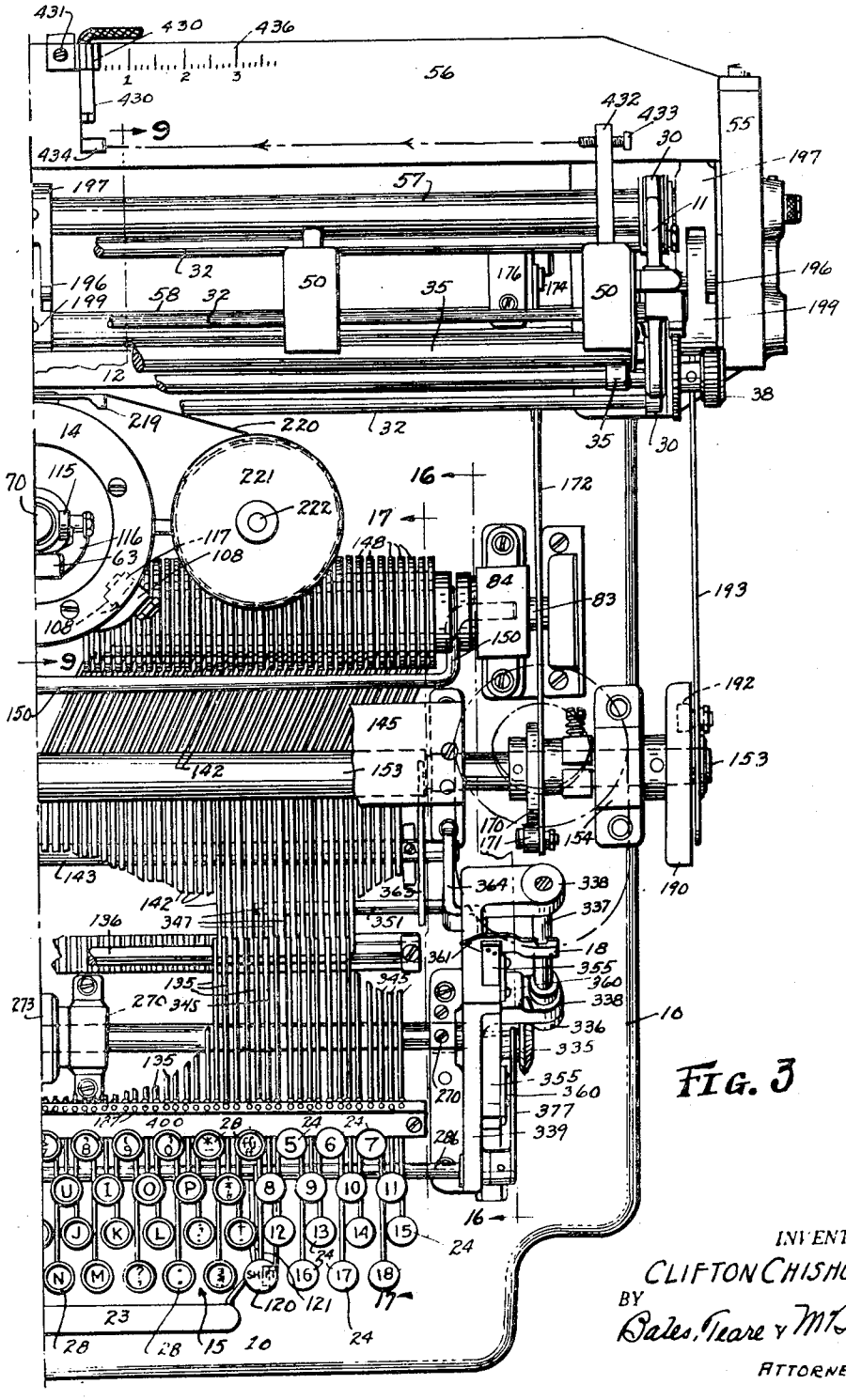

FIG. 3

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VARIABLE FEED MECHANISM FOR TYPEWRITERS OR THE LIKE

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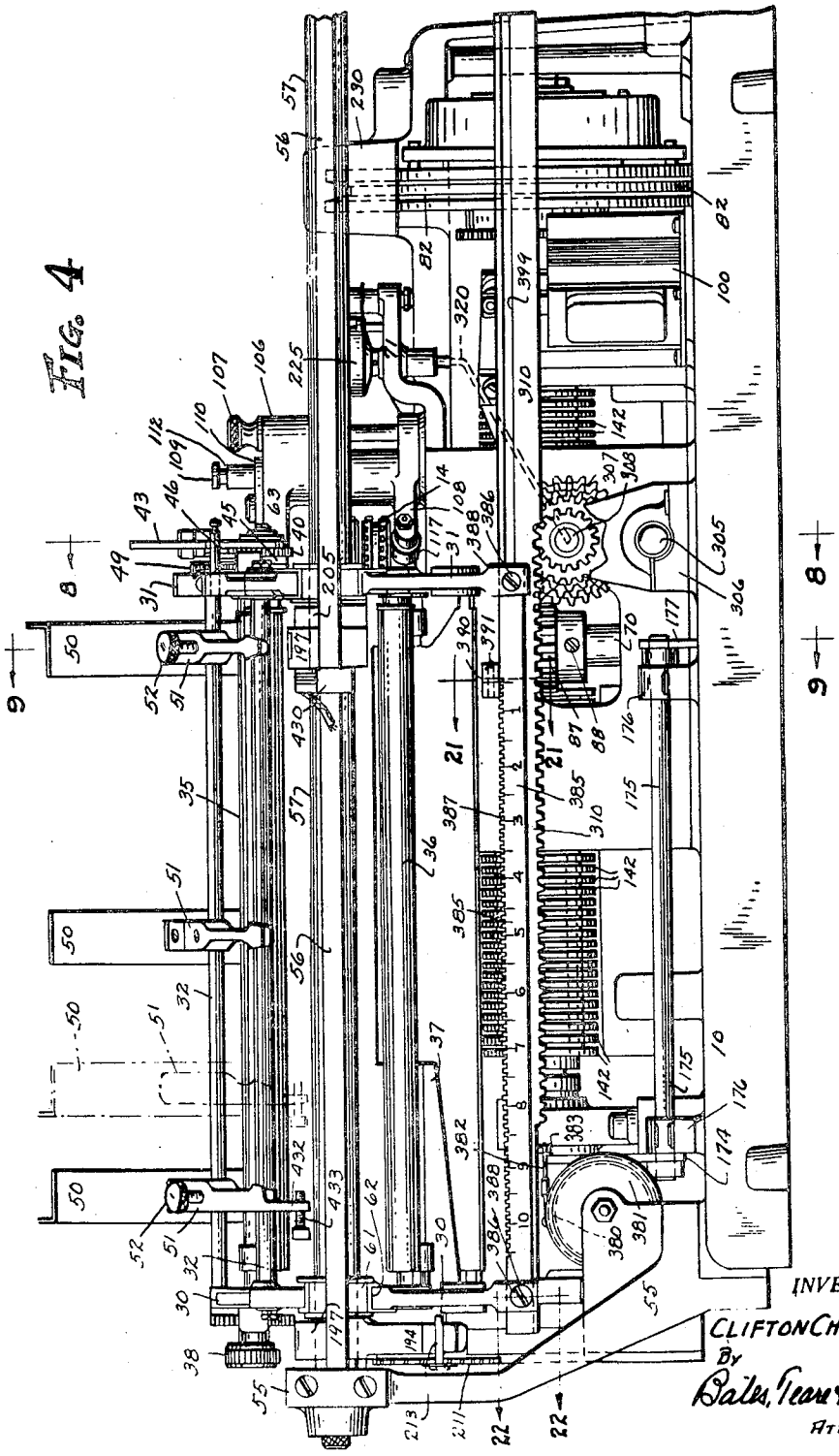
FIG. 4



