March 14, 1944. O. C. W. HENZE ET AL 2,343,905

TYPEWRITING MACHINE

Filed June 18, 1941 6 Sheets Sheet 1

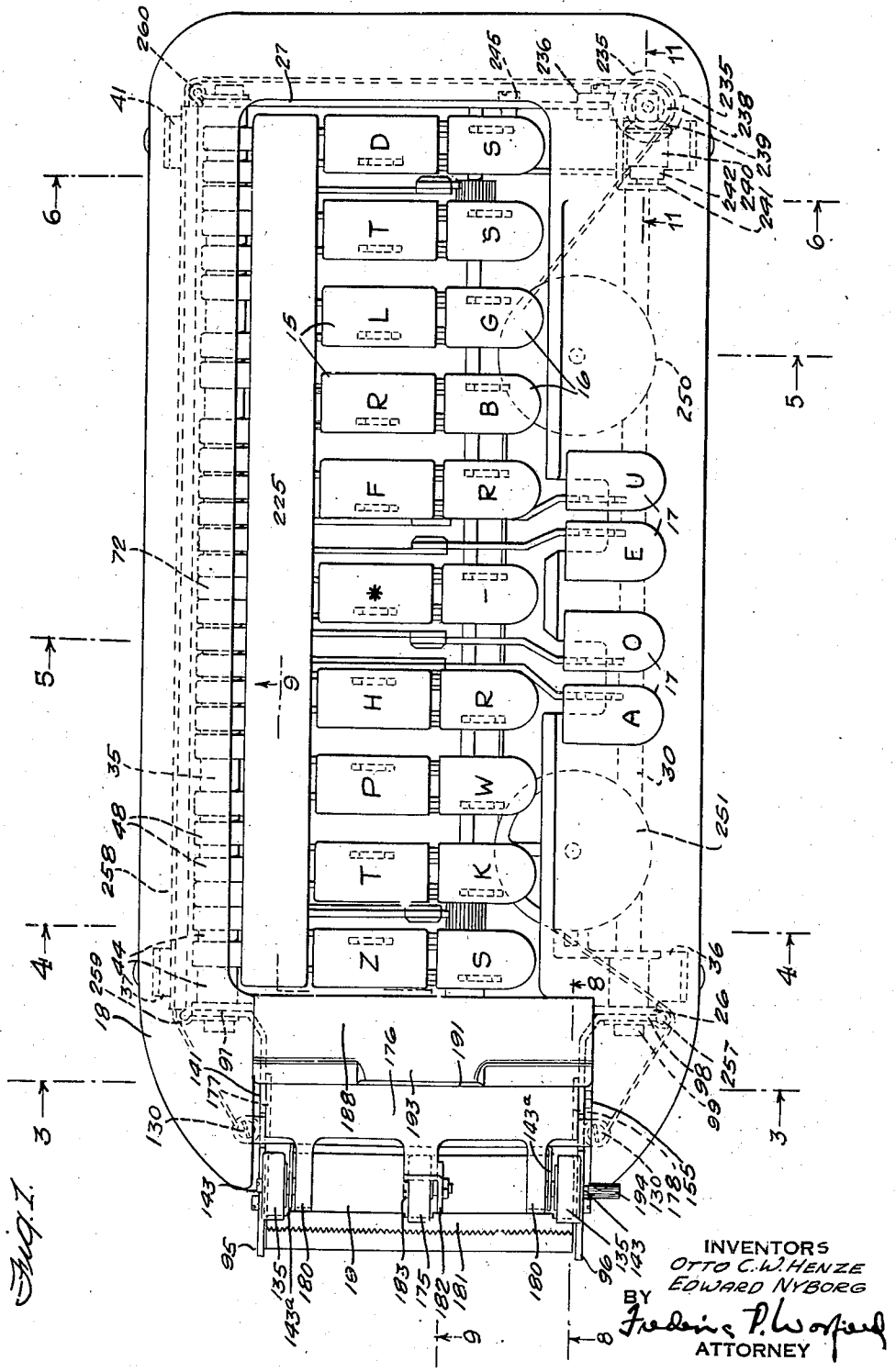



Fig. 1.

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TYPEWRITING MACHINE

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Fig. 2.

