This invention relates to an improved printing or typewriting machine of the keyboard type. More specifically, the invention relates to an improved power operated, keyboard controlled, printing machine which will facilitate the production of a clear, distinct and 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 this invention.

My prior patents Nos. 2,165,223, 2,165,224 and 2,165,225, issued July 11, 1939, disclose 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 typied 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 process.

One of the objects of the present invention is to provide a keyboard controlled printing mechanism for effecting the reproduction of an exceedingly clear and distinct copy.

Another object of the invention is to provide a keyboard controlled printing mechanism having type of different widths, with an 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 inkjet ribbon feed mechanism 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.

Another object of the invention is to provide an improved keyboard controlled, power operated, printing machine in which the actuation of the keys is prevented when either the power is cut off, or when a predetermined length of line has been printed.

A further object of the present invention is to provide a printing machine wherein type of varying widths are selected by the operator at the end of each line, 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.

A further object of the invention is to provide an electrically operated, keyboard controlled, printing machine in which the actuation of the keys will be prevented so long as the power is off or after a predetermined length of line has been printed.

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 8—8 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. 5; 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 18—18 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 for controlling the left hand margin of the work sheet, the plane 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 22—22 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 sectional detail, certain parts being broken away, of a mechanism for preventing the simultaneous depression of a plurality of keys and for preventing the depression of any key when the power is off, the plane of the section being indicated by the lines 25—25 on Fig. 1; Figs. 26 and 27 are sectional details as indicated by the correspondingly numbered lines on Fig. 25; Fig. 28 is a sectional detail similar to Fig. 26 but illustrating a modified form of the invention; Fig. 29 is a diagrammatic illustration of a justification chart; Fig. 30 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 operated 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 0-point type, another 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 a position. The keyboard 15 also controls a mechanism which causes the paper carriage 11 to move bodily toward the type wheels 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 distance self 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, a copyholder, generally indicated at 19, is positioned between the keyboard 15 and the type wheels 14. This copyholder may comprise coating 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 23 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 is reached. This distance is generally sufficient for the impression of five to six letter characters without overrunning the end of the line and therefore gives the operator opportunity to determine how much more may be typed without over-running 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 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.

The operator, during the initial typing, causes the typed line to approach the desired length as
nearly as possible and then reads the scale 10. At this time the indicator 10 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 type line to be justified 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 10 to return to their starting positions. Thus the machine is 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 simultaneously letter press impressed.

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 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 the plate 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 46 which engages a pin 46 on the pawl and 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 48.

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 adjustable positioned as desired, but 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 provided 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 reinforcing bar 56 carries 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 forward 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, to enable the movement of the carriage in a horizontal plane toward and from the platen 12 relative to the shaft 57. 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 71 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 embraces 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 16 (Fig. 3) 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 88 which meshes with a spiral gear 87 drivingly secured to the type wheel shaft 70 as by a pin 88. As herebefore mentioned, the type wheels 14 are rotated for axial movement by 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 controlled from the keyboard 15, and particularly by a shift key 90, Figs. 1, 2, 6 and 7. As shown, the lower end 91 of the shaft 92 is mounted 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 91 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 106 raising the rod vertically. The rod 106 is mounted for axial movement in the frame 10 and the frame bracket 71. Axial movement of the rod 106 is imparted to the type wheels 14 by a carriage 108. This carriage comprises an upper member 63 and a lower member 64 which are normally secured together as a unit by a set screw 109. The carriage 108 is positioned vertically on the shaft 105 by a manually operated 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 105. 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 108 is prevented by a pin 114 carried by the bracket 71 and having a sliding engagement with the carriage. When raising of the rod 106 by the solenoid 100 raises the carriage 108 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 115, each 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 assured.