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VARIABLE FEED MECHANISM FOR TYPEWRITERS OR THE LIKE

Original Filed July 20, 1946 15 Sheets-Sheet 5

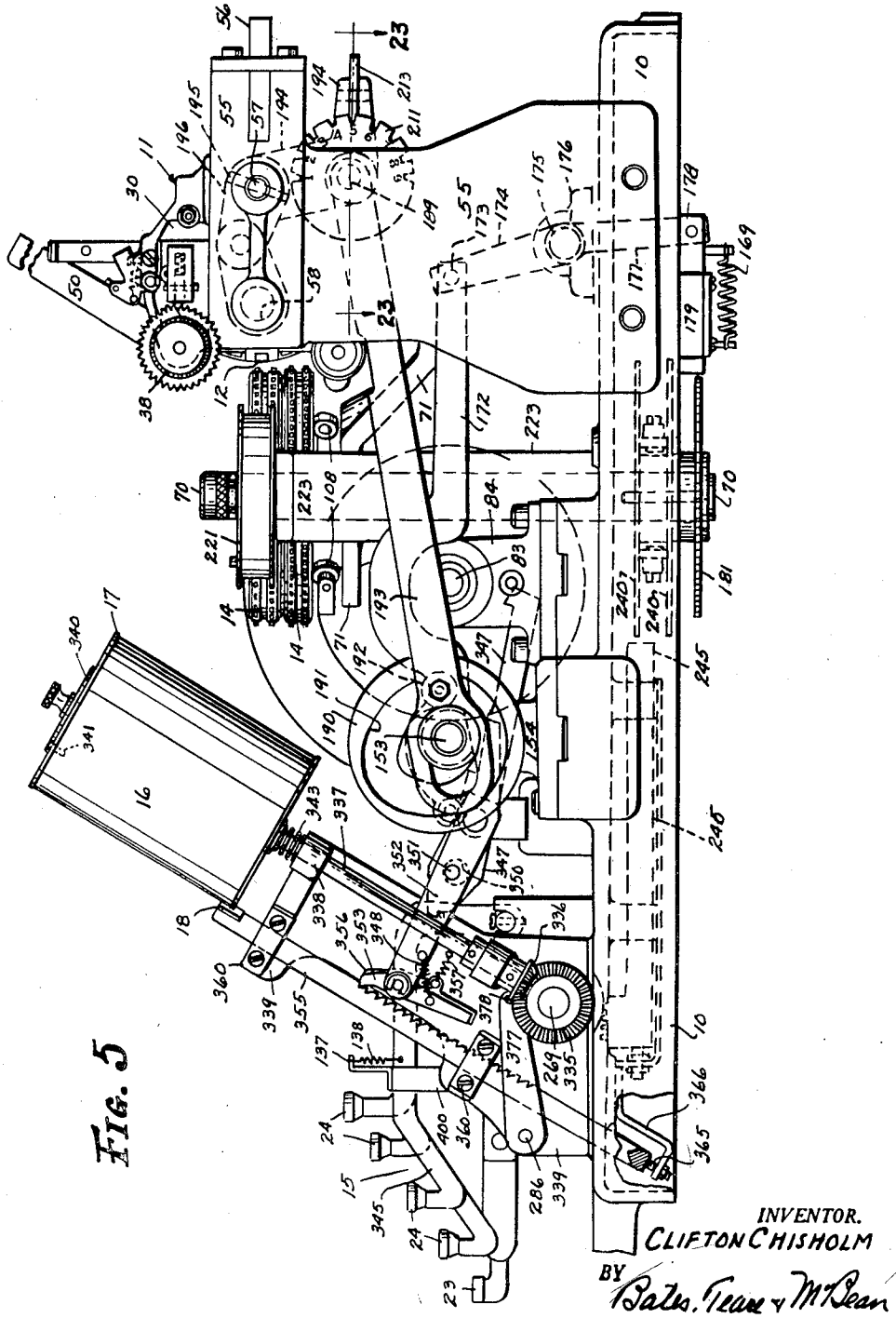

Fig. 5

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VARIABLE FEED MECHANISM FOR TYPEWRITERS OR THE LIKE

Original Filed July 20, 1946 15 Sheets-Sheet 6

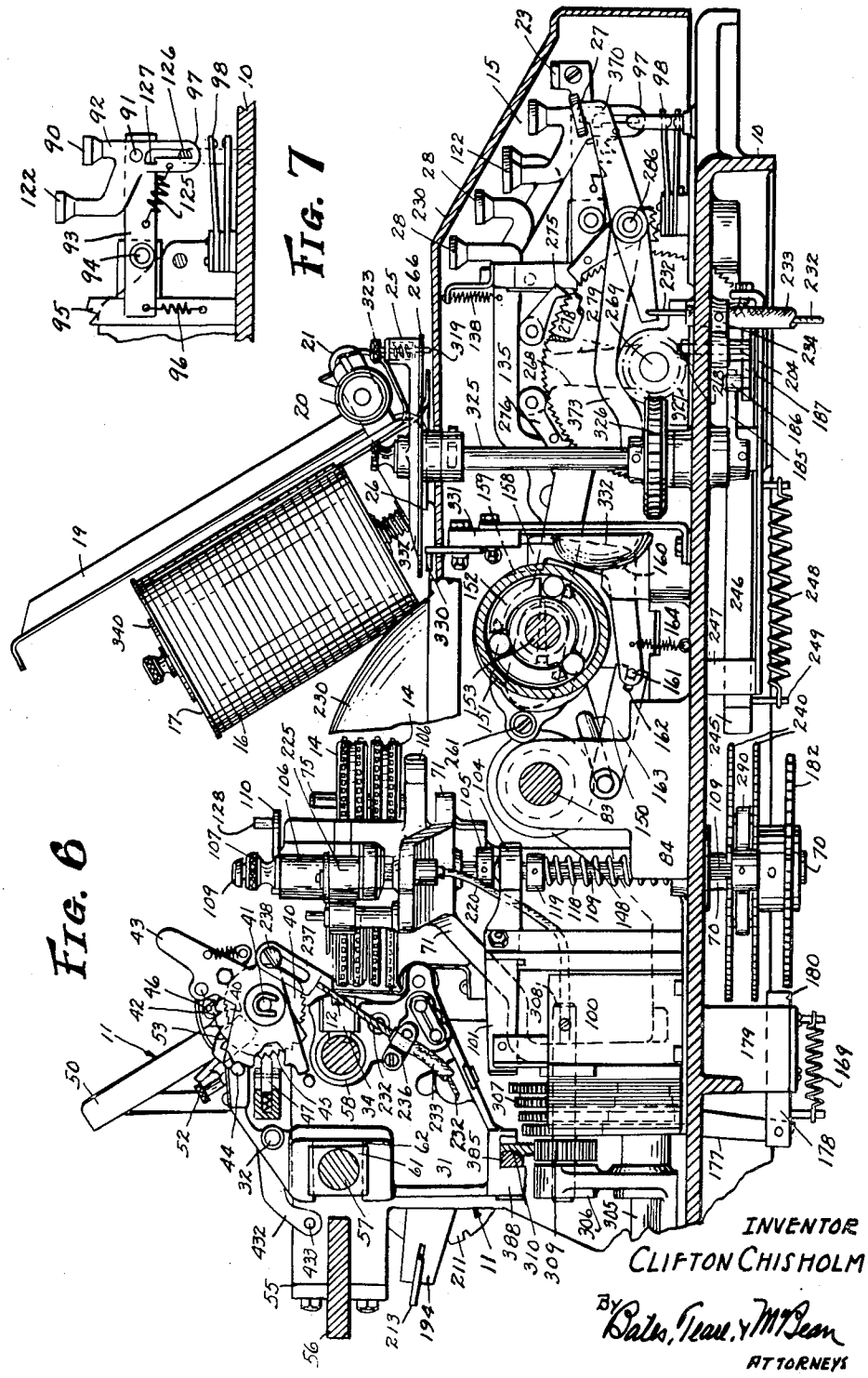

FIG. 6

FIG. 7

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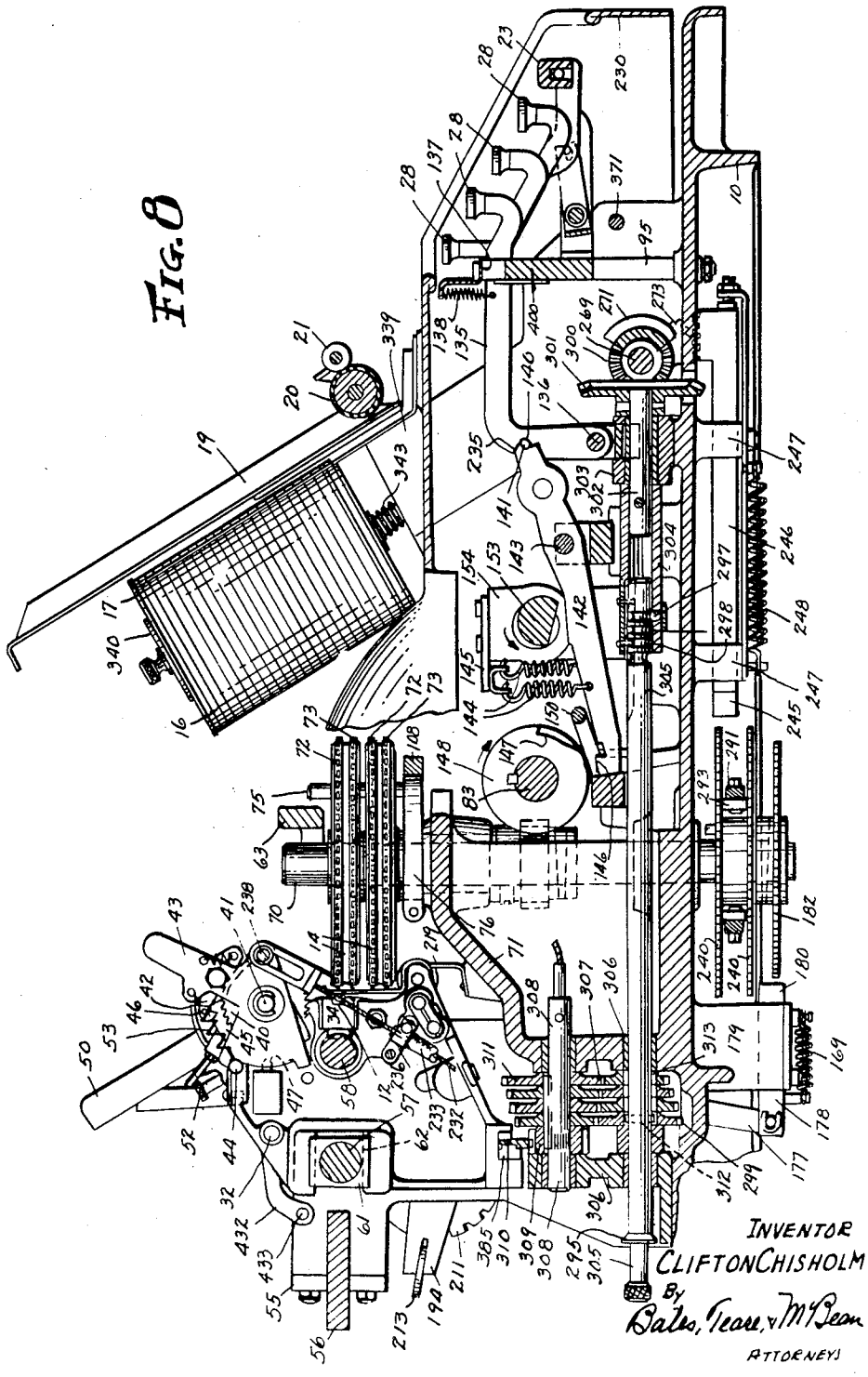
VARIABLE FEED MECHANISM FOR TYPEWRITERS OR THE LIKE

Original Filed July 20, 1946 15 Sheets-Sheet 7

FIG. 8



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VARIABLE FEED MECHANISM FOR TYPEWRITERS OR THE LIKE

Original Filed July 20, 1946 15 Sheets-Sheet 8

FIG. 9

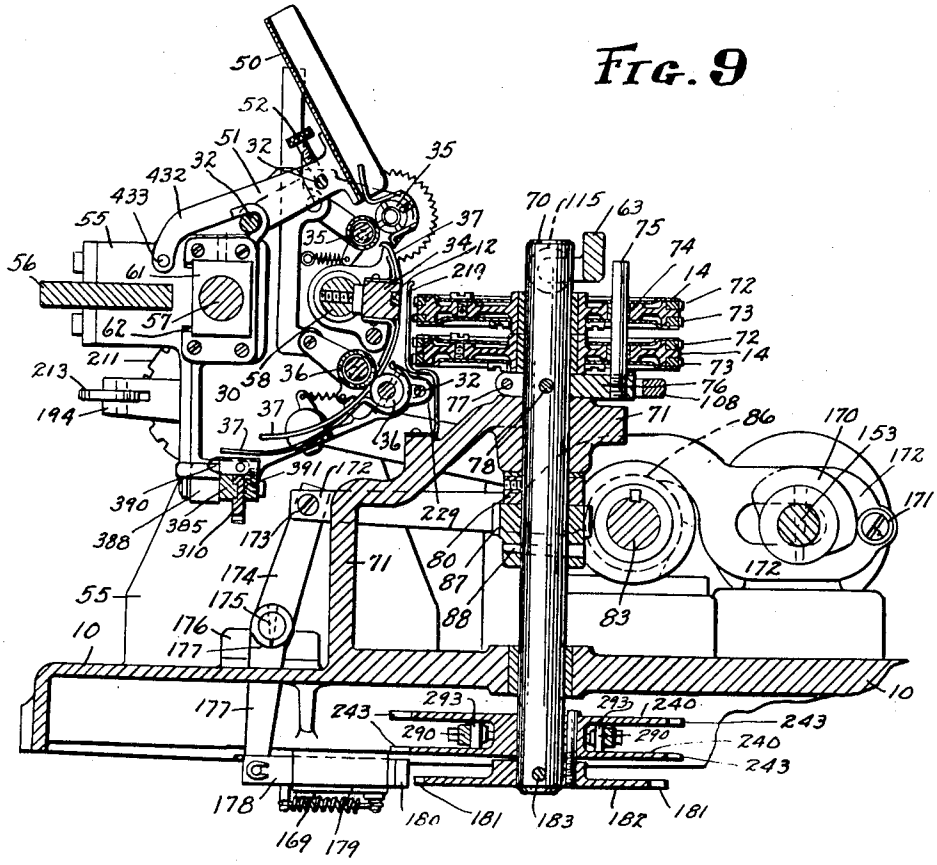
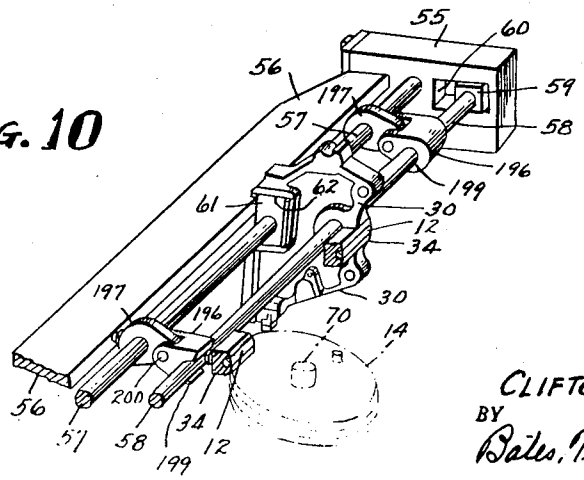