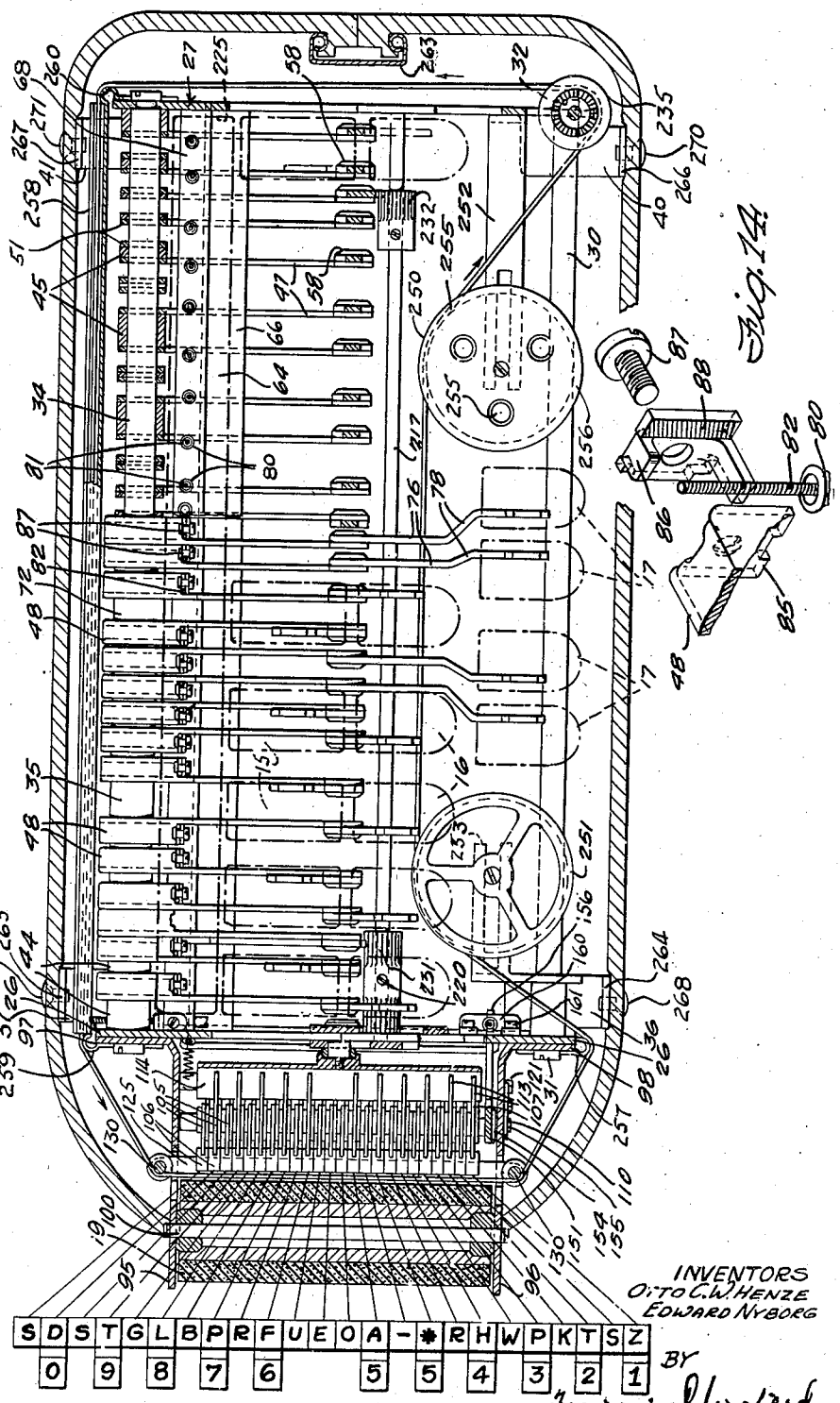



Fig. 14.



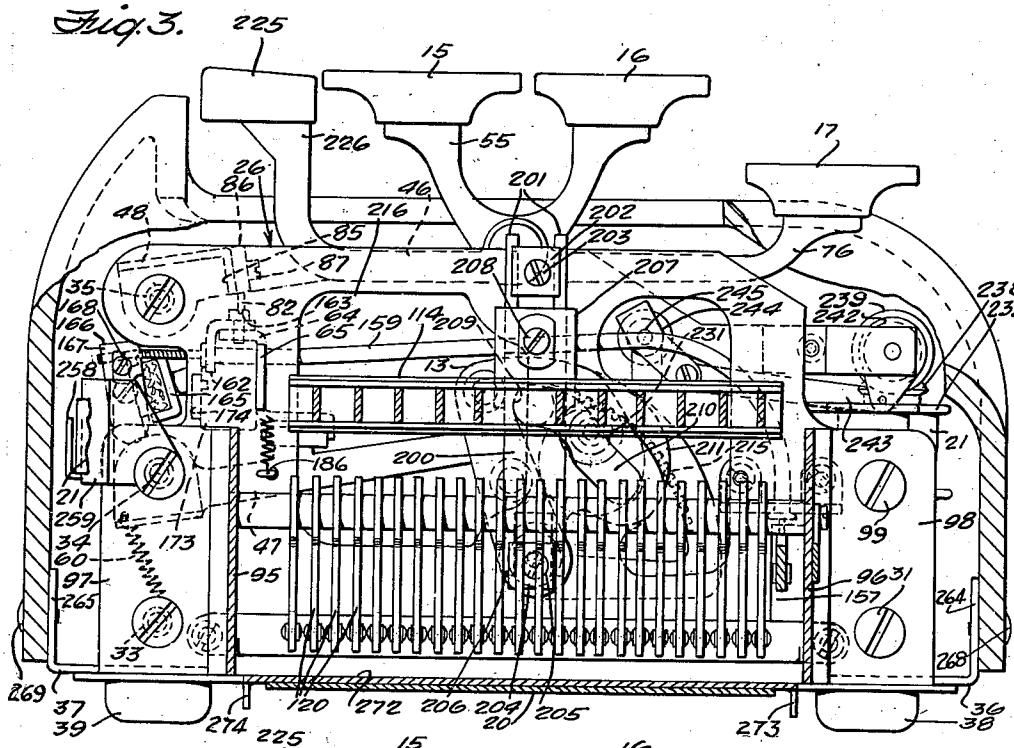
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TYPEWRITING MACHINE

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Fig. 3.