To ease the load on the solenoid 100, I encircle the rod 105 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 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 105, while the uppermost position is limited by the collar 105 likewise pinned to the rod 105. 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 for axial movement on a shaft 123 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 96 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 lever 93 to its 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. 5) at the right hand side of the keyboard 15. 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 stops the rotation of 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, 5 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 144. 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 144 to a position wherein the pin 140 is withdrawn from the notch 141 in the respective lever 142. Thereupon 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 143. There are a plurality of such discs one for each lever 142. The discs 143 are keyed to the main drive shaft 63 so that their notches 147 are spaced circumferentially one from the other. Thus each disc will stop the rotation of the shaft 63 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 7. 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 ball 150 the ends of which are pivoted in the bearing members 84 heretofore described. The movement of the ball 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 16 in bearings 154. The driven member 155 of the clutch 152 is rotatably mounted on the cam shaft 153 and 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 any of the springs 144 heretofore described and engagement of 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 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 ball 150. A spring 164, interposed between the latch 158 and the frame 16, serves to restore the latch 158, the ball 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 tension 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 guide way 179 carried by the frame 10. As the cam 170 rotates, a spring 189 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 170. 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 189 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 201, with a lever 202 carried by a pin 195 which is secured as by a pin 196 to the shaft 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, 5 and 9, 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 toggles 196 are also rigidly secured to the frame members 55, a clock-wise movement (Fig. 24) of the rod 57 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 54 which, opposite the point of the impression, engages the enlarged head 203 of a pin 202 carried by the bar 56. 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 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 184, 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 184 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 184.

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 com-
position 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 228 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 216, interposed between the plate 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 216 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 sheets. However, as the paper carriage is brought forward to cause the impression to be made, a portion of the carriage, such as for instance a roll 223 (Fig. 9) carried by one of the frame bars or rods 32 of the carriage, engages the ribbon shield 219 urging the ribbon 221 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 148 and rocks the associated lever 135 a distance sufficient to permit the spring 148 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 promotes the paper carriage 11 and the linking 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 228 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 78. The discs are driven by a pin 242 carried by the disc 183 and which engages suitable recesses in the hub 241. Each of these discs 240 contains a number of peripheral spaced notches 248, 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 246 (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 248 to be urged forward yieldingly until the end 246 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 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 269 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. 3 and 9) 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 276 and 278. As shown in Figs. 12, 14 and 15, the pawl carrier 268 carries two paws, namely, the paws 275 and 276. The pawl 276 normally engages the ratchet wheel 276 which is drivingly secured to the shaft 269. This pawl prevents rebound of the ratchet wheels by preventing adverse clockwise movement thereof. The paw 276 normally engages a ratchet wheel 278, which is secured to the ratchet wheel 276. The pawl 276, consequent upon the completion of the rotation of the shaft 153, engages the ratchet wheel 278 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 276 and 278 are preferably of the same diameter and are provided with an identical number of teeth, each tooth representing one unit of type width. The use of this simple clearness of illustration these two ratchet wheels are shown in Figs. 13, 14 and 15 as having different diameters. The paws 276 and 278 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 interconnected by respective springs 282 with a pin 283 carried by the pawl carrier 268 to thereby normally retain the paws in engagement with their respective ratchet wheels. As the link 262 moves in a left hand direction (Figs. 13 to 15), it has no immedi-
affect on the pawl carrier 285, but instead the end 258 of the link engages a pin 251 carried by the lever 181 of the pawl 275 and rocs the pawl 275 out of engagement with its ratchet wheel 276. Following the release of the pawl 275, the link 262 picks up the pawl carrier, by reason of the pin and slot connection 261, 259 with the pawl carrier heretofore described. During the movement of the pawl carrier under the influence of the spring 263, a detent pawl 259 pivoted 10 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 275 by a spring 288 interposed 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 250, it first moves out of engagement with the pin 251 thereby permitting the spring 282 to draw the pawl 275 into contact with the ratchet wheel 276. Thus any adverse clockwise 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 12 of type, while the bottom disc is used for the upper case bands 13 of type. The arrangement is such that when the type wheels are raised so that the bottom band of type 13 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 271, 199 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 co-axial slidable shaft 305. This shaft is journaled in bearings 306 and is connected as, for instance, by gearing generally indicated at 307 with a coupler 308 which carries 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 a bearing 316 of the frame 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 rotation in 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, 309.