FIG. 10



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VARIABLE FEED MECHANISM FOR TYPEWRITERS OR THE LIKE

Original Filed July 20, 1946 15 Sheets-Sheet 9

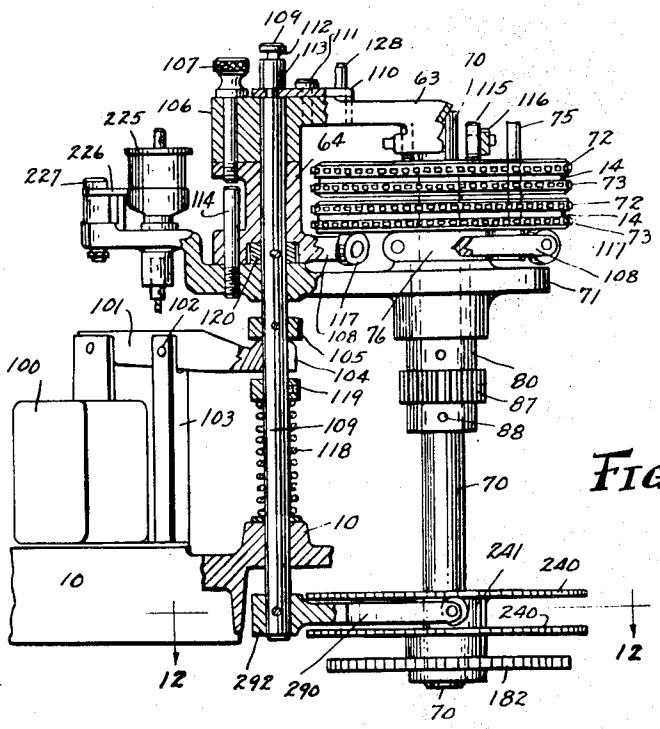

FIG. 11

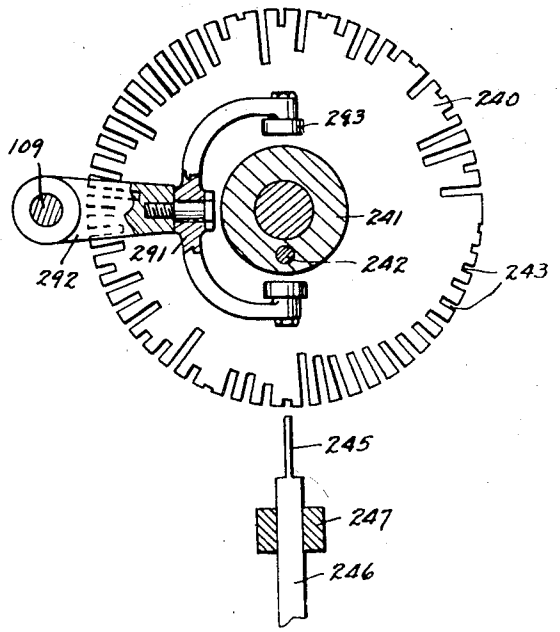

FIG. 12

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VARIABLE FEED MECHANISM FOR TYPEWRITERS OR THE LIKE

Original Filed July 20, 1946 15 Sheets-Sheet 10

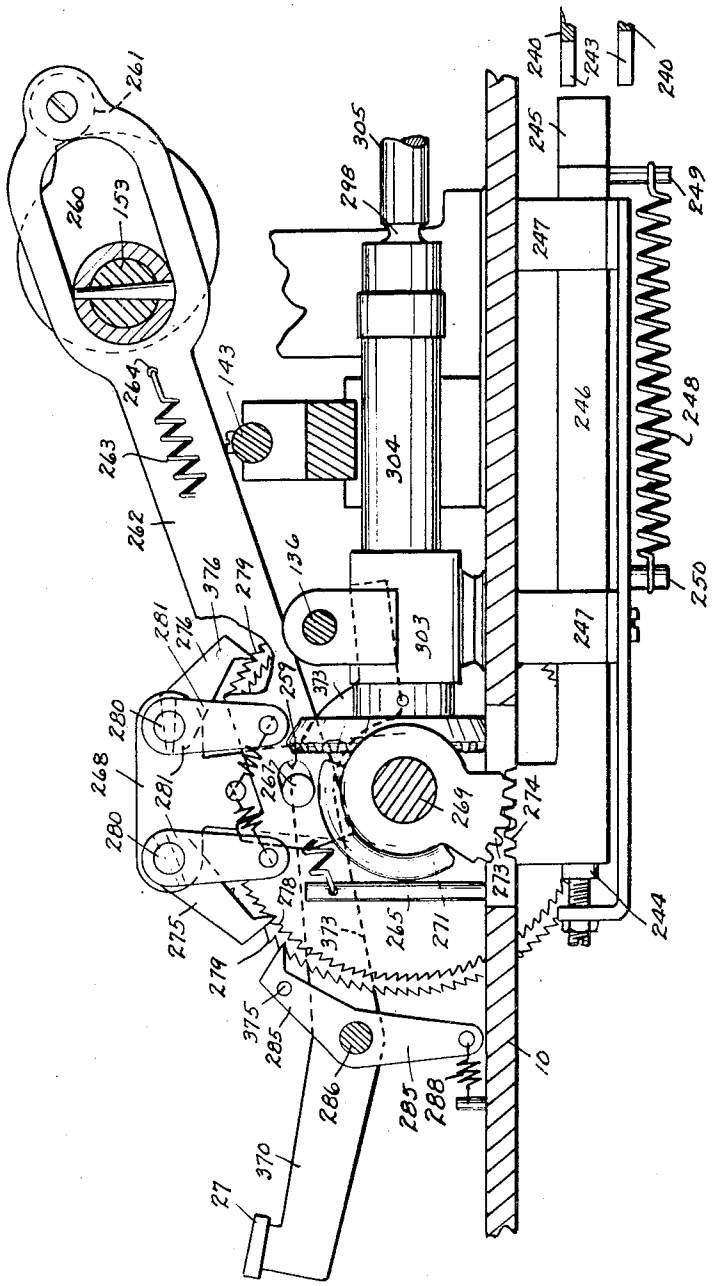

FIG. 13

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VARIABLE FEED MECHANISM FOR TYPEWRITERS OR THE LIKE

Original Filed July 20, 1946 15 Sheets-Sheet 11

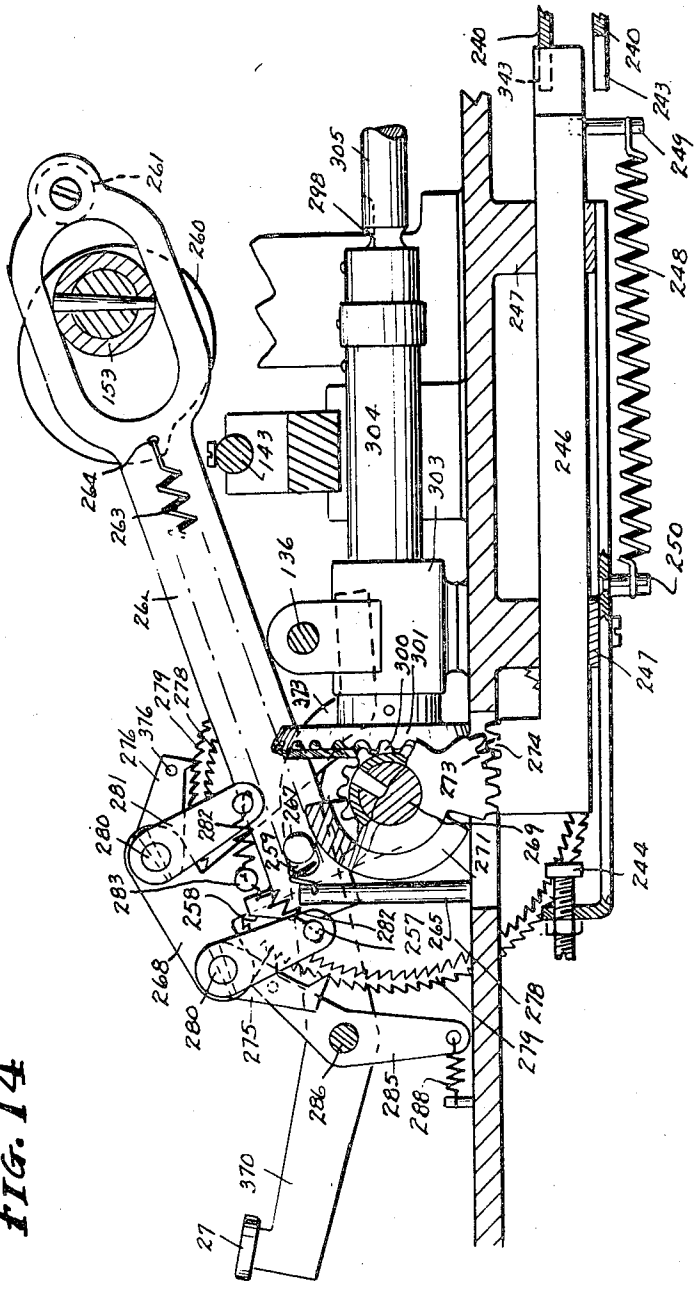

FIG. 14

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VARIABLE FEED MECHANISM FOR TYPEWRITERS OR THE LIKE

Original Filed July 20, 1946 15 Sheets-Sheet 12

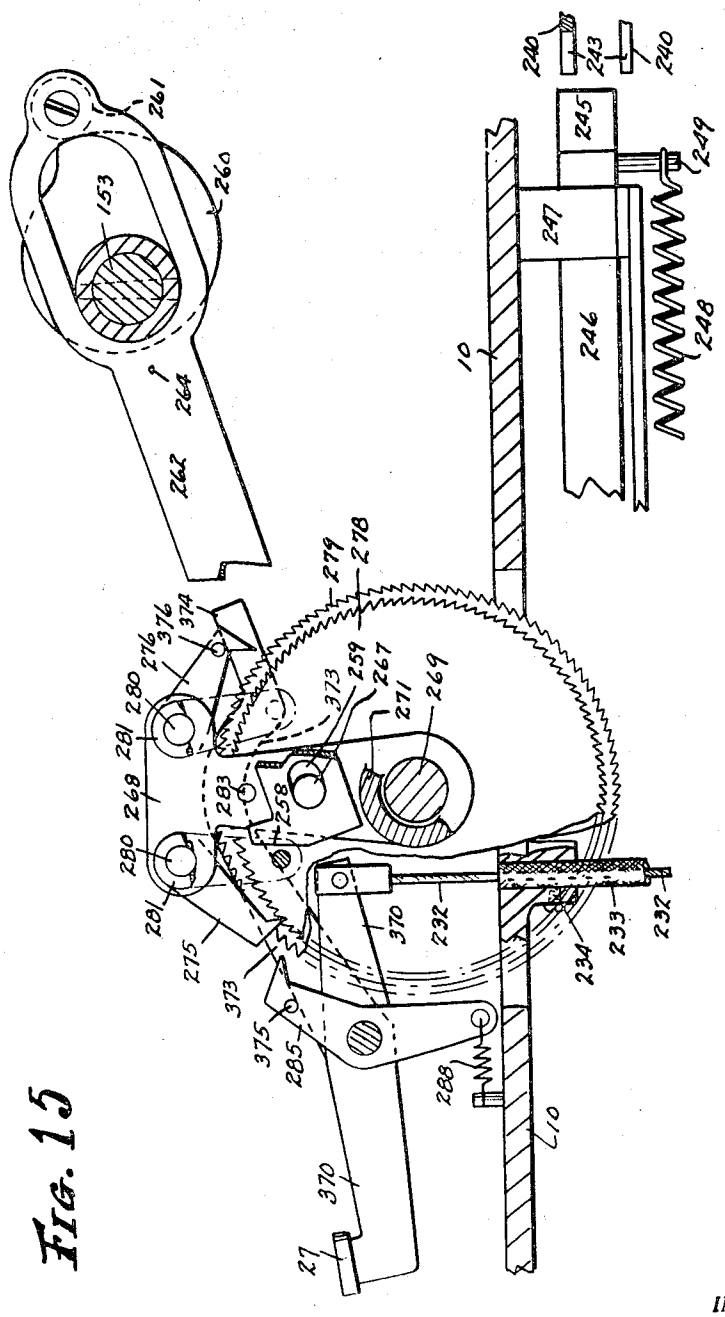

Fig. 15

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May 9, 1950 C. CHISHOLM 2,506,702

VARIABLE FEED MECHANISM FOR TYPEWRITERS OR THE LIKE

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FIG. 17

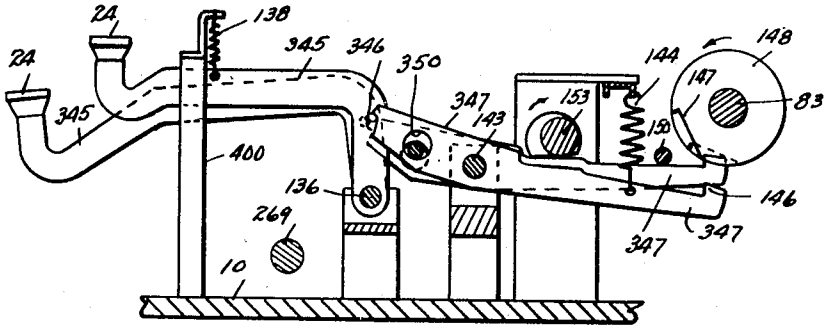


FIG. 16

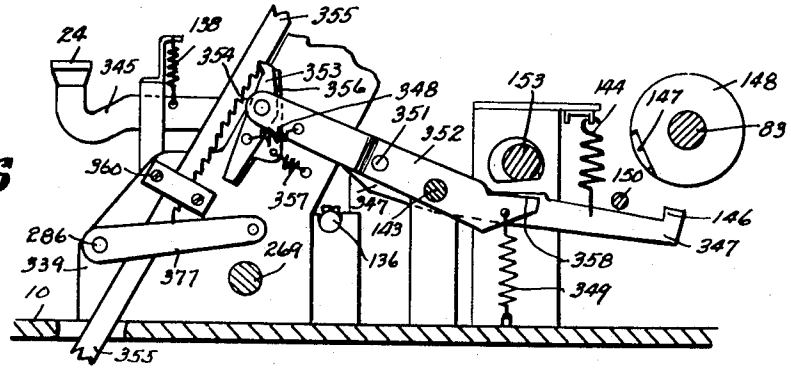
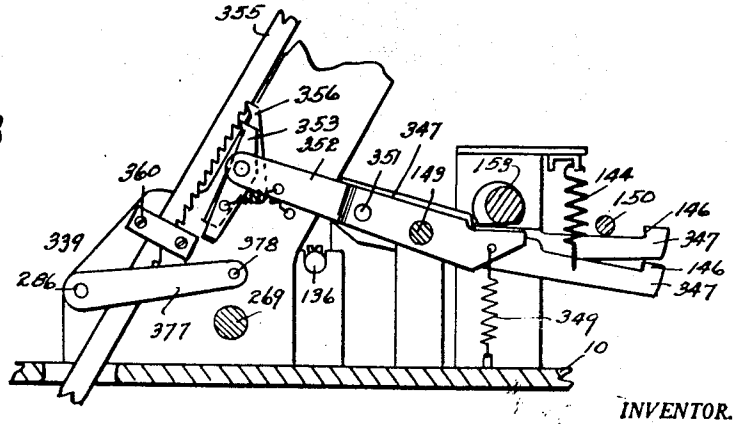