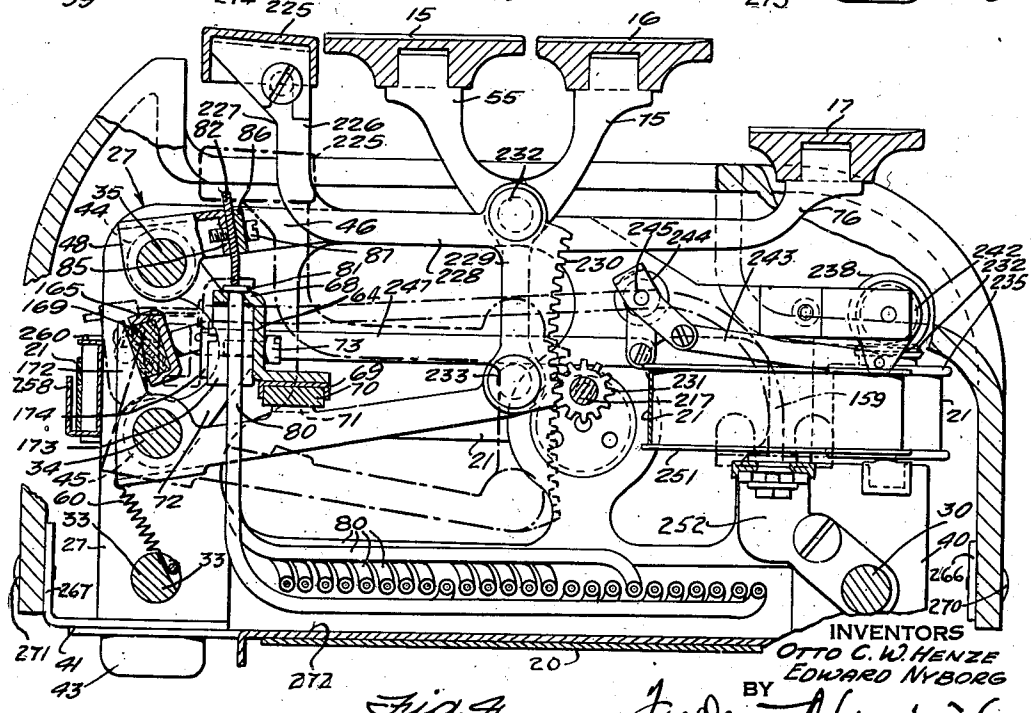


Fig. 4.

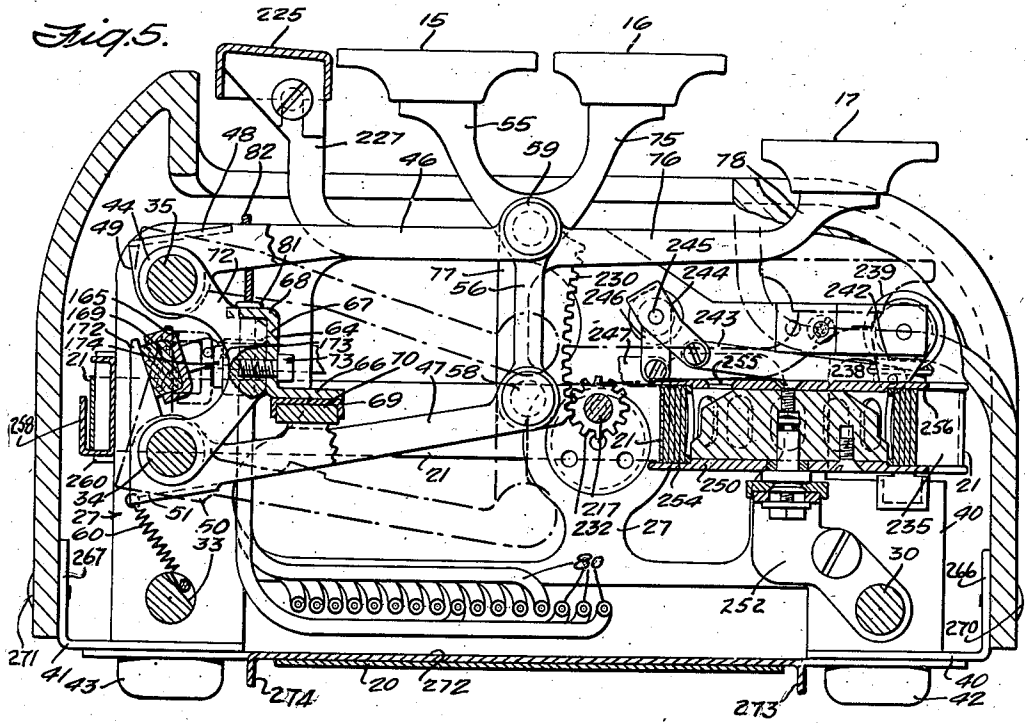
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TYPEWRITING MACHINE

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Fig. 5.