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 268 which is secured to a vertically extending shaft 325 suitably journaled in bearings 324 carried by the frame 10. The shaft 268 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 28 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 325 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 318 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 6, the right hand end of the shaft 269 is provided with a beveled pinion 335 which meshes with a beveled pinion 338 drivingly secured to a shaft 331. The shaft 331 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 331 and is normally held in engagement with the pin 341 by a spring 343 encircling the shaft intermediate the upper bearing 335 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 248. 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 heretofore described is drivingly secured to the shaft 19 is one member 316 of a one-way clutch, the other member of which is integral with the roller 225. The
characters of the font are determined. For example, the cap "M" is preferably three times as wide as the lower case letter "m," 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 "m" comprises six units, while the lower case letter "a" will be nine units. Other letters will vary according 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 line to be printed, which will be called the justified or page line, 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 24, 28 are depressed and a line printed, the justifying chart keeps count of the number of units or difference between the printed or set line and a justified or page 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 18 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 1f four units each time it is struck, a total of thirty-two units will have been used for the page line. 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 28, as heretofore mentioned, is provided with a settable plunger 332 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 332. Accordingly, if this scale is set at its starting or zero position and the indicator 28 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 19 and types at the end of the line the figures enclosed by the pointer or indicator 19. If such figure is "5" he types the numeral "5," or if the figures appear he types "5-2" 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 "5-2" he will strike the justifying space key 24, indicated by the index "5" instead of the space key 23. If he sees the figures "5-2" at the end of the set line he will, in making his justified copy, strike the space key 24, indicated by the index "5" for the first two spaces and the space key 23 indicated by the index "2" 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 18 is best shown in Fig. 29. On inspection of this figure it will be noted that there are seventy-two vertical rows 431 of indicia on the chart, each row of indicia representing one unit. While the average line is considerably longer than seventy-two units, I nevertheless find that if the line is more than seventy-two 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-two 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 18 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 19 be aligned with the zero column on the chart. It is evident that if the em scale 28 is set for any multiple of four ems and the chart 18 is rotated one complete revolution for each four ems, the zero point on the chart will be in alignment with the indicator 19. 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 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 433 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 cms in the opening 342 marked (1).

The space key 23 or 24 is struck, the pointer 19 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 heretofore described in connection with the letter keys 28. Each lever 345 has a hatching connection 346 with a lever 347 which is similar to and performs substantially the same function as the levers 142 heretofore described. This hatching connection 346 is released and restored the same as heretofore described in connection with the levers 135 and 142. However, each of the levers 341 is provided with an enlarged opening 350 (Fig. 17). The openings 350 in respective levers 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 rod lever 345 is restored to lever 347 counter clockwise (Fig. 17) to position the type wheel 14 and release the clutches 152 to cause the shaft 153 to make one revolution, also causes the lever 347 to engage the rod 351 and rock the lever 352 counter clockwise, around the pivot shaft 143, against the action of a spring 348, moving such lever from the position shown in Fig. 16 to the position shown in Fig. 18. This lever may comprise two members 353 and 354 joined by the rod 351 as shown in Fig. 5. 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 the ratchet teeth 345 formed on the face of a bar 355, the upper end of which carries the indicator 18 (Figs. 3 and 4). The indicator bar 355 is slidable 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 345 by a spring 351, prevents the lifting of the bar 355 during the retraction of the pawl 353 by the counter clockwise movement of the lever 352. When the cam shaft 153, 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 contacts with a scale 362 carried by the cover 230 in the machine, and indicates to the operator the total number of spaces struck.

The space 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 266 jour- nalled in bearings 287. Also fixed to the shaft 266 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 278, 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 353 and connected with a pin 353 carried by the rock 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 the right in Figs. 1, 2 and 3). This movement of the carriage through the gearing 301, 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 266, to which the release key lever 370 is secured, extends through the frame bracket 339. When the release key lever is depressed the shaft 266 is rocked, and a pin 376 carried by a lever 371 mounted on the shaft engages the pawls 353 and 354 and moves them out of engagement with the teeth 356 of the indicator bar 355. This bar then drops into engagement with an adjustable stop 366 (Fig. 5) carried by a bracket 366 secured to the frame 10.