FIG. 18



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VARIABLE FEED MECHANISM FOR TYPEWRITERS OR THE LIKE

Original Filed July 20, 1946 15 Sheets-Sheet 14

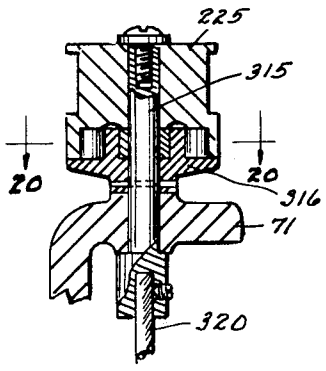

FIG. 19

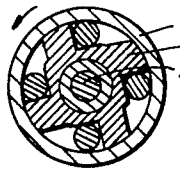

FIG. 20

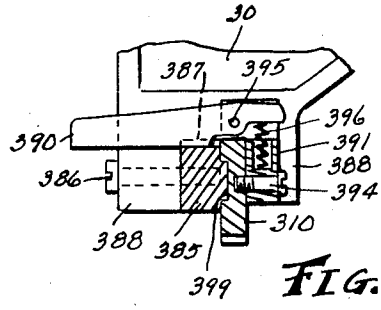

FIG. 21

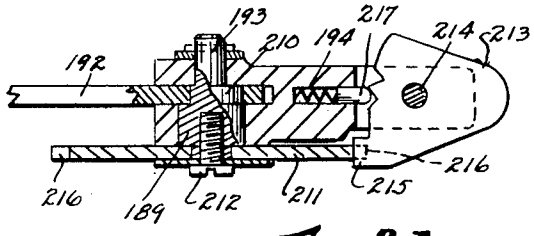

FIG. 23

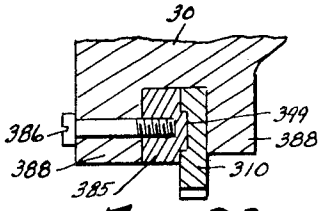

FIG. 22

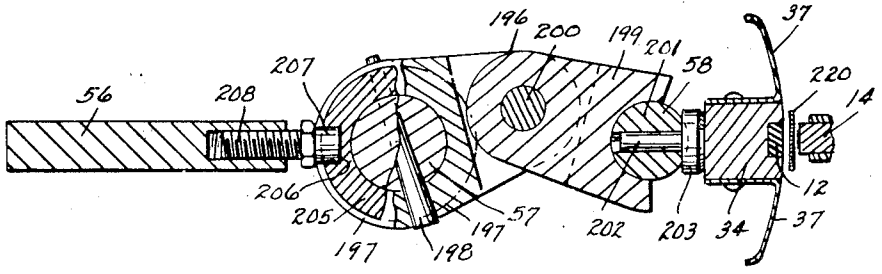

FIG. 24

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VARIABLE FEED MECHANISM FOR TYPEWRITERS OR THE LIKE

Original Filed July 20, 1946 15 Sheets-Sheet 15

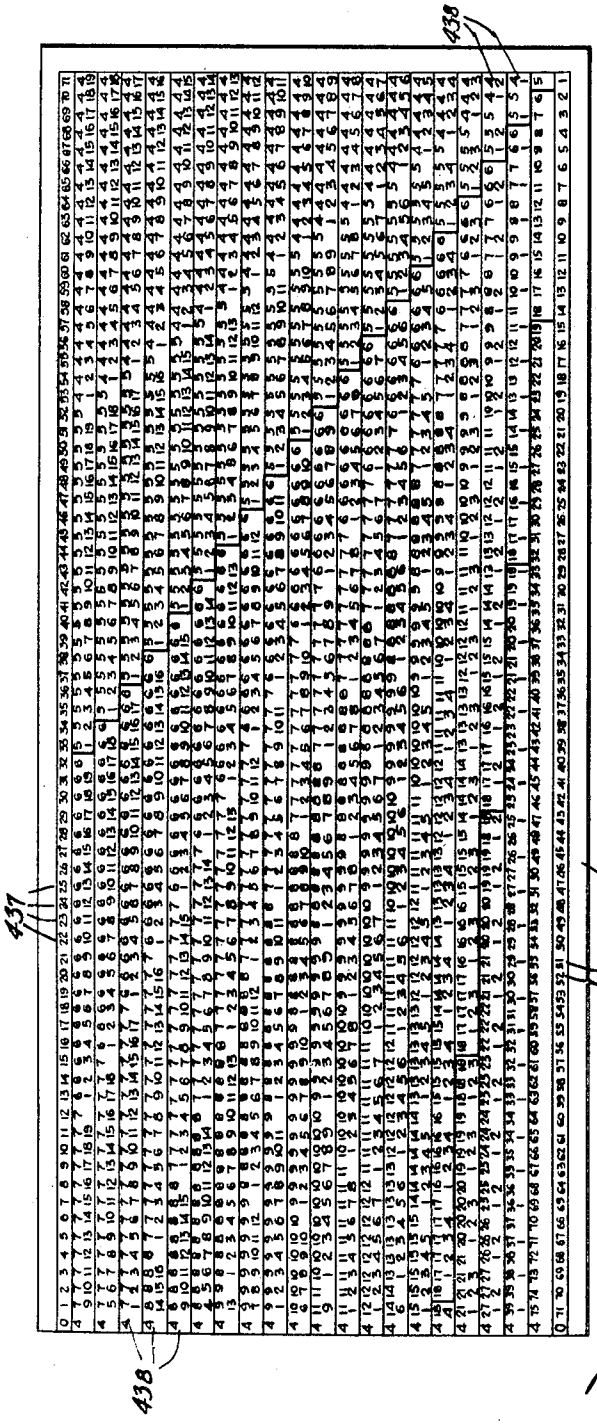

Fig. 25

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Patented May 9, 1950

2,506,702

UNITED STATES PATENT OFFICE

2,506,702

VARIABLE FEED MECHANISM FOR TYPEWRITERS OR THE LIKE

Clifton Chisholm, Cleveland Heights, Ohio, assignor of one-fourth to Marie F. Chisholm, Cleveland Heights, and one-half to Henry C. Osborn, Cleveland, Ohio

Original application July 20, 1946, Serial No. 685,107. Divided and this application May 29, 1947, Serial No. 751,303

14 Claims. (Cl. 197—84)

1

This application is a division of my copending application, Serial No. 685,107, filed July 20, 1946, on a Keyboard operated machine.

The present invention relates to improvements in variable feed mechanisms for a keyboard machine, and more particularly to improvements in variable carriage feed and related mechanisms. The present invention is especially adapted to facilitate the production of justified copy, similar to letter press printing and from which a master printing member such as a planographic printing plate, may be reproduced as, for instance, by a photographic transfer process. These, therefore, are the general objects of the present invention.

My prior Patents Nos. 2,165,223; 2,165,224 and 2,165,225, issued July 11, 1939, discloses a keyboard machine of the general type with which the present invention is concerned. In general, such a machine includes a plurality of individual letter keys for causing a copy to be reproduced as in an ordinary typewriter. However, a plurality of spacing keys are also provided. These space keys are arranged to space the words a varying distance from each other as, for instance, by any selected number of units from four to eighteen as desired. Further, the mechanism is arranged to utilize printing type of varying widths such as is ordinarily used in letter press printing.

In using a machine of the type with which this invention is concerned, the operator first types a line in the usual manner, using a standard space key or bar. Mechanism, which is dependent upon the difference between the length of the typed line and the length of a standard line, is provided to indicate to the operator which space key or keys should be used when retyping the line to produce a justified or standard length line. This information is typed by the operator at the end of the line and subsequent lines are typed using the same procedure. To produce the justified copy, these typed lines are removed from the machine and retyped, using the space bars or keys indicated at the ends of the respective lines. The lines so retyped will all be of standard length. The retyped copy is then removed from the machine and utilized in any well known manner to form a master printing member or plate. For example, a planographic printing plate may be produced from the retyped copy by a photographic reproduction process.

One of the objects of the present invention is to provide a keyboard controlled printing machine having type of different widths, with an

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improved work sheet feed mechanism, which mechanism will accurately advance the work sheet a distance corresponding to the width of individual type following the impression of such individual type on the work sheet.

A further object of the invention is to provide an improved inking ribbon feed mcchanism for a keyboard controlled printing machine, which feed mechanism will advance the ribbon varying amounts depending upon the width of individual impressions made on a work sheet, even though such impressions may vary in width from each other.

A further object is to provide a printing machine having a work sheet carriage and an indicating device which are advanced following the impression of each individual character, with an advancing mechanism arranged to prevent the overthrow or rebound of the carriage or indicator during or following the feeding operation.

Other objects and advantages of the invention will become more apparent from the following description, reference being had to the accompanying drawings in which there is illustrated a preferred embodiment of the invention. The essential characteristics of the invention will be summarized in the claims.

In the drawings, Fig. 1 is a plan view of a machine embodying my invention; Fig. 2 is an enlarged plan view of the left hand side of the machine, the cover and certain other parts being broken away to more clearly illustrate the internal construction; Fig. 3 is a plan view similar to Fig. 2 but illustrating the right hand side of the machine; Fig. 4 is a rear elevation of the machine; Fig. 5 is a side elevation looking at the right hand side of Figs. 1 and 3; Fig. 6 is a longitudinal vertical section, the plane of the section being indicated by the lines 6—6 on Figs. 1 and 2; Fig. 7 is a sectional detail of a shift key lock mechanism; Fig. 8 is a longitudinal vertical section as indicated by the lines 8—8 on Figs. 1, 2 and 4; Fig. 9 is a fragmentary vertical section through the type wheels and associated mechanism, the plane of the section being indicated by the lines 9—9 on Figs. 1, 3 and 4; Fig. 10 is a fragmentary perspective view and illustrates a portion of the paper carriage together with portions of its supporting and actuating mechanisms; Fig. 11 is a transverse vertical section, as indicated by the offset line 11—11 on Fig. 1; Fig. 12 is a sectional detail, the plane of which is indicated by the line 12—12 on Fig. 11; Fig. 13 is a sectional detail on an enlarged scale, illustrating a ratchet mechanism for controlling

the progress of a paper carriage and justification chart, the plane of the section being substantially indicated by the offset line 13—13 on Fig. 2; Fig. 14 is a sectional detail, similar to Fig. 13 but illustrating certain of the parts in different operating positions; Fig. 15 is a view similar to Figs. 13 and 14 illustrating another position of the parts, certain parts being omitted to more clearly illustrate a ratchet release mechanism; Fig. 16 is a sectional detail illustrating a space key lever mechanism, the parts of which are shown in the same position as in Fig. 5, the plane of the section being substantially indicated by the line 16—16 on Fig. 3; Fig. 17 is a sectional detail similar to Fig. 16 illustrating certain of the parts in different positions, the plane of the section being substantially indicated by the lines 17—17 on Fig. 3; Fig. 18 is a view similar to Fig. 16 certain parts having been broken away and others shown in different operating positions; Fig. 19 is a sectional detail of a ribbon spool mechanism, the plane of the section being indicated by the line 19—19 on Fig. 2; Fig. 20 is a sectional detail as indicated by the lines 20—20 on Fig. 19; Figs. 21 and 22 are sectional details of portions of a mechanism controlling the left hand margin of the work sheet, the planes of the sections being indicated by the correspondingly numbered lines on Fig. 4; Fig. 23 is a sectional detail of a mechanism for adjusting the travel of the paper carriage to thereby control the printing pressure, the plane of the section being indicated by the lines 23—23 on Fig. 5; Fig. 24 is an enlarged sectional detail through a portion of a mechanism for moving the paper carriage to cause an impression to be made, the plane of the section being indicated by the lines 24—24 on Fig. 2; Fig. 25 is a diagrammatic illustration of a justification chart; Fig. 26 is an electrical diagram illustrating an electrical circuit for the machine.

Referring now to the drawings, and particularly to Fig. 1, it will be seen that my improved keyboard controlled printing machine comprises a frame 10 which supports a paper carriage 11. The paper carriage is progressed across the frame from right to left by a suitable feeding mechanism, and is arranged to carry a platen 12 and a work sheet W so that the latter may be line spaced. A series of type wheels 14 are mounted on the frame 10, for rotation as a unit about a vertical axis. Each type wheel 14 carries an entire font of type. One wheel, for instance, may carry 6-point type, another 8-point type, another 10-point type, etc. The wheels are arranged to be selectively positioned, relative to the platen 12, to enable use of the desired font of type. A keyboard 15 controls the rotation of the type wheels so as to bring the desired type of a selected font into printing position. The keyboard 15 also controls a mechanism which causes the paper carriage 11 to move bodily toward the type wheel 14 to cause an impression to be made of the selected character or type.

Following the impression of a character on the work sheet, the paper carriage 11 is moved from right to left a distance which is determined by the width of the character last impressed. The total number of spaces between the words of a printed line, and the total distance the work sheet is advanced, controls the relative positions of a justifying scale 16 carried by a drum 17 and an indicator or pointer 18. The drum 17 and indicator 18 are mounted at the right hand side of the machine in front of the paper carriage.

To facilitate the operation of the mechanism, a copyholder, generally indicated at 19, is positioned between the keyboard 15 and the type wheels 14. This copyholder may comprise coacting rollers 20 and 21 between which a sheet to be copied is placed. It also may include a suitable copy support or guide 22. The arrangement is such that the operator may rotate the roll 20 by means of knobs 29 to bring the desired line of the copy into position where it is readily visible by the operator.

In making the initial impression, the operator first determines the length of the lines to be printed and sets an indicator 25 on an em scale 26 to indicate such length in ems. This scale is automatically advanced as the line is typed, and a signal, such as the ringing of a bell, is given to the operator as will be hereinafter more fully described. This signal is arranged to inform the operator when a point a fixed distance from the end of the desired length of line has been reached. In the machine illustrated, the signal is given four ems before the line limit is reached. This distance is generally sufficient for the impression of five to six letter characters without over-running the end of the line and therefore gives the operator opportunity to determine how much more may be typed without overrunning the line.

During the first typing or printing of the copy, the operator uses a space bar 23 of the keyboard 15 to cause the paper carriage to be advanced for word spacing. Each time this space bar is actuated it causes the carriage to be advanced a predetermined distance, which, in the construction illustrated, is four units. Each time a character key 28 is actuated, the carriage 11 is advanced a number of units equivalent to the width of the type selected by the actuation of such key.

The keyboard 15 is also provided with a plurality of justifying space keys 24 each of which, when actuated, causes the carriage to be advanced a different number of units. In the form illustrated the keys are arranged to advance the carriage any desired number of units from five to eighteen inclusive.

The operator, during the initial typing, causes the typed line to approach the desired length as nearly as possible and then reads the scale 16. At this time the indicator 18 is opposite indicia on the scale 16 which will indicate which space key or keys 24, if used instead of the space bar 23, in retyping for word spacing, will cause the typed line to be justified or extended to a length equal to the length of line desired for the finished copy. This designation is then typed at the end of the line.

Following the typing of the justification indicia at the end of a typed line the operator depresses a release key 27. The depression of this key causes the paper carriage 11 to be returned to its right hand or starting position; advances the work sheet on the carriage 11 to position it to receive the next line to be printed, causes the em scale 26 to return to its zero or starting position, and causes the justifying scale 16 and indicator 18 to return to their starting positions. Thus the machine is made ready for the typing of the next line.

After all lines of a page have been typed or printed, the initial copy is removed from the carriage 11 and placed in the copyholder 19, and the sheet is then retyped. During this retyping the words are spaced by the keys 24 designated by the indicia at the end of the respective lines. The retyped page is thus justified and simulates a letter press impression.

The work sheet or paper carriage 11 and the platen 12 are best illustrated in Figs. 1, 3, 4, 5, 6, 8 and 9. As there illustrated, the paper carriage 11 comprises a pair of end plates 30 and 31, spaced apart by cross frame members, such as rods 32 and bars 385 and 34, all of which are secured at their ends to the end plates. The frame member or bar 34 is positioned at the front of the carriage and is provided with a longitudinally extending, forwardly facing groove in which a plastic bar, which comprises the platen 12, is fixedly seated.