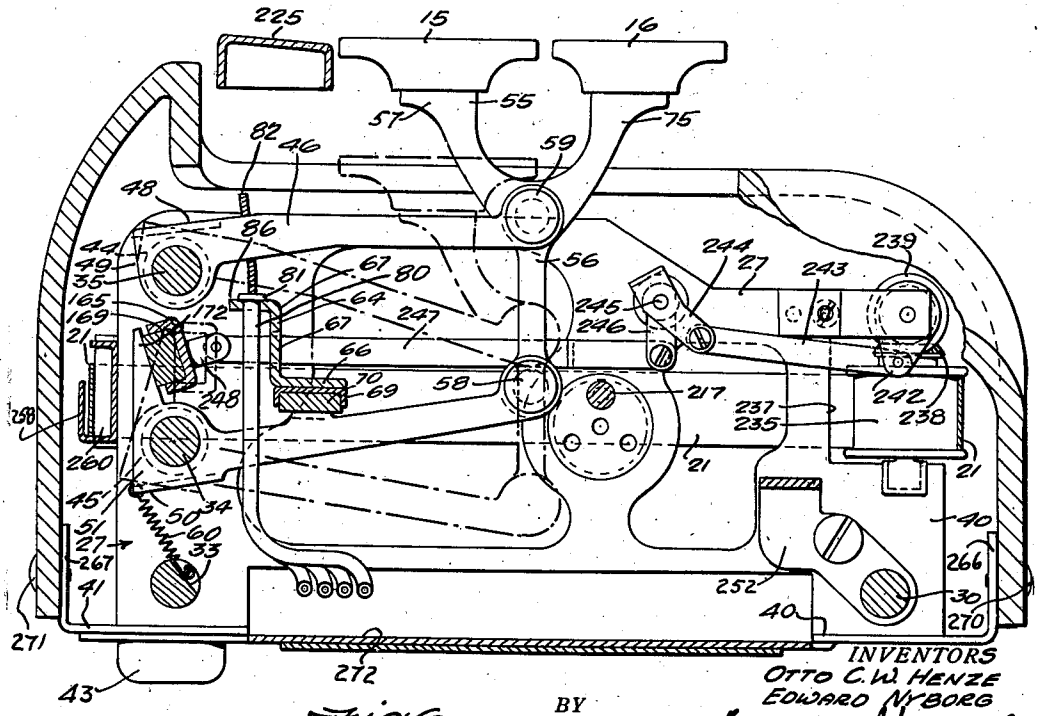




Fig. 6.

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TYPEWRITING MACHINE

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Fig. 7.

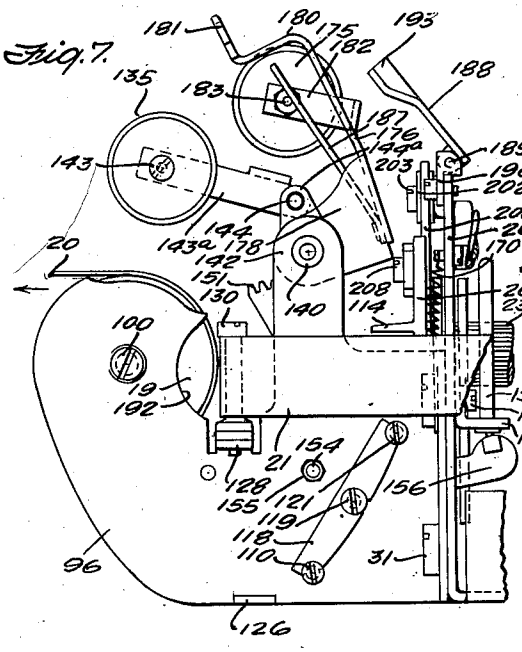


Fig. 8.