The starting position of the ratchet wheels 278 and 279 and associated mechanisms may be adjusted to facilitate accurate positioning of the parts. As illustrated in Figs. 2 and 6 a lever 188 is engaged to the shaft 325. When the parts return to their starting positions, this lever 188 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 made to act on a cam or an eccentric and is secured to a threaded rod 209 passing through the frame 10. A nut 210 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 222 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 222 is secured to a link 237 which has a pin and slot connection 235 with the pawl carrier 43 heretofore described in connection with the manual line spacing of the work sheet. The arrangement is such that the depression of the key lever 27 causes the pawl 22 to advance the ratchet wheel 188 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 eliminate 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 306 in the nature of a collar is attached to the shaft 305 as shown in Fig. 2, and coacts with a stationary indicator 306 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 306. Encircling the shaft 305, adjacent its left hand end (Fig. 3), are four gears 299 which mesh with corresponding gears 311 mounted on the countershaft 306 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 these gears, 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 key way 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 335 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 334. The bar 335 has a tongue and groove connection 390 with the rack 310 which retains the rack 310 in position in between depending ears 338 of the frame members 30 and 31.

When it is desired to print, say three inches from the edge of the paper, a latch 396, carried by a latch carrier 396 which is secured to the rack 310 by bolts 334, is rocked about its pivot 305 against the action of a spring 306 raising the latch out of one of a series of notches 307 in the bar 336. The latch is then positioned in another notch, for instance, the one indicated in Fig. 4 above the left hand margin of 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.

The keyboard 18 is arranged to prevent the depression of more than one key at a time. As illustrated in Fig. 25, all of the key levers 135 or 345 pass through individual notches in a guide plate or bar 400 which extends between the frame posts 95, heretofore mentioned, immediately to the rear of the keyboard as indicated by the dotted lines in Fig. 1. This bar or guide is provided with a notch 401 for each key lever. The key levers 135 or 345 are normally drawn upward in contact with the stop bar 137 extending thereacross by springs 138, as heretofore described. The lower portions of the key levers, however, extend into the respective notches 401. The bar 400 has an elongated groove or channel 402 in which a series of balls 405 are positioned. The balls are held in their position by a comb 400 secured to the guide plate and having notches 404 corresponding to the notches 401 in the guide 400. The balls 405 are so spaced in the groove 402 that the depression of a key lever separates two of the balls a distance equivalent to the width of such lever. As the length of the groove 402 is limited as, for instance, by pins 406 at either end thereof, the channel is completely filled longitudinally when one key lever has been depressed. The depression of a second key lever to an extent to release the latch 141 between the key lever and its associated lever 142 is prevented by contact with coating balls 405.

I have so arranged the keyboard of the machine that a key cannot be operated so long as the power is off. As illustrated, when the key 410 having notches 411, similar to the notches 401 and 404 in the guide 400 and the guide comb 403, is mounted for longitudinal reciprocation on the bar 400, as for instance, by screws 412 carried by the guide comb, a pin passing through slotted openings 413 in the comb 410. Normally, a spring 415 holds the comb 410 in the position indicated in Fig. 25 with the teeth 414 thereof aligned with the notches 401 and 404 in the guide 400 and the guide comb 403. The spring 415 is interposed between a pin 416 on the guide and a bracket 417 carried by the comb 410. Thus, when the comb 410 is in its normal position, the teeth thereof prevent the depression of any key lever 135 or 345. When, however, an electrical switch 418 (Fig. 30) is closed to energize the motor M, which is drivingly connected to the main drive pulley 82 as heretofore mentioned, a solenoid 419 (Figs. 25, 26 and 30) is energized.