Mounted above the platen 12 are a pair of coacting work sheet guide rollers 35, while a similar set of rollers 36 are mounted below the platen. A work sheet is passed between and gripped by the pairs of rollers 35 and 36 and held tightly against the platen thereby. Suitable plate-like guide members 37 are provided to guide the work sheet and prevent undesired contact between it and various parts of the mechanism.

As indicated in the drawings, the work sheet may be fed upwardly for line spacing by rotating one of the rollers 35 which is provided with a knob 38 (Fig. 1).

The work sheet may be advanced by a ratchet mechanism shown in Figs. 4 and 6 and 8. This ratchet mechanism is similar to that used on typewriters and comprises a ratchet wheel 40 secured to a shaft 41 journaled in the carriage end plate 31. This ratchet wheel is advanced by a spring pressed pawl 42 (Fig. 8) pivotally mounted on a pawl carrier 43 which in turn is pivotally mounted on the shaft 41.

The stroke of the pawl carrier may be limited by a pin 44. A spring 53 is interposed between the pin and the pawl carrier 43 to normally swing the carrier to its idle position shown in Fig. 8.

The effective stroke of the pawl is determined by a cam 45 which engages a pin 46 on the pawl and spaces the pawl from the ratchet wheel 40 so long as the pin rides on the cam. Thus the swinging of the carrier through a complete stroke may advance the ratchet one, two, three or four teeth as desired. The cam 45 is manually settable and is normally retained in its set position by a spring pressed plunger 47 (Fig. 6) which engages any one of a series of notches formed in the cam face. The shaft 41 carrying the ratchet wheel 40 may be geared to the shaft of one of the rollers 35 by gearing, generally indicated in Fig. 4 at 49.

The work sheet is positioned lengthwise of the carriage by end guides 50 carried by supporting brackets 51 which in turn are mounted on a pair of rods 32 heretofore mentioned. At least the right hand guide 50 (Fig. 1) is adjustable lengthwise of the carriage and may be secured in an adjusted position by a set screw 52 (Fig. 4). The other end guide 50 may be permanently or adjustably positioned as desired, but when once accurately positioned, need not be changed.

The paper carriage 11 is mounted for movement from right to left (Fig. 1), transversely across the machine. As shown in the drawings, particularly in Figs. 1 to 6, the frame 10 of the machine is provide with a pair of upstanding side brackets 55 which have their bases rigidly connected to the frame 10 and which are connected adjacent their upper ends by a comparatively rigid reinforcing bar 56. This bar 56 extends between the brackets in substantially the same horizontal plane as the platen 12. Also mounted in substantially the same horizontal plane as the reinforcing bar 56 and the platen 12, are a pair of comparatively heavy rods 57 and 58. As indicated in Figs. 6, 9 and 10, the rod 57 is mounted in the frame standards 55 for rotation about a fixed axis relative thereto. The rod 58 is mounted or secured to guide blocks 59 which are slidably mounted in horizontally extending ways 60 formed in the brackets 55. Thus the rod 58 may be reciprocated toward and from the platen 12 in a substantially horizontal plane.

The paper carriage is mounted on the rods 57 and 58 for movement axially thereof. As indicated in Figs. 9 and 10 the carriage end plates 30 and 31 are slidable axially along the rod 58 which is journaled in such plates. Journaled on, and slidable axially of the rod 57, are a pair of blocks 61 which are mounted in ways 62 formed in respective carriage end members 30 and 31. Thus the carriage may move or reciprocate horizontally relative to the bar 57 the axis of which is fixed relative to the frame brackets 55. This reciprocation of the carriage is used to effect the printing operation as will hereinafter be described more fully.

The type wheels 14 are best shown in Figs. 1, 9 and 11. In the present embodiment I have illustrated two type wheels 14, each of which is mounted on a shaft 70 journaled in a frame bracket 71. Each type wheel carries on its periphery two annular sets or bands of type. The type in the top band 72 of each type wheel 14 comprise lower case type, whereas those in the bottom band 73 of each wheel comprise upper case type. The upper wheel 14 may carry, for instance, six point type and the lower wheel eight point type.

The type wheels are drivingly connected to the shaft 70. A collar 76 is clamped and pinned to the shaft 70, as at 77 and 78, and carries a pin or rod 75 which engages openings 74 in the wheels 14. The shaft 70 is restrained from axial movement by the collar 76 and a collar 80 which embrace the frame bracket 71. The type wheels are free for axial movement on both the shaft 70 and the pin 75. Thus either type wheel may be moved into printing position with the upper band of type thereof in the same horizontal plane as the platen 12.

When the machine is in operation the type wheels are continuously rotated, the rotation being stopped for the printing operation under the control of the keyboard 15 as will be hereinafter more fully described. The type wheels are normally rotated by a motor M (Fig. 30) which may be drivingly connected by a suitable V-shaped driving belt, not shown, with a drive pulley 82 best shown in Fig. 2. This pulley is rotatably mounted on a shaft 83 which extends transversely across the frame 10 being journaled in suitable bearings 84. A friction clutch 85 is interposed between the pulley 82 and the shaft 83. This clutch permits the rotation of the shaft to be stopped for the printing operation without stopping the rotation of the drive pulley 82. As such clutches are well known, no detailed description will be given. Secured to the shaft 83, intermediate its ends, is a gear 86 which meshes with a gear 87 drivingly secured to the type wheel shaft 70 as by a pin 88.

As heretofore mentioned, the type wheels 14 are mounted for axial movement on the shaft 70 to bring the upper case band 73 of type into printing position, that is, in horizontal alignment with the platen 12. This movement of

the type wheels is accomplished by a shift mechanism which forms the subject of my copending application, Serial No. 752,995. This mechanism is controlled by the keyboard 15, and particularly by a shift key 90, Figs. 1, 2, 6 and 7. As shown herein, the key 90 is pivotally mounted as at 91 on a plate 92 which is carried by a lever 93. This lever is secured to a shaft 94 which is journaled in frame members 95. A spring 96 normally retains the lever in an inactive position, shown in Fig. 7. When the key 90 is depressed by the operator, the lower end 97 of the plate 92 contacts a leaf-type switch 98 energizing an electric circuit which causes the energization of a solenoid 100.

The solenoid 100 is best illustrated in Figs. 6 and 11, and is arranged to actuate a lever 101 pivoted at 102 to a frame bracket or post 103. When the solenoid is energized, the yoked end 104 of the lever coacts with a collar 105 pinned to a vertically extending rod 109 raising the rod vertically. The rod 109 is mounted for axial movement in the frame 10 and the frame bracket 71.

Axial movement of the rod 109 is imparted to the type wheels 14 by a carriage 106. This carriage comprises an upper member 63 and a lower member 64 which are normally secured together as a unit by a set screw 107. The carriage 106 is positioned vertically on the shaft 109 by a manually operable latch 110 pivoted as at 111 to the upper carriage member 63 and arranged to selectively engage vertically spaced grooves 112 or 113 in the rod 109. When the latch is in the lower recess 113, as shown in Fig. 11, the upper type wheel 14 is in printing position and when the latch is in the groove 112 the lower type wheel is in printing position. Rotary movement of the carriage 106 is prevented by a pin 114 carried by the bracket 71 and having a sliding engagement with the carriage.

The raising of the rod 109 by the solenoid 100 raises the carriage 106 a distance sufficient to bring the upper case band of type 73 into alignment with the platen 12. The carriage is connected to the type wheels 14 by two pairs of rollers. One pair of rollers 115 is carried by arms 116 of the upper carriage member 63 and engages the upper surface of the top type wheel 14. The other set of rollers 117 is carried by arms 108 of the carriage member 64 and engages the bottom surface of the lower type wheel 14. The type wheels 14 are gripped between the two sets of rollers 115 and 117 and accurate alignment of the printing impressions is possible.

To ease the load on the solenoid 100, I encircle the rod 109 with a spring 118. This spring is interposed between the frame 10 and a collar 119 and serves to counterbalance a portion of the weight of the carriage 106 and the type wheels 14. The carriage and type wheels, however, have sufficient weight to insure their return under the influence of gravity to normal position, shown in Fig. 11. The lower position of the type wheels is limited by a collar 120, which is shown in Fig. 11 as being pinned to the rod 109, while the uppermost position is limited by the collar 105 likewise pinned to the rod 109. These collars are arranged to engage respective faces of the frame bracket 71 heretofore described.

The shift mechanism for moving the type wheels to their upper case positions may be latched to retain the wheels in such position. To accomplish this the operator depresses a key 122 (Fig. 7) instead of the key 90. This key is

mounted on the plate 92 (Fig. 7) and is arranged so that when depressed it will cause the plate to swing in a counterclockwise direction against the action of a spring 125 which is interposed between the lever 93 and the plate 92. Thus when the key 122 is depressed, a cam 126 will engage a locking notch 127 formed in the plate 92 and is retained in such position by the spring 125 until the key 90 is depressed. The depression of the key 90 swings the plate 92 in a clockwise direction, thus moving the notch 127 out of engagement with the cam 126, permitting the spring 96 to return the key levers to their normal position and opening the switch 98 and the circuit to the solenoid 100. The shift to upper case type may also be made by depressing a key 120 (Fig. 3) at the right hand side of the keyboard 13. This key 120 is connected with a lever 121 which is secured to the shaft 94 heretofore described.

The depression of a letter key 28 stops the rotation of the type wheels 14 with the selected type in printing position, while the depression of the space bar 23 or a space key 24 stops the type wheel 14 with a portion thereof either having no characters or having quads in printing position. The mechanism for accomplishing this is best shown in Figs. 2, 3, 6 and 8. As shown, in Fig. 8, each key 28 or 24, as well as the space bar 23, is secured to a respective key lever 135. These levers are pivoted to a stationary shaft 136.

The key levers 135 are normally held in their uppermost position, against a stop bar 137 carried by the frame members or posts 95 heretofore mentioned, by individual springs 138. Each key lever 135 carries a pin 140 which is normally in latching engagement with a notch 141 formed in the end of respective levers 142. The levers 142 are pivoted to a stationary rod 143 extending across the frame 10, and are normally retained in the position shown in Fig. 8 by individual springs 144 which are interposed between the respective levers 142 and a frame bar 145.

When the operator depresses a key 28, 24, or the bar 23, the respective key lever 135 is rocked clockwise against the action of its spring 138 to a position where its pin 140 is withdrawn from the notch 141 in the respective lever 142, whereupon a spring 144 rocks such lever 142 clockwise about its pivot shaft 143, causing a lug 146 on the end of such lever to engage a notch 147 in a disc 148. There are a plurality of such discs one for each lever 142. The discs 148 are keyed to the main drive shaft 83 so that their notches 147 are spaced circumferentially one from the other. Thus each disc will stop the rotation of the shaft 83 and accordingly the type wheel 14 in a different circumferential position. Accordingly, any selected character on the type wheel may be brought into printing position relative to the platen 12.

The depression of a key 23, 24 or 28 also causes the carriage 11 to move bodily toward the type wheels 14 to cause an impression to be made on the work sheet W. As shown in Figs. 2, 3, 6 and 8, the rocking of a lever 142, as a result of the depression of a key, causes such lever to engage a bail 150 the ends of which are pivoted in the bearing members 84 heretofore described. The movement of the bail 150 controls a single revolution clutch generally indicated at 152 in Figs. 2 and 6. The driving member 157 of this clutch is secured to a cam shaft 153 mounted on the frame 10 in bearings 154. The driven member 155 of the clutch 152 is rotatably mounted on the shaft 153 and is drivingly connected by gearing

156 with the constantly rotating drive pulley 82 heretofore described. The single rotation clutch may be of any well known make, and hence is not described herein in detail. Suffice it to say that the shaft 153 will rotate consequent upon the withdrawing of a latch 158 from a notch 159 in a clutch control member 151 (Fig. 2) whereupon the shaft 153 will make one complete revolution following which the latch 158 will again engage the notch 159 and disengage the driving connection.

The latch 158 of the single revolution clutch 152 is in the form of a bell crank and is pivoted intermediate its ends as at 160 to a suitable frame bracket. The latch 158 carries a pin 161 engaged by a slot 162 in a lever 163 which, as indicated in Fig. 6, is secured to the bail 150. A spring 164, interposed between the latch 158 and the frame 10, serves to restore the latch 158, the bail 150 and their associated parts to their normal position as shown in Fig. 6. The action of the spring 164 is such that it may be readily overcome by the action of any of the springs 144 heretofore described.

The movement of the shaft 153 locks the type wheels 14 with the selected character in printing position prior to the making of an impression therefrom. As shown in Figs. 3, 5 and 9, a cam 170 is secured to the shaft 153 and is arranged to coact with a roller 171 carried by one end of a link 172, the other end of which is pivotally connected at 173 with a lever 174. The lever 174 is secured to a shaft 175 journaled in suitable bearings 176 carried by the frame, and carries a lever 177 which actuates a bolt 178 slidably mounted in a guideway 179 carried by the frame 10. As the cam 170 rotates, a spring 169 interconnected between the bolt and the guide 179 brings a V-shaped nose 180 of the bolt into locking engagement with one of a plurality of notches 181 in a disc 182 which is secured as by a pin 183 to the lower end of the type wheel shaft 70. Following the making of the impression, hereinafter to be described, continued rotation of the cam 170 actuates the bolt 178 moving it against the action of the spring 169 and disengaging it from the disc 182.

Continued movement of the cam shaft 153, following the locking of the type wheels 14, causes the carriage 11, together with the work sheet carried thereby, to move bodily against the type wheel 14, thus making an impression through a ribbon 220, hereinafter to be described, on the work sheet W of the selected type. As illustrated in Figs. 3 and 5, a cam disc 190 is secured to the right hand end of the shaft 153. This disc has a cam groove 191 arranged to be engaged by a roller 192 carried by a link 193. The link is in turn pivotally connected, as at 189, with a lever 194 which is secured as by a pin 195 to the shaft or rod 57 heretofore described as being one of the rods which supports the paper carriage 11.