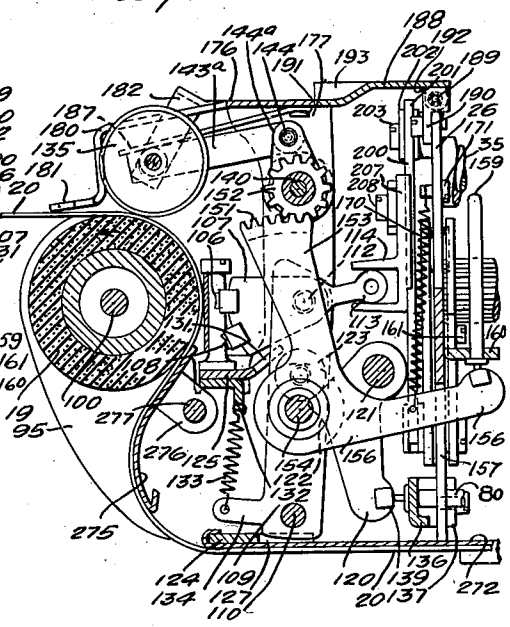
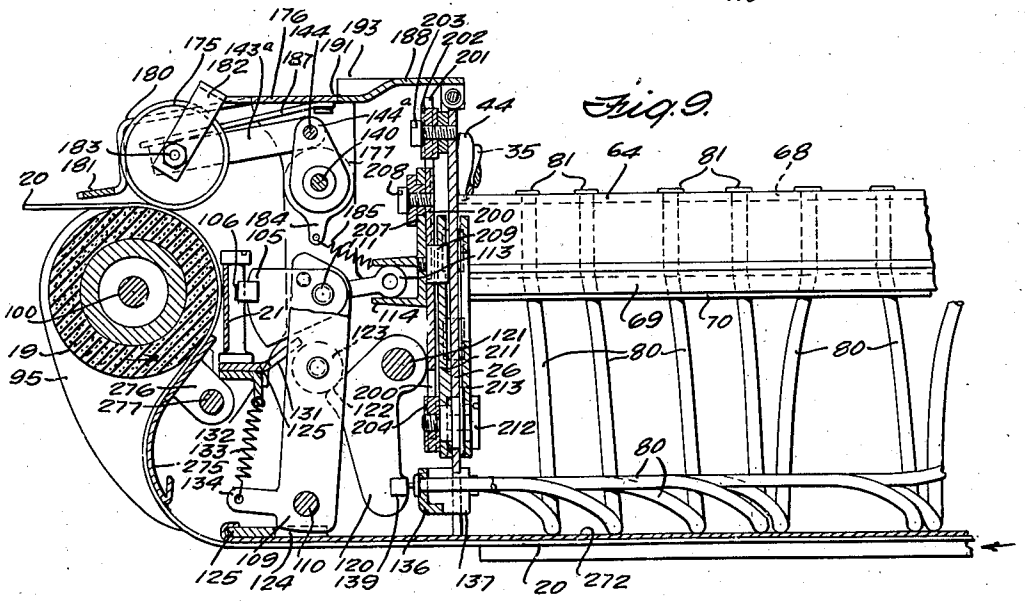


Fig. 9.



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TYPEWRITING MACHINE

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Fig. 10.

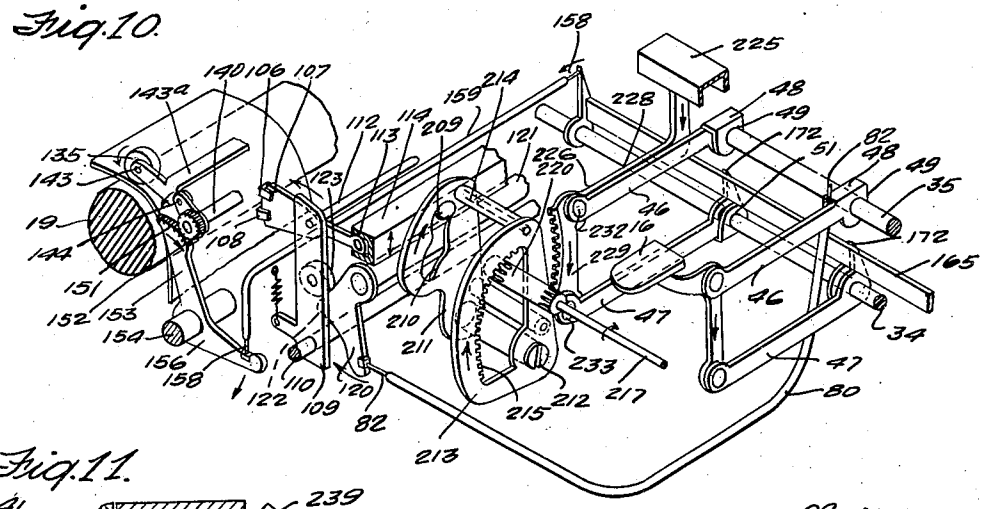



Fig. 11.

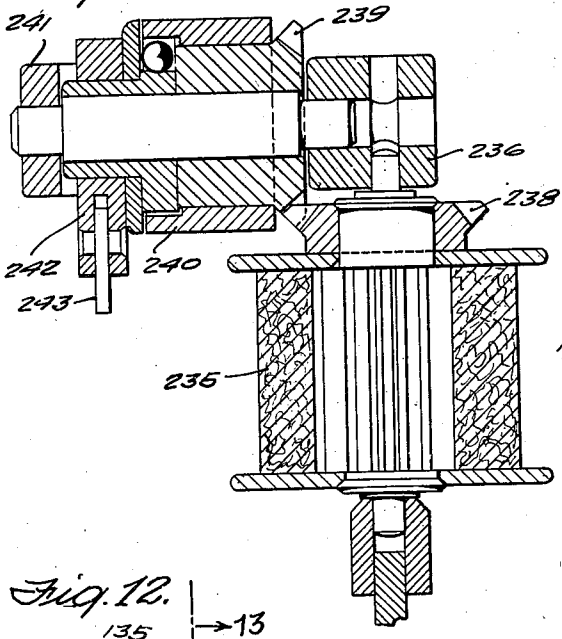



Fig. 15.