The solenoid 419 is secured to a bracket 420 which, in turn, is adjustably mounted on the guide member 30 and passing through slotted openings 422 in the member 420 and engaging suitable threaded openings in the guide 400. The movable core 451 of this solenoid 419 is connected with the bracket 417 as, for instance, by a pin 425. When the solenoid 419 is energized the comb 410 is moved to the left (Fig. 25) a distance equivalent to the width of the gap 424 in the solenoid. This moves the notches 411 of the comb 410 into registration with the slots 401 and 404 heretofore described, thus permitting the depression of a key so long as the motor is supplied with power.

In Fig. 28, I have illustrated a modified form of mechanism for preventing the operation of a key when the power is off. In this form a solenoid 425 is connected in the electrical circuit in the same manner as described heretofore. This moves the comb 410, and through it, moves the lever 427 which enters one of the notches 402 in the guide member 400 and is normally held in its lowermost position between the balls 405 in the race or groove 410. A spring 426 is interposed between the lever and a pin 428 carried by the guide 400. Thus the lever 427 normally serves to occupy the free space in the ball race 402 and pre-
vents the actuation of any of the keys 335 or 349.

In this form the energization of the motor circuit by the closing of the switch 416 energizes the solenoid 418, which in turn raises the locking lever 421 about its pivot (not shown) from the full line position to the dotted line position shown in Fig. 28. When the lever is in its dotted line position, it is withdrawn from the ball race 422, thus freeing the race to permit the actuation of the key lever 335 or 349 as desired.

I have also provided a mechanism to prevent the actuation of a key after a predetermined length of line has been printed. In other words, I have provided a mechanism to insure that a predetermined margin is left at the right hand edge of the printed sheet. I accomplish this by preventing the operation of a key a predetermined distance before the right hand margin of the sheet W has been reached. As shown in the drawings, particularly in Figs. 1, 3, 4 and 30, I insert a leaf switch 430 in one of the electrical circuits between the motor M and the solenoid 419 or 425 which operates the locking comb 410 to prevent a depression of a key.

The switch 430 is shown in Fig. 3 as being adjusted from the axis 380 a.s. for instance, by being clamped thereto and held in position by a set screw 431. The switch 430 may comprise a leaf switch and is of the type which is normally closed. Secured to the bracket 50 of the left hand paper guide 80 (Fig. 4 or right hand guide in the remaining figures) is an arm 432 provided with an adjustable contact member 433. This contact is arranged to coast with the switch 430 and open the switch whenever the abutment 434 (Figs. 1 and 3) is struck by the member 435 following the movement of the carriage in the direction of the arrow on Fig. 5. If desired, the bar 56 may be provided with a scale generally indicated in Fig. 3 at 436. This scale may be indexed in inches so that the switch 430 may be moved along the index on the scale indicating the width of the right hand margin desired on the sheet.

I claim:

1. In a printing machine of the keyboard type, a frame, a plurality of manually operable keys thereon, a type carrier movably mounted on said frame and provided with a plurality of type means including said keys to control the movement of said type carrier to bring a selected type into printing position in a predetermined horizontal plane, a carriage mounted on said frame for bodily movement in said horizontal plane toward and from the selected type to effect an impression on work sheet, mechanism to move said carriage to effect the impression, said mechanism including a pair of interconnected toggle links pivoted about axes lying in said horizontal plane, and means to move the carriage in another direction to advance the work following each impression.

2. In a printing machine of the keyboard type, a frame, a plurality of manually operable keys thereon, a type wheel rotatably mounted on said frame and provided with a plurality of type extending about its periphery, a means to control the rotation of the type wheel to bring a selected type into printing position in a predetermined plane, a work receiving carriage mounted on said frame for bodily movement in said horizontal plane toward and from the periphery of the type wheel to effect an impression of said selected type on a work sheet carried by said carriage, said carriage being movable in another direction relative to said type wheel to advance the work sheet and thereby effect letter spacing of the work, an elongated flat plate on said carriage, means on said carriage to support a work sheet and retain it in position against said plate, a mechanism to move said carriage to effect the impression including a pair of toggle links having their axes in said horizontal plane, means to move the carriage to letter space the work following each impression, and means to return the carriage to its starting position to advance the work sheet relative to the carriage to effect line spacing thereof.