Interconnected between the rod 57 and the other paper carriage supporting rod 58 are a plurality of toggles 196. Each toggle, Fig. 24, comprises a link 197 which is pinned as by a pin 198 to the rod 57, and a second link 199 pivotally connected to the first link by a pivot pin 200, and to the rod 58 as at 201. As shown in Figs. 1, 2 and 3, there are three such toggles, one at each end of the rods 57 and 58 adjacent the frame brackets 55, and one in substantially the longitudinal center of such bars, the latter toggle being substantially in alignment with the axis of the type wheels 14. The rod 57 being permanently secured to the frame members 55, a clockwise movement (Fig. 24) of the rod 55 causes the toggles to straighten, forcing the rod 58 and accordingly the carriage 11 toward the type wheels 14 to cause an impression to be made.

The arrangement is such that the impression may be made by a relatively sharp blow without danger of springing the various parts of the carriage or the frame. To accomplish this the force of the blow is transmitted to the frame brackets 55 through the reinforcing bar 56. As heretofore mentioned, one of the toggles, such as that illustrated in Fig. 3, is in alignment with the axis of the printing wheel 14. The movement of the rod 58 is transmitted directly to the frame bar 34 which, opposite the point of the impression, engages the enlarged head 203 of a pin 202 carried by the bar 58. The force of the blow is therefore transmitted through this pin and the central toggle 196 to the rod 57. Closely adjacent the central toggle 196 and journaled on the rod 57 is a collar 205. This collar is provided with a socket 206 into which a head 207 of a threaded stud 208 extends. This stud is carried by the reinforcing bar 56 and by reason of its threaded engagement therewith is adjustable so that the parts may be placed under tension to avoid the springing of the bars 57 and 58 under the impact of the printing blow.

The extent of movement of the rod 57 and accordingly that of the toggles 196 is adjustable to control the printing pressure. As shown in Figs. 5 and 23, the pivot 189 between the link 193 and the lever 194, is provided with an eccentric portion 210 which engages the link. The position of this eccentric is controlled by a disc 211 secured thereto as, for instance, by a stud 212. The disc 211 may be manually placed in any one of a plurality of positions, thus changing the position of the eccentric 210. The disc 211 is held in its adjusted position by a latch 213 pivoted as at 214 to the lever 194 and provided with an ear 215 which is normally urged into engagement with any one of a plurality of recesses 216 formed in the disc 211 by a spring pressed plunger 217 carried by the lever 194.

As heretofore mentioned, the impression is made through an inked ribbon 220. This ribbon may comprise an elongated strip of cellophane or similar material having a suitable ink composition on one side thereof, and is so arranged as to be used only once. As shown in Figs. 1, 2, 3 and 5, a supply of the ribbon 220 is wound about a ribbon spool 221 rotatably mounted on a pin 222 carried by a frame member 223. The ribbon passes from the spool 221 to a suitable sheet metal guide 219 interposed between the platen 12 and the type wheels 14, and thence to the bite of a pair of rolls 224 and 225. The roll 225 is rotatably mounted on the frame bracket 71, while the roll 224 is rotatably mounted on a lever 226 pivotally mounted as at 227 to such bracket and normally urged into contact with the roller 225 by a spring 228 (Fig. 2). From the rolls 224 and 225 the ribbon may extend across the cover 230 of the machine. The roller 225 is rotated to progress the ribbon as will be hereinafter more fully described.

The ribbon guide 219 may be made of spring metal and may be similar to those ordinarily found in typewriters. It serves to space the ribbon from the normally rotating type wheels and from the work sheet. However, as the paper carriage 11 is brought forward to cause the im-

pression to be made, a portion of the carriage, such as for instance a roll 229, carried by one of the frame bars or rods 32 of the carriage, engages the ribbon shield 219 urging the ribbon 220 into contact with the type wheel 14 prior to the engagement between the work sheet W and the ribbon, and maintaining such engagement until after the work sheet has moved clear of the ribbon with the return movement of the carriage. The ribbon spool 221 may be tensioned in any suitable manner not shown.

The rotation of the cam shaft 153 automatically restores the depressed key lever 135 to its normal position in latching engagement with its respective lever 142. As shown in Fig. 8, the central portion of the shaft 153 is in the form of an elongated cam which, after the impression has been made, engages the lever 142 which was swung clockwise by its spring 144 following the depression of the corresponding key. The cam thus moves the lever 142 against the action of its spring 144 to the position shown in Fig. 8. As the lever 142 returns to its normal position a cam portion 235 on the right hand end of the lever engages a pin 140 and rocks the associated lever 135 a distance sufficient to permit the spring 138 to cause the pin to reengage the notch 141 in the lever 142, thus latching the levers together.

The rotation of the shaft 153 also progresses the paper carriage 11 and the inking ribbon 220, the movement of both being under control of a ratchet mechanism shown in Figs. 2, 6, 13, 14 and 15. The ratchet mechanism is arranged to cause the paper carriage 11, as well as the ribbon 220, to be advanced a distance commensurate with the width of the type from which the last impression was made. This type of advancement of the carriage produces a copy which simulates letter press work, while the advancement of the ribbon in this manner prolongs the life of the ribbon.

The distance the paper carriage 11 and ribbon 220 are to be advanced is under direct control of a notched disc 240 (Figs. 11 and 12). As shown in the drawings, there are two such discs 240 secured to a common hub 241. These discs are mounted for vertical movement on the lower end of the type wheel shaft 70. The discs are driven by a pin 242 carried by the disc 182 and which engages suitable recesses in the hub 241. Each of these discs 240 contains a number of peripherally spaced notches 243, the position and depth of which vary according to position and width of corresponding type in the type wheels 14. As the shaft 70 is rotated to bring a specific type character or space quad into printing position, the notch 243 corresponding to such character or space quad is brought into alignment with a spur 245 carried by a plunger or justifying bar 246 mounted for reciprocation in suitable brackets 247 formed on the under side of the frame 10. This plunger is normally held in a retracted position against an adjustable stop 244 (Figs. 6 and 13) by a spring 248 interconnected between a pin 249 carried by the plunger and a pin 250 carried by a relatively stationary member.

The rotation of the shaft 153 during the making of the impression releases a mechanism which causes the bar 246 to be urged forward yieldingly until the end 245 thereof seats in the notch 243 of the disc 240 which at that time is aligned therewith. As shown in Fig. 13, a cam 260 is pinned to the shaft 153. While the impression is being made the shaft 153 moves this cam out of contact with a roller 261 carried by a link 262, whereupon a spring 263 draws the link to the left (Fig. 13). This spring is interconnected between the link 262 as at 264, and a pin 265 carried by the frame 10.

As the link 262 moves to the left, under impulse of the spring 263, the end of a slot 259 in the link 262 engages a pin 267 carried by a pawl carrier 268 which is pivotally mounted on a shaft 269 journaled in suitable bearings 270 (Figs. 2 and 3) carried by the frame 10 and swings the carrier from the position shown in Fig. 13 to the position shown in Fig. 14. The pawl carrier 268 is connected by an elongated segment 271 (Figs. 2 and 13), with a segmental gear 273 journaled on the shaft 269, and the teeth of which engage a rack-like formation 274 on the left hand end of the justifying bar 246. It is thus obvious that the depth of the notch controls the amount of movement of the justifying bar 246 as well as the extent of movement of the pawl carrier 268.

The pawl carrier 268 advances a pair of ratchet wheels 278 and 279. As shown in Figs. 13, 14 and 15, the pawl carrier 268 carries two pawls, namely, the pawls 275 and 276. The pawl 275 normally engages the ratchet wheel 278 which is drivingly secured to the shaft 269. This pawl prevents rebound of the ratchet wheels by preventing counterclockwise movement thereof. The pawl 276 normally engages a ratchet wheel 279, which is secured to the ratchet wheel 278. The pawl 276, consequent upon the completion of the rotation of the shaft 153, engages the ratchet wheel 279 and advances the ratchet wheels a distance commensurate with the depth of the notch 243 which was engaged by the bar 246. The ratchet wheels 278 and 279 are preferably of the same diameter and are provided with an identical number of teeth, each tooth representing one unit of type width.

For clearness of illustration the two ratchet wheels 278 and 279 are shown in Figs. 13, 14 and 15 as having different diameters. The pawls 275 and 276 are secured to respective pins 280 which are journaled in the pawl carrier 268, and each of which is provided with a lever 281. These levers are connected by respective springs 282 with a pin 283 carried by the pawl carrier 268 to thereby normally retain the pawls in engagement with their respective ratchet wheels. As the link 262 moves in a left hand direction (Figs. 13 to 15), it has no immediate effect on the pawl carrier 268, but instead the end 258 of the link engages a pin 257 carried by the lever 281 of the pawl 275 and rocks the pawl 275 out of engagement with its ratchet wheel 278. Following the release of the pawl 275, the link 262 picks up the pawl carrier, by reason of the pin and slot connection 267, 259 with the pawl carrier heretofore described. During the movement of the pawl carrier, under the influence of the spring 263, a detent pawl 285 pivotally mounted on a shaft 286 journaled in frame brackets 287 (Fig. 2) prevents counterclockwise movement of the ratchet wheels. This pawl is normally drawn into engagement with the ratchet wheel 279 by a spring 288 interconnected between an arm of the pawl and a pin which is secured to the frame 10.

As heretofore mentioned, the pawl 275 acts to prevent overthrow of the ratchet wheels 178 and 179. As the link 262 moves to the right (Fig. 14) under the impulse of the cam 260, it first moves

out of engagement with the pin 257 thereby permitting the spring 282 to draw the pawl 275 into contact with the ratchet wheel 278. Thus any counterclockwise movement or rebound of the ratchet wheels is prevented.

As heretofore mentioned, two notched discs 240 are provided. The top disc (Fig. 11) is used for the lower case bands 72 of type, while the bottom disc is used for the upper case bands 73 of type. The arrangement is such that when the type wheels are raised so that the bottom band of type 73 of a type wheel is brought into printing position, the bottom disc 240 will be brought into alignment with the plunger 246. As shown in Figs. 11 and 12, a yoke 290 is pivotally connected, as at 291, with an arm 292. This arm is secured to the rod 109 which controls the movement of the type wheels 14 to present upper or lower case characters to printing position as desired. The yoke 290 is provided with a pair of rollers 293 which engage the under surface of the uppermost disc 240. Accordingly, the discs 240 are raised simultaneously with the raising of the type wheels 14. Such raising movement raises the uppermost or lower case disc 240 out of the path of the plunger 246, and moves the lowermost wheel 240 into position to be engaged by such plunger.

The arcuate movement of the shaft 269 is transmitted to the carriage 11 and the ribbon feed roller 225 to advance them a distance equivalent to the width of the type character last impressed. The mechanism for transmitting this movement is best illustrated in Figs. 2, 4, 6, 8 and 14. As there shown, a beveled gear 300 is drivingly secured to the shaft 269 and meshes with a beveled gear 301 drivingly secured to a stub shaft 302 (Fig. 8). This stub shaft is journaled in a bearing 303 carried by the frame 10 and is drivingly secured to a sleeve 304. Drivingly connected to this sleeve as, for instance, by a spline is a coaxial slidable shaft 305. This shaft is journaled in bearings 306 and is connected as, for instance, by gearing generally indicated at 307 with a countershaft 308 which carries a pinion 309 meshing with a rack 310 carried by the paper carriage 11. Thus the movement of the shaft actuates the paper carriage.

The ribbon feed roller 225 (Figs. 19 and 20) is rotatably mounted on a shaft 315 which is journaled in the frame member 71 heretofore described. Drivingly secured to this shaft is one member 316 of a one-way clutch, the other member of which is integral with the roller 225. The arrangement is such that rotation of the member 316 in the direction of the arrow of Fig. 20 causes a similar rotation to be imparted to the ribbon feed roller whereas a reversal of the direction of rotation of the member 316 will have no effect upon the roller 225. The driving connection to the shaft 315 comprises a flexible drive shaft 320 which, as indicated in Fig. 6, is interconnected between the lower end of the ribbon spool shaft 315 and the shaft 308.

The rotation of the shaft 269 also controls the movement of the em scale 26 and the justification chart or scale 16. The em scale is best shown in Figs. 1, 2 and 6, and comprises a disc 266 which is secured to a vertically extending shaft 325 suitably journaled in bearings 324 carried by the frame 10. The shaft 325 is provided with a worm gear 326 which is driven by a worm 327 indicated by dotted lines on Fig. 6, and which in turn is drivingly secured to the shaft 269. Thus the em scale 26 is rotated a definite amount depending upon the rotary movement of the shaft 269.

The indicator 25 for the em scale 26 is rotatably mounted on the shaft 325 and carries a pointer 322 at one end and a spring pressed plunger 323 at the other end. This plunger may be raised out of contact with the disc 266 and set in any one of a plurality of openings 321 in the disc as will be hereinafter more fully described. Suffice it to say at this time that when the plunger 323 is in a position similar to that shown in Fig. 6, the lowermost end 319 of the plunger projects below the bottom of the disc in position to engage a pin 330 carried by a bell-ringing mechanism generally indicated at 331 and which is arranged to give a signal by striking a bell 332. Inasmuch as this mechanism is similar to that commonly used on typewriting machines, no specific description will be given herein.