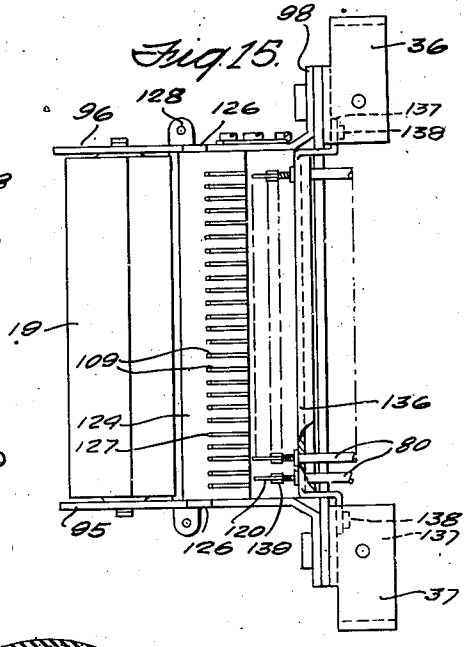
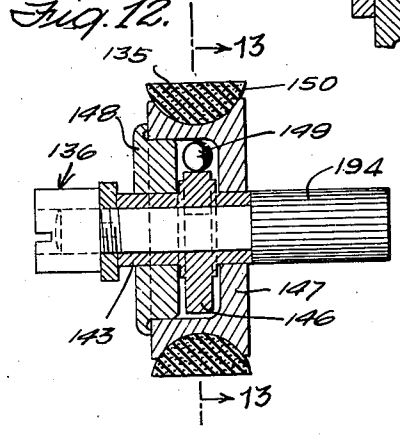



Fig. 12.



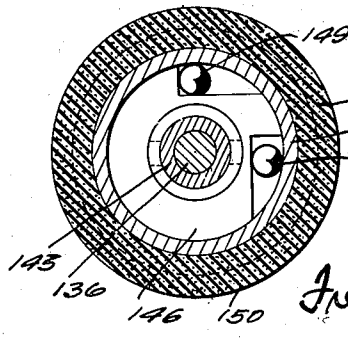




Fig. 13.

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Patented Mar. 14, 1944 2,343,905

# UNITED STATES PATENT OFFICE

2,343,905

## TYPEWRITING MACHINE

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Application June 18, 1941, Serial No. 398,552

26 Claims. (Cl. 197—9)

This invention relates to typewriting machines.

One of the objects of the invention is to provide a typewriter with novel operating mechanism between the keys and the types which permits the arrangement of keys to be entirely independent of the order in which the types are positioned.

Another object of the invention is to provide a typewriting machine with a flexible cable connection between each key and its associated type.

Another object of the invention is to provide an improved key lever construction for a typewriting machine in which the keys will have substantially straight-line movement with a minimum of resistance in the moving parts.

Another object of the invention is to provide a typewriter in which the position of the type assembly and paper holding mechanism may be entirely independent of the arrangement and position of the keys.

Still another object of the invention is to provide a typewriter with a force transmitting mechanism between the keys and the types by means of which a minimum of force is required to cause a type to print, providing a light touch.

Another object of the invention is to provide a typewriter with a combination type shifting and paper feeding arrangement by means of which a single key is used either to advance the paper a predetermined amount through the machine or to shift the types.

A further object of the invention is to provide a typewriter having a plurality of types arranged to be printed simultaneously, which includes a shift mechanism whereby a selected number of type bars are shifted for printing other types when the keys are operated together with the shift mechanism.

An important object of the invention is to provide a stenotype machine which is compact, being but slightly larger than the keyboard, and which is lighter in weight than those heretofore used.

Another object of the invention is to provide a paper feed mechanism which will start feeding the paper when a key is depressed but which will complete the feeding operation before the type bar strikes the paper.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the features of construction, combinations of elements, and arrangement of parts, which will be exemplified in the constructions hereinafter set forth, and the scope of the application of which will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention reference should be had to the following detailed description taken in connection with the accompanying drawings, in which:

Fig. 1 is a plan view of a typewriting machine embodying our invention;

Fig. 2 is a sectional plan, the section being taken just above the types but showing some of the key levers intact;

Fig. 3 is a sectional end view of the typewriting machine taken on the line 3—3 of Fig. 1;

Fig. 4 is a sectional end view of the typewriting machine taken on the line 4—4 of Fig. 1;

Fig. 5 is a sectional end view of the typewriting machine taken on the line 5—5 of Fig. 1;

Fig. 6 is a sectional end view of the typewriting machine taken on the line 6—6 of Fig. 1;

Fig. 7 is a front view of one end of the typewriting machine showing the paper feed mechanism;