3. In a printing machine of the keyboard type, a frame, a plurality of manually operable keys thereon, a type wheel rotatably mounted on said frame and provided with a plurality of type extending about its periphery, means to rotate said type wheel, key controlled means to stop the rotation of the type wheel with a selected type in printing position in a predetermined horizontal plane, a work holding carriage mounted on said frame for bodily movement in said horizontal plane toward and from the periphery of the type wheel to effect an impression on a work sheet, said carriage being movable in another direction relative to said type wheel to advance the work sheet and thereby effect letter spacing of the work, a plurality of toggles having their axes in said horizontal plane and connected to move said carriage to effect the impression, means under control of said keys to actuate said toggles, means to vary the movement of said toggles to control the printing pressure, one of said toggles being positioned in a vertical plane passing through the selected type, means to advance the carriage following each impression, and means to return the carriage to its starting position and to advance the work sheet relative to the carriage to effect line spacing thereof.

4. In a printing machine of the keyboard type, a frame, a plurality of keys thereon, a plurality of type, means including said keys to bring a selected type into printing position, a work holder mounted on said frame for bodily movement toward and from the selected type to effect an impression on work, a toggle mechanism connected to move said work holder to cause an impression to be made, means under control of said keys to actuate said toggle mechanism, and an adjustable member interposed between said last-named means and said toggle mechanism to vary the movement of said toggle mechanism and thereby control the printing pressure.

5. In a printing machine of the keyboard type, a frame, a plurality of type, a plurality of keys, key controlled means to bring a selected type into printing position, a pair of parallel bars carried by said frame, a work holder mounted on said bars, one of said bars being fixed relative to said work holder and movable relative to said frame towards the type in printing position, and a toggle mechanism controlled by said keys to move said last mentioned bar and work holder to effect an impression on work carried by said work holder.

6. In a printing machine of the keyboard type, a frame, a plurality of type, movably mounted on said frame, a plurality of type on said carrier, key controlled means to bring a selected type into printing position, a pair of parallel bars carried by said frame, a carriage mounted on said bars, one of said bars being fixed relative to said carriage and movable relative to said frame towards the type carrier, a plurality of toggles interconnecting said bars, and means controlled by said keys to actuate said toggles to
move said movable bar to cause an impression to be made on work carried by said carriage.

7. In a printing machine of the keyboard type, a frame, a type carrier movably mounted on said frame, a plurality of type on said carrier, a plurality of keys, key controlled means to bring a selected type into printing position, a pair of parallel bars carried by said frame, a carriage mounted on said bars and movable lengthwise thereof, means on said carriage to support work, one of said bars having its axis fixed relative to said frame and movable relative to said carriage, the other of said bars having its axis movable relative to the frame and fixed relative to the carriage, and means to move the axis of the last-named bar toward and from the type carrier to thereby move the carriage to cause an impression to be made on the work.

8. In a printing machine of the keyboard type, a frame, a type wheel rotatably mounted on said frame, a plurality of keys, a plurality of type extending about the periphery of said wheel, key controlled means to bring a selected type into printing position, a pair of parallel rods for body and said frame, a carriage slidably mounted on said rods, means on said carriage to support work, one of said rods having its axis fixed relative to said frame and movable relative to said carriage, the other of said rods having its axis movable relative to the frame and fixed relative to the carriage, toggle means interconnecting said rods to move the axis of the last-named rod and the carriage toward and from the type wheel to cause an impression to be made on the work, and key controlling means to lock the first-named rod to actuate said toggle means.