As heretofore mentioned, the justification chart 16 is carried by a drum 17. This drum is rotated or actuated by the rotation of the shaft 269. As illustrated in Figs. 3, 5 and 8, the right hand end of the shaft 269 is provided with a beveled gear 335 which meshes with a beveled pinion 336 drivingly secured to a shaft 337. The shaft 337 is journaled in bearings 338 carried by a frame bracket 339 and has secured to its upper end a disc 340. This disc is provided with a pin 341 which is arranged to selectively engage any one of four openings 342 (Fig. 1) in the upper end of the drum 17. This drum is slidably and rotatably mounted on the shaft 337 and is normally held in engagement with the pin 341 by a spring 343 encircling the shaft intermediate the upper bearing 338 and the lower end of the drum. The chart 16, hereinafter to be more fully explained, is wrapped about the circumference of this drum.

It has now been explained how the paper carriage 11, the feed for the ribbon 220, as well as the feed for the justifying scale 16 and the em scale 26 are all actuated by the movement of the shaft 269 which is controlled by the depth of the notches in the wheel 240. The system used for determining the depth of these notches and the particular arrangement of the scales will now be explained.

The width of each type used on the type wheel bears a fixed relation to each other type used on the wheel. This width is commonly called the "set size." In designing the type the width of the basic character of the font, usually the upper case letter "M" is divided into eighteen equal parts and using one of these parts as a unit of measurement, the widths of all of the remaining characters of the font are determined. For example, the cap "M" is preferably three times as wide as the lower case letter "j," and twice as wide as the lower case letter "a," and since the upper case letter "M" is divided into eighteen units, the lower case letter "j" comprises six units, while the lower case letter "a" will be nine units wide. Other letters will vary accordingly in width, and the smallest letter, such as a period, may be four units wide. Therefore, the depth of the notches in the wheels 240 for the various characters will vary accordingly in depth as the type vary in width, and, as heretofore explained, the depth of these notches controls the advance of the paper carriage.

The desired length of the lines to be printed, which will be called the justified or page lines, is also divided into units of the same width as the type units, the total number of units of such

lines determining their length. As the keys 23, 24, 28 are depressed and a line printed, the justifying chart keeps count of the number of units or difference between the printed page or set line and a justified page or line. The em scale 25 indicates to the operator, by ringing the bell 332, that the set line has reached a distance, four ems (seventy two units) from the end of the page line. When the end of the set line has been reached, it will either be the same length as the page line or some unit short thereof. If it is short, it is justified when retyped by using the keys 24; in other words, by increasing the number of units in the spaces between the words of the lines so that the line will completely fill the space allotted to a justified or page line. The chart 16 indicates to the operator in what manner the line is to be retyped so that it will make a page length line. In other words, this chart indicates to the operator which justifying space key 24 must be used when retyping the line to produce a page line. These justifying keys are arranged so that they will space the words any desired number of units from five to eighteen.

When the operator reaches the end of a set line, it is obvious that, if there are eight spaces in such line and the space key 23 advances the paper carriage 11 four units each time it is struck, a total of thirty-two units will have been used for the spaces. Likewise, if the printed line lacks eight units of being a justified or page line, it follows that if the spaces had been five units in width instead of four units as fixed by the operation of the space bar 23, the allotted space for the page or justified line would have been filled. It follows, therefore, that upon retyping, a justifying space key advancing the paper carriage five units each time it is struck, will produce a justified or page line.

The em scale 26, as heretofore mentioned, is provided with a settable plunger 323 so that the operator may set the pointer or indicator so that it will ring the bell 332 (Fig. 6) four ems or seventy-two units before the end of the page or justified line is reached. This scale is divided into seventy-two equal portions, each portion being equal to one em or eighteen units, seventy-two ems being the maximum length of the page line which the present embodiment will conveniently print. Each of these spaces is provided with a numerical index and with an opening 328 for the spring pressed plunger 323. Accordingly, if this scale is set at its starting or zero position and the indicator 25 set for a line thirty-two ems long, the bell will ring when the line is twenty-eight ems long. The operator then must type not more than four ems.

When the operator completes the set line, he looks at the justifying scale 16 and types at the end of the line the figures enclosed by pointer or indicator 18. If such figure is "5" he types the numeral "5," or if the figures

"6"
2

appear he types "6—2" at the end of the set line. When retyping to produce the justified or finished copy the operator looks at the end of the set line and if he sees the figure "5" he will strike the justifying space key 24, indicated by the index "5" instead of the space key 23. If he sees the figures "6—2" at the end of the set line he will, in making his justified copy, strike the space key 24, indicated by the index "6" for the space between the first two words and the space key 24 indicated by the index "7" for the remaining words, the first numeral representing the first space key to be used and the second representing the number of times it is to be used, after which the space key 24 of one unit higher than that indicated by the first figure is used for the remaining spaces.

The chart 16 is best shown in Fig. 29. On inspection of this figure it will be noted that there are seventy-one vertical rows 437 of indicia on the chart, each row of indicia representing one unit. While the average line is considerably longer than seventy-one units, I nevertheless find that if the line is more than seventy-one units short of completing a page or justified line, the set line may be lengthened by the addition of another word or words so that in practice there is seldom, if ever, more than seventy-one units which must be provided to justify a set line in order that a page line be completed. It will also be noted that there are twenty horizontal rows 438 of indicia on the chart. This arrangement provides for twenty spaces.

The chart 16 begins to rotate as soon as the first key is struck to begin a line. Accordingly, when the signal is given indicating that the operator has reached a point seventy-two units or four ems from the end of the page or justified line, it is important that the indicator 18 be aligned with the zero column on the chart. It is evident that if the em scale 26 is set for any multiple of four ems and the chart 16 is rotated one complete revolution for each four ems, the zero point on the chart will be in alignment with the indicator 18. However, if the em scale were set for a line thirty-three ems long, the bell would ring at twenty-nine ems. The scale 16 would then be one quarter of a revolution beyond zero. Accordingly, if the operator sets the indicator 25 for any number of ems other than a multiple of four, the scale 16 must be rotated prior to the starting of the line to compensate for this difference. In such case, the scale 16 is pressed down against the action of the spring 343 and the pin 341 seated in an opening 342 in the drum 17 indicated by a numeral which, added to the number of ems at which the indicator is set, gives a sum divisible by four. For example, if the em scale is set for a line thirty-three ems long, the bell 332 will ring at twenty-nine ems, and if the pin 341 is seated in the opening 342 indicated by the numeral (3), the em scale will be at zero when the signal or bell 332 is struck. If the em scale were set for thirty-four ems, the pin would be set in the opening 342 marked (2), and for thirty-five ems in the opening 342 marked (1).

As heretofore mentioned, each time a space key 23 or 24 is struck, the pointer 18 is raised one line on the justifying scale 16. The mechanism for accomplishing this is best shown in Figs. 3, 5, 16, 17 and 18. As there shown, each space key 23 or 24 is mounted on a lever 345 similar to the key levers 135 heretofore described in connection with the letter keys 28. Each lever 345 has a latching connection 346 with a lever 347 which is similar to and performs substantially the same function as the levers 142 heretofore described. This latching connection 346 is released and restored the same as heretofore described in connection with the levers 135 and 142. However, each of the levers 347 is provided with an enlarged opening 350 (Fig. 17). The opening 350 in respective letters 345 are aligned one with the other and are arranged to receive a rod 351 which is

secured to a lever 352 pivoted intermediate its ends to the rod 143 heretofore described.

When any one of the keys 23 or 24 is struck, a spring 144 in rocking that respective lever 347 counterclockwise (Fig. 17) to position the type wheel 14 and release the clutch 152 to cause the shaft 153 to make one revolution, also causes the lever 347 to engage the pin 351 and rock the lever 352 counterclockwise, around its pivot shaft 143, against the action of a spring 349, moving such lever from the position shown in Fig. 16 to the position shown in Fig. 18. This lever may comprise two members 363 and 364 joined by the rod 351 as shown in Fig. 2. However, for illustrative purposes it has been shown as one lever in Figs. 16, 17 and 18. The lever 352 carries on its outermost end a pawl 353 which a spring 348 normally retains in contact with ratchet teeth 354 formed on the face of a bar 355, the upper end of which carries the indicator 18 (Figs. 3 and 5). The indicator bar 355 is slidably mounted in guideways 360 on the frame bracket 339. A detent pawl 356, carried by the frame bracket 339 and normally held in engagement with the ratchet teeth 354 by a spring 357, prevents the lowering of the bar 355 during the retraction of the pawl 353 by the counterclockwise movement of the lever 352. When the cam shaft 153, the rotation of which was initiated through the action of a lever 347 on the bail 150, as heretofore described in connection with the levers 142, engages a surface 358 on the lever 352, the lever will be swung clockwise and the indicator 18, which is mounted on the bar 355, will be advanced a distance of one tooth or an amount equivalent to advance it one horizontal line on the chart 16.

The indicator bar 355, in addition to the pointer or indicator 18, carries a second pointer 361 (Fig. 1). This pointer coacts with a scale 362 carried by the cover 230 in the machine, and indicates to the operator the total number of spaces struck.

The release key 27 which, as heretofore mentioned, returns the em scale 26 and chart 16 to a zero or starting position, and the carriage 11 to its starting position, is best shown in Figs. 2, 3, 5, 6, 13 and 13 to 18 inclusive. As shown in Fig. 6, the release key 27 is mounted on a key lever 370 which is fixed to the shaft 286 journaled in bearings 287. Also fixed to the shaft 286 is a bar 373 which normally lies in the position shown in Figs. 6, 13 and 14. When, however, the key 27 is depressed, as indicated in Fig. 15, the bar 373 moves counterclockwise from the position shown in Fig. 13 to the position shown in Fig. 15. As the bar moves to the position shown in Fig. 15, it engages a pin 375 carried by the detent pawl 285 for the ratchet wheel 279 heretofore described, moving this detent out of coaction with the ratchet wheel. At the same time the outermost end 374 of this bar 373 engages a pin 376 on the pawl 276 raising it out of engagement with the ratchet wheel 279, whereupon a spring 380 (Fig. 4) returns the ratchet wheels and the shaft 269 to their original or starting positions. The spring 380 is mounted in a housing 381 secured to a frame bracket 55 and connected with a pin 383 carried by the rack 310 of the carriage 11 by a flexible connecting member 382. This spring acts to return the carriage to its original position (to the left in Fig. 4, or right in Figs. 1, 2 and 3). This movement of the carriage through the gearing 307, the shafts 305, 302 and 269, restores the ratchet wheels 278 and 279, the shaft 269, the em scale 26, the justifying scale 17 and the carriage 11, to their starting positions.

The depression of the release key 27 also restores the indicator 18 for the justification scale 16 to its normal or lowermost position. As illustrated in Fig. 18, the shaft 286, to which the release key lever 370 is secured, extends through the frame bracket 339. When the release key 27 is depressed the shaft 286 is rocked, and a pin 378 carried by a lever 377 mounted on the shaft engages the pawls 353 and 356 and moves them out of engagement with the teeth 354 of the indicator bar 355. This bar then drops into engagement with an adjustable stop 365 (Fig. 5) carried by a bracket 366 secured to the frame 10.

The starting position of the ratchet wheels 278, 279 and associated mechanisms may be adjusted to facilitate accurate positioning of the parts. As illustrated in Figs. 2 and 6 a lever 185 is secured to the shaft 325. When the parts return to their starting positions, this lever 185 engages a pin 186 carried by a lever 187 pivotally mounted on the frame 10 as at 188 and arranged to engage an adjustable stop 204 carried by the frame. As indicated in Fig. 2, this stop is in the nature of a cam or an eccentric and is secured to a threaded rod 209 passing through the frame 10. A nut 218 secures the rod 209 in its adjusted position.

The depression of the release key 27 also line spaces the work sheet W carried by the carriage 11. As shown in Fig. 6, one end of a cable 232 is secured to the lever 370. This cable passes from the lever 370 through a flexible sheath 233, one end of which is connected to the frame 10 in the usual manner as at 234 and the other end of which is connected to the carriage as at 236. The other end of the cable 232 is secured to a link 237 which has a pin and slot connection 238 with the pawl carrier 43 heretofore described in connection with the manual line spacing of the work sheet. This arrangement is such that the depression of the key lever 27 causes the pawl 42 to advance the ratchet wheel 40 and line space the work sheet as heretofore described.

When the shift is made from one type wheel to another, it follows that the paper carriage must be advanced a different distance for the twelve point type than it was for the eight, etc. However, it has been found desirable to make the characters of one font a definite ratio to the widths and the corresponding characters of the other fonts regardless of point size. Accordingly, I arrange my mechanism so that the same notched discs 240 will control the advance of the various mechanisms, including the paper carriage as heretofore described. This is accomplished through the gearing 307, heretofore mentioned.

As heretofore described, the shaft 305 is splined to the sleeve 304 so that it may be moved axially. This shaft has four positions, one position for six point type, one position for eight point type, one for ten point type and the other for twelve point type. A pointer 295 in the nature of a collar is attached to the shaft 305 as shown in Fig. 2, and coacts with a stationary indicator 296 to indicate to the operator the point size for which the machine is set.

The axial position of the shaft 305 is accurately controlled by a spring pressed ball 297 (Fig. 8) which is arranged to engage any one of four grooves 298 formed in the rod 305. Encircling the shaft 305, adjacent its left hand end (Fig. 8), are four gears 299 which mesh with corresponding gears 311 mounted on the counter shaft 308 heretofore described. Each pair of intermeshing gears are arranged to drive the carriage at a different speed ratio. Each gear

299 is normally free to rotate on the shaft 305. One of the gears 299, however, dependent upon the axial position of the shaft 305, is driven by a radially extending key 312 carried by the shaft 305, and adapted to engage a keyway 313 in the gear 299 with which it has been aligned. Thus even though the disc 240 causes the ratchet mechanism to be advanced a unit of one width, the carriage may nevertheless be advanced a unit of an entirely different width to provide for the different points of type.