Fig. 8 is a fragmentary sectional front view of the typewriting machine showing the paper feed mechanism and taken on the line 8—8 of Fig. 1;

Fig. 9 is a fragmentary sectional front view showing the type bar operating mechanism and taken on the line 9—9 of Fig. 1;

Fig. 10 is an isometric view of a portion of the typewriting machine showing somewhat diagrammatically, with the parts separated, the complete connections between one key and its associated type bar and the paper feed and type shifting mechanism;

Fig. 11 is an enlarged front sectional view through the ribbon feed mechanism taken on the line 11—11 of Fig. 1;

Fig. 12 is an enlarged sectional view through one of the paper feed rollers;

Fig. 13 is a sectional front view of the roller of Fig. 12 taken on the line 13—13 of that figure;

Fig. 14 is an enlarged fragmentary view of the connecting means between the keys and type bars; and

Fig. 15 is a bottom view of the end of the typewriter containing the types and platen.

Referring now more specifically to the drawings, the invention is shown in connection with a typewriting machine in which a plurality of types are adapted to be printed simultaneously across one line of a paper strip, the strip being adapted to advance a predetermined distance through said machine at each operation of a type or a plurality of types. Such a machine may be one designed for use with stenotypy in which sounds are represented by various letters or com-

binations of letters so that syllables, words, and phrases may be recorded by a single stroke of a plurality of keys.

In Fig. 1 of the drawings the keyboard is shown as comprising a plurality of keys 15, 16, and 17, arranged in three rows, as indicated, keys 15 and 16 being used to record consonantal sounds, while keys 17 are fewer in number and are used to record vowel sounds. As will be seen from Fig. 1, the casing 18 which houses the entire machine, is but little larger than the keyboard itself and contains at the left side thereof the platen 19, over which the strip of paper 20 is fed, the paper thus feeding into the side of the machine in a direction transverse to the usual direction of feeding paper into such machines. The types are also housed at the left side of the machine adjacent the platen in a manner to be described later. An inked ribbon 21 is caused to move between the platen and types to furnish the ink for printing.

The frame work of the machine comprises two end plates 26 and 27 (Figs. 1 to 6), the former at the left end of the machine and the latter at the right end of the machine. These plates are held in spaced relation by four rods (Figs. 2 and 4). The rod 30 at the lower front of the machine is secured to the plates 26 and 27 by means of screws 31 and 32, respectively, which pass through the plates. At the rear of the machine we provide three such rods: 33 in the lowermost position, 34 about midway up, and 35 near the top of the machine. These rods are held in place by suitable screws which pass through the end plates, similar to the screws 31 and 32 securing the rod 30.

Plate 26 is provided with downwardly extending feet 36 and 37 at the front and rear corners thereof, which may be flanged over to form supports for rubber feet 38 and 39, respectively. In a similar manner the plate 27 is provided at its lowermost corners with front and rear feet 40 and 41 which are flanged over to receive rubber feet 42 and 43, respectively.

The two rods 34 and 35 form the bearing rods for the supporting mechanism for the keys 15, 16, and 17, and the novel manner of supporting these keys is best illustrated in Figs. 6 and 10. Certain parts of the key supporting mechanism are substantially the same for all keys, and hence only the one set of these need be described. In Fig. 6 a pair of upper and lower lever arms 46 and 47 are shown supported respectively on the rods 35 and 34. The lever arm 46 has a portion 48 at its rear end bent over so as to form two spaced bearing flanges 49, provided with aligned holes through which the rod 35 passes. These bearing flanges 49, therefore, permit the lever arm 46 to pivot about the rod 35, at the same time the spacing of the flanges maintaining the lever arm against any sidewise movement. In the same manner, the lever arm 47 is provided with a bent over portion 50 at the rear, which provides two spaced flanges 51 having aligned holes through which the rod 34 extends to permit the lever arm 47 to pivot about the rod 34 without any sidewise movement. It will be seen in Figs. 6 and 10 that the portion 48 connecting the bearing flanges 49 of the lever arm 46 is at the top, while the lever arm 47 has its connecting portion 50 at the bottom. A pair of these lever arms 46 and 47 are used not only to support each key, but two pairs are also used to support the combination paper feeding and type shifting key to be later described. Some of the lever arms 46 and 47 have the additional bearing flange extending towards the right while some have it extending towards the left, this being determined by the manner in which the lever arms fit on the pivot rods for the desired spacing of the keys.

In Fig. 6, two of the keys 15 and 16 are shown. The key 15 is mounted on a member 55 which has a vertical portion 56 and an upper portion 57 extending at an angle rearwardly thereof, as indicated. The lowermost end of the portion 56 is pivoted to the lower lever arm 47, as at 58, by a suitable rivet or other means, and the uppermost end of the portion 56 is pivoted to the forward end of the upper lever arm 46, as at 59. When the key 15 is depressed, the member 55 moves downwardly in substantially straight-line movement as the two lever arms 46 and 47 pivot about the rods 35 and 34, the lowermost position of the key 15 being shown in dot-and-dash lines in Fig. 6. A spring 60 is provided attached to the rearmost end of the portion 50 of each of the lever arms 47 with its other end attached to the rod 33 in any desired manner, so as to cause the spring to be extended when the lever arm 47 is depressed, the spring then tending to raise the lever arm 47 and the associated members when the pressure is removed. The lever arms 46 are separated from each other along the rod 35, where necessary, by washers 44 (Fig. 2), and the lever arms 47 are similarly separated on the rod 34 where necessary by means of washers 45.