9. In a printing machine of the keyboard type, a frame, a type carrier movably mounted on said frame, a plurality of type on said carrier, key controlled means to bring a selected type into printing position, a pair of parallel rods carried by said frame, a carriage mounted on said rods for movement lengthwise thereof, a platen and a paper support mounted on said frame, one of said rods having its axis fixed relative to the frame and journaled therein, a pair of blocks journaled on said rod and on which said carriage is slidably mounted for movement toward and from the type carrier, the other of said rods being rotatably journaled in said carriage and having its axis fixed relative thereto, a pair of blocks journaled on the last-mentioned rod and slidably mounted in said frame for movement toward and from said type carrier, a toggle mechanism comprising a pair of interconnected links connecting said rods, a driving connection between the first mentioned rod and its accompanying toggle link, and means connected to the first mentioned rod for oscillating the rod to thereby actuate the toggle mechanism and cause an impression to be made.

10. In a printing machine of the keyboard type, a frame, a type carrier movably mounted on said frame and provided with a plurality of type, key controlling means to bring a selected type into printing position, a work holding carriage, a pair of parallel rods carried by said frame the axis of one of said rods being fixed relative to the frame and movable relative to the carriage, the axis of the other of said rods being movable relative to the frame and fixed relative to the carriage, a reinforcing member mounted on said frame and spaced from said rods, said reinforcing member and said rods being in substantially the same horizontal plane as the type in printing position, said carriage being mounted for sliding move-
14. In a printing machine of the keyboard type, a frame, a plurality of manually operable keys thereon, a type wheel rotatably mounted on said frame and provided with a series of type extending about its periphery, means including said keys to control the rotation of said type wheel to bring a selected type into printing position in a horizontal plane, an elongated rigid bar secured to said frame, said bar being spaced from said type wheel and positioned in said horizontal plane, a carriage mounted on said frame between said bar and said type wheel for bodily movement in said horizontal plane toward and from the selected type to effect an impression on work carried thereby, means acting consequent upon the operation of said keys to move said carriage to effect an impression, a platen mounted on said carriage, said impression resulting from the impression stroke of said platen to said bar, and means on said carriage to support work and retain it in position against said platen.

15. In a printing machine of the keyboard type, a frame, a plurality of manually operable keys thereon, a type wheel rotatably mounted on said frame and provided with a series of type extending about its periphery, means including said keys to control the rotation of said type wheel to bring a selected type into printing position in a horizontal plane, an elongated rigid bar mounted on said frame spaced from said type wheel and in said horizontal plane, a carriage mounted on said frame between said bar and said type wheel for bodily movement in said horizontal plane toward and from the selected type to effect an impression on work carried thereby, means acting consequent upon the operation of said keys to move said carriage to effect an impression, a platen mounted on said carriage, said impression resulting from the impression stroke of said platen to said bar, and means on said carriage to support work and retain it in position against said platen.

Clifton Chisholm.

REFERENCES CITED

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

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>448,996</td>
<td>Richardson</td>
<td>Mar. 24, 1891</td>
</tr>
<tr>
<td>499,498</td>
<td>Barten</td>
<td>June 13, 1893</td>
</tr>
<tr>
<td>534,013</td>
<td>Schuckers</td>
<td>Feb. 12, 1896</td>
</tr>
<tr>
<td>570,545</td>
<td>Fredrick et al.</td>
<td>Nov. 3, 1896</td>
</tr>
<tr>
<td>811,247</td>
<td>Houssel</td>
<td>Jan. 30, 1906</td>
</tr>
<tr>
<td>1,690,442</td>
<td>Chisholm</td>
<td>Nov. 6, 1928</td>
</tr>
<tr>
<td>2,165,223</td>
<td>Chisholm</td>
<td>July 11, 1939</td>
</tr>
<tr>
<td>2,255,030</td>
<td>Tholstrup</td>
<td>Sept. 2, 1941</td>
</tr>
<tr>
<td>2,326,097</td>
<td>Reid</td>
<td>Aug. 31, 1943</td>
</tr>
<tr>
<td>2,336,122</td>
<td>Madsen</td>
<td>Jan. 4, 1944</td>
</tr>
</tbody>
</table>

FOREIGN PATENTS

<table>
<thead>
<tr>
<th>Number</th>
<th>Country</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>498,004</td>
<td>Germany</td>
<td>of 1930</td>
</tr>
</tbody>
</table>