The carriage mechanism is so arranged that normally the printing of a line is commenced a half an inch from the edge of the sheet. However, it is sometimes desirable to commence the printing line a greater distance from the edge of the sheet. To facilitate increasing the left hand margin, without interfering with the operation of any of the mechanisms or indicators, I prefer to adjustably mount the rack 310 on the carriage.

As shown in Fig. 4, the rack 310 extends substantially the entire width of the machine and is adjustably connected to the carriage. As illustrated in Figs. 4 and 21, a bar 385 extends substantially the entire length of the carriage 11 and is secured to the carriage end frame members 30 and 31 as, for instance, by screws or bolts 386. The bar 385 has a tongue and groove connection 389 with the rack 310 which retains the rack 310 in position between depending ears 388 of the frame members 30 and 31.

When it is desired to print, say three inches from the edge of the paper, a latch 390, carried by a latch carrier 391 which is secured to the rack 310 as by bolts 394, is rocked about its pivot 395 against the action of a spring 396 raising the latch out of one of a series of notches 387 in the bar 385. The latch is then positioned in another notch, for instance, the one indicated in Fig. 4 above the numeral three. This moves the carriage to the right (Fig. 4) relative to the rack bar 310 so that the left hand margin on the work sheet will be three inches.

I claim:

1. In a printing machine of the keyboard type, a movably mounted type carrier having a plurality of type, key controlled means to position a selected type on said carrier in printing position, a movably mounted work holder, means to cause relative movement between the work holder and the type carrier to cause an impression to be made from a selected type, advancing means to progress the work holder following each impression, a rotatable disc having a series of notches of varying depths in its periphery, each notch corresponding to one of said type, a member adapted to enter a notch and cooperate with said advancing means to determine the distance the work holder is to be advanced, means to position said disc with a notch corresponding to a selected type in position to be engaged by said member, said advancing means including a ratchet wheel, resilient means to urge said member into engagement with a notch, a pawl carrier, a connection between the pawl carrier and said member whereby the movement of the carrier in one direction is controlled by the movement of said member, means including a pawl mounted on said carrier to transmit the movement of the carrier in the other direction to the ratchet wheel and an operating connection between said ratchet wheel and said work holder.

2. In a keyboard operated machine, a rotatable shaft, a type wheel mounted on the shaft for rotation therewith and having a plurality of type of various widths mounted about its periphery, a disc mounted on said shaft for rotation therewith and having a plurality of notches in its periphery, each notch corresponding to one of said type and varying in depth from the other notches as its corresponding type varies in width from the other type, a work holder, means to cause relative movement between the work holder and the type wheel to effect an impression of a type in printing position on work, key actuated means to control the rotation of said shaft to bring a selected type to printing position and the corresponding notch to a selected position, means to advance the work holder following each impression, and means to coact with the notch in the selected position and cause the work holder to be advanced a distance equivalent to the width of the type from which the last impression was made.

3. In a keyboard operated machine, a rotatable shaft, a type wheel axially slidable on said shaft and keyed for rotation therewith, said type wheel having two annular bands, each band including a plurality of type of various widths, a pair of discs slidably mounted on said shaft and keyed for rotation therewith, each of said discs having a plurality of notches in its periphery, each notch corresponding to one of said type and varying in depth from the other notches as its corresponding type varies in width from the other type, the notches of one disc corresponding to one band of type and the notches in the other disc corresponding to the other band of type, a work holder, means to cause relative movement between the work holder and the type wheel to effect an impression of a type in printing position on work, key actuated means to control the rotation of said shaft to bring a selected type to printing position and the corresponding notch to a selected position, key controlled means to slide both said type wheel and said discs axially of said shaft to determine which band and which disc will be in selected position, means to advance the work holder following each impression, and means to coact with the notch in the selected position to cause the work holder to be advanced a distance equivalent to the width of the type from which the last impression was made.

4. In a keyboard operated machine, a plurality of keys, a plurality of type of different widths, a work holders, key operated means to cause an impression to be made upon work carried by said work holder from a selected type, a ratchet wheel, a pawl carrier, a pawl on said carrier resiliently urged toward said wheel for advancing the same, means to retract said pawl carrier relative to said ratchet wheel a distance having a fixed relation to the width of the selected type, a detent pawl to prevent movement of said ratchet wheel during the retraction of said carrier, means to advance the carrier to cause the ratchet wheel to move a distance equivalent to the retraction of the pawl carrier following each impression, means to transmit the movement of the ratchet wheel to the work holder to advance the work holder following each impression a distance equivalent to the width of the selected type, and means to prevent overthrow of said ratchet wheel.

5. In a keyboard machine, a plurality of manually operable keys, a plurality of type of various widths, a work holder, means controlled by said keys to cause an impression to be made on work

carried by said work holder from a selected type, a ratchet wheel, a pawl carrier, a pawl mounted on said carrier resiliently maintained in contact with said ratchet wheel, means to retract said pawl carrier a distance depending upon the width of the type selected, a detent pawl to prevent movement of said ratchet wheel during the retraction of said pawl carrier, means to advance the pawl carrier to thereby advance the ratchet wheel, means interconnected between said ratchet wheel and said work holder to transmit the movement of said ratchet wheel to the work holder to advance the work following each impression, a second ratchet wheel secured to the first named ratchet wheel and having teeth facing in the opposite direction from the teeth of the first named ratchet wheel, and a second pawl carried by said pawl carrier and resiliently urged into contact with the second named ratchet wheel to prevent overthrow of said ratchet wheels during the advancing movement of said carrier.

6. In a keyboard operated machine, a plurality of keys, a rotatable type wheel having a plurality of type of various widths about its periphery, a work holder movable toward and from said type wheel to cause an impression to be made upon work carried thereby from a selected type, key actuated means to control the rotation of such type wheel to bring a selected type into printing position, a ratchet wheel, a pawl carrier, a pawl on said carrier resiliently urged into contact with said ratchet wheel, means to retract said pawl carrier a distance dependent upon the width of the type selected, means to advance said pawl carrier to thereby advance said ratchet wheel, means to transmit the movement of said ratchet wheel to said work holder whereby the work holder will be advanced variable amounts depending upon the width of the type in the selected position, a second ratchet wheel secured to the first named ratchet wheel and having teeth facing in the opposite direction from the teeth of the first named ratchet wheel, a second pawl carried by said pawl carrier and resiliently urged into contact with the teeth of the second named ratchet wheel to prevent overthrow of said ratchet wheels consequent upon the advancing movement of said carrier, a detent pawl coacting with the first named ratchet wheel to prevent movement of said ratchet wheel during the retracting movement of said pawl carrier, and means to move the second named pawl out of engagement with its ratchet wheel prior to the retraction of said pawl carrier.

7. In a keyboard operated machine, a plurality of keys, a plurality of type of various widths, a movable work holder, key controlled means to cause an impression to be made from a selected type on work carried by said work holder, a ratchet wheel, a driving connection between said work holder and said ratchet wheel whereby the movement of said ratchet wheel advances said work holder, resilient means to bias the movement of said work holder and ratchet wheel, a pawl carrier, a pawl mounted on said carrier and resiliently urged into contact with said ratchet wheel, means to retract said pawl carrier a distance dependent upon the width of the last selected type, a detent pawl to prevent movement of said ratchet wheel during such retraction of the pawl carrier, means to advance said pawl carrier to cause the advance of said ratchet wheel, a second ratchet wheel secured to the first named ratchet wheel and having its teeth facing in the opposite direction from the teeth of the first named ratchet wheel, a third pawl mounted on said pawl carrier and resiliently urged into contact with said second named ratchet wheel, means to release said third pawl prior to the retraction of said ratchet wheel, and key actuated means to release said detent pawl and said first named pawl to thereby free said ratchet wheels for movement in a reverse direction and permit said biasing means to return the work holder and said wheels to their starting positions.

8. In a keyboard machine, a rotatable type wheel having a plurality of type of various widths mounted thereon, a rotatable disc having a plurality of notches on its periphery each notch corresponding to one of said type and varying in depth from the depth of other notches as the corresponding type varies in width from the width of other type, a work holder, an inked ribbon interposed between the work holder and said type wheel, means to cause relative movement between the work holder and the type wheel to effect an impression on work of a type in printing position, key actuated means to control the rotation of said wheel and said disc to bring a selected type to printing position and to bring the corresponding notch to a selected position, means to advance the work holder and said ribbon following each impression, and means coacting with the notch in selected position to cause the work holder and said ribbon to be advanced a distance equivalent to the width of the type from which said impression was made.

9. In a keyboard machine, a work holder, a plurality of letter type of various widths, key controlled mechanism to cause a selected type to be impressed on work carried by the work holder, means to advance the work holder following each impression a distance corresponding to the width of the impressed type to thereby cause a line to be printed, settable means to indicate the desired length of line to be typed, a standard space key, means whereby the actuation of said space key advances the work holder a predetermined distance, a plurality of supplemental space keys each adapted to advance the work holder a different distance, a signal actuated by said settable means a predetermined distance before the desired length of line is reached, a cylindrical justifying scale having a vertically extending zero column, an indicator for such scale, a rotatable support for said scale, means to rotate said support and said settable means variable distances depending upon the advance of said work holder, and an adjustable driving connection between said support and said justifying scale whereby the scale may be set prior to the operation of the mechanism so that the zero column will be aligned with the indicator when the signal is given.

10. In a keyboard typing machine, a plurality of letter keys, a plurality of space keys, a paper carriage, a plurality of type of varying widths, means to cause an impression to be made from a selected type, means to advance the carriage as the typing progresses a distance corresponding to the width of the type impressed, means to advance the paper carriage varying distances dependent upon the space key depressed, a spring to return the carriage to its starting position, a work sheet holder on said carriage, means on the carriage to advance the work sheet to space the lines of typed copy, a justifying scale, an indicator for said scale, means to cause relative movement between the scale and indicator each

time a letter key or a space key is actuated, a signal, settable means to actuate said signal when the copy has been progressed a predetermined distance short of a desired length of line, means to advance said settable means and said justifying scale as the carriage moves, a release key, and means controlled by the actuation of said release key to cause the carriage to return to its starting position, to actuate said advancing means to line space the work sheet, to return the settable means to its starting position, and to return the line space indicator and justifying scale to their normal positions.

11. In a keyboard operated printing machine, a frame, a paper carriage including a platen mounted for movement on said frame, a vertically extending shaft rotatably mounted in said frame, means to restrain axial movement of said shaft, a type wheel having a pair of vertically spaced bands of type, said wheel being mounted on said shaft for axial movement relative thereto, a driving connection between the type wheel and said shaft, a second vertically extending shaft mounted in said frame for axial movement relative to said first named shaft, a carriage secured to said last named shaft, a connection between said carriage and said second named shaft whereby axial movement of such shaft is imparted to said carriage, a connection between said carriage and said type wheel whereby the carriage controls the axial position of the type wheel relative to the first named shaft, a solenoid, key controlled means to selectively energize said solenoid, a connection between said solenoid and said second named shaft whereby energization of said solenoid moves said second named shaft axially, means to make an impression on a work sheet carried by said paper carriage from the selected band of type, means to advance said paper carriage, means to variably control the distance of said advance including a pair of notched discs mounted on said first named shaft for axial movement relative thereto, and means carried by said second named shaft whereby axial movement of said second named shaft is imparted to said discs.

12. In a keyboard operated printing machine, a frame, a work holder movably mounted on said frame, a shaft rotatably mounted in said frame, a type wheel mounted on said shaft for axial movement relative thereto, a driving connection between said shaft and said wheel whereby rotation of the shaft is imparted to said type wheel, a carriage mounted on said frame for movement in a direction parallel with the axis of said shaft, key controlled means for determining the position of said carriage, said carriage having a pair of spaced arms projecting toward said shaft on opposite sides of said wheel and rollers carried by said arms and engaging opposite faces of said wheel, means to advance said work holder, means including a pair of notched discs to control the amount of said advance, said discs being axially movably mounted on said shaft, a driving connection between said discs and said shaft, and means movable as a unit with said carriage to shift said discs axially of said shaft to determine which disc will be active.

13. In a machine of the character described, a frame, a horizontally extending platen carried by said frame, means to periodically advance said platen, a vertically extending shaft mounted in said frame, a type wheel mounted on said shaft for axial movement relative thereto, a pair of vertically spaced bands of type on said wheel, a driving connection between said shaft and said wheel, a carriage mounted for vertical movement on said frame, a connection between said carriage and said wheel whereby the vertical movement of said carriage moves said wheel axially to selectively position said bands of type relative to said platen, a pair of vertically spaced notched discs mounted on said shaft for axial movement relative thereto, means coacting with said discs to control the advance of said platen, and means movable with said carriage to selectively position said discs for cooperation with said means.

14. In a keyboard operated printing machine, a frame, a vertically extending shaft rotatably mounted in said frame, means to restrain axial movement of said shaft, a type wheel mounted on said shaft for axial movement relative thereto, a plurality of axially spaced bands of type on said wheel, a driving connection between the type wheel and said shaft, a plurality of axially spaced notched discs mounted on said shaft for axial movement relative thereto, there being one disc for each band of type, a platen, means to periodically advance said platen, means adapted to cooperate selectively with said discs to control the advance of said platen, a second vertically extending shaft mounted in said frame for axial movement relative to said first named shaft, a carriage secured to said last named shaft, a connection between said carriage and said second named shaft whereby axial movement of such shaft is imparted to said carriage, a connection between said carriage and said type wheel whereby the carriage controls the axial position of the type wheel relative to the first named shaft, a connection between the second named shaft and said discs whereby the position of said second named shaft controls the axial position of said discs on said first named shaft, a solenoid, key controlled means to selectively energize said solenoid, and a connection between said solenoid and said second named shaft whereby energization of said solenoid moves said second named shaft axially.

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