A Z bar 64 is provided extending completely across the machine from the plate 26 to the plate 27 and secured to the plates in any desired manner, as by having end portions 65 (Fig. 3) fitted into slots in the plates. This Z bar has a lower horizontal portion 66 extending forwardly from a vertical portion 67 and a second horizontal portion 68 at the top extending rearwardly of the vertical portion 67. The Z bar is positioned between the two lever arms 46 and 47 and just forward of the pivot rods 35 and 34. A channel member 69 is secured in any desirable manner to the under surface of the horizontal portion 66 and carries a felt pad 70 which acts as a buffer for the lever arms 47. These arms have small flanges 71 bent over from the upper edge thereof to engage the felt pad 70. The return of the key to its uppermost position is thus cushioned and made substantially noiseless.

The Z bar 64 and pivot rods 34 and 35 are rigidly supported with respect to each other at the center of the machine by means of a curved bracket 72 (Fig. 5) the ends of which fit over the rods 34 and 35 and the center section of which is secured to the Z bar by the screw 73. This bracket also acts as a spacer for the lever arms at the center.

The keys 16 are mounted on members 75 which are identical with the members 55, although mounted in reversed position so that the upper portions extend towards the front of the machine. These members 75 are mounted on lever arms which are identical to the arms 46 and 47. The keys 17 (Fig. 5) are mounted on members 76 each of which has a vertical portion 77 corresponding to the vertical portion 56 of the member 55, and a forwardly extending portion 78 upon the forward end of which the key 17 is mounted. Depression of the key 17 causes the member 76 to move downwardly with the portion 77, and therefore the key follows the substantially straight-line movement, as produced by the lever arms 46 and 47. It will be understood that all of the lever arms 47 are provided

with the springs 60 so that all of the keys are returned to their normal positions when the pressure is removed therefrom.

We have provided a novel method of transmitting motion between the key lever assemblies and the types, and by means of this novel connection, we are able to place the type assembly in any position with respect to the keys, and arrange the various types in any desired relation irrespective of the particular order of the keys. The motion is transmitted by means of flexible cables 82, as indicated in Figs. 4, 10, and 14, encased in guide tubes 80. Each cable 82 comprises a closely wound coil of wire, the turns being so close together that the cable itself is substantially non-compressible, but because of the formation it is extremely flexible. Each guide tube 80 is a seamless metal tube with its ends anchored in the machine. It may be bent in almost any desired shape but the cable will still have free longitudinal movement therein, such longitudinal movement being enhanced and made more efficient by the smooth inner walls of the tube.

A plurality of these guide tubes 80 are provided extending between the horizontal flange 68 of the Z bar 64 and the type assembly. The tubes 80 pass up through suitable holes in the horizontal flange 68 and have their ends belled over, as indicated at 81, so as to secure the tubes rigidly to the Z member 64. Each tube is secured to the Z member immediately beneath one of the arms 46, so that the upper ends of all of the tubes 80 are arranged in a row on the Z bar flange, as indicated at right hand side of Fig. 2. One of the coiled flexible cables 82 is provided inside of each tube, the cable being of such a diameter that it will slide through the tube longitudinally, regardless of the bends in the tube, and the upper end of each of these cables is adjustably secured to the lever arm 46 which is immediately adjacent to it. In order to secure the cable 82 to the lever arm 46, we provide a flange 85 (Figs. 4 and 14) on the forward end of the member 48, against which is secured a clamp 86 by means of a screw 87 which passes through both the clamp and the flange 85. The clamp may also have its inner side provided with a plurality of grooves 88 to fit the turns in the cable so as to lock the cable firmly in position with respect to the lever 46. By means of this removable clamp the effective length of the cable may be adjusted. The manner of connecting the other end of the cables so as to operate the type bars will be described hereinafter.

The platen 19 and type assembly are mounted at the left of the machine between a pair of plates 95 and 96 which extend to the left of the plate 26 and which have the configuration shown in Fig. 7. These plates are secured to the plate 26 by means of flanges 97 and 98 (Figs. 2 and 3), the former being held in position by the screws securing the rods 33 and 34 to the plate 26, and the latter being held by the screw 31 and an additional screw 99. The platen 19 is mounted between the two plates 95 and 96 on a suitable shaft 100 which is secured to the plates 95 and 96 in any desirable manner.

In the particular stenotype machine used to illustrate the invention certain types are normally caused to print when the associated keys are depressed. These types are arranged in a single row. However, additional types are provided to be operated when some of the same keys are depressed simultaneously with the operation of a shift mechanism. These types are fewer in number and are mounted below the other types. We therefore use two different forms of type bars. The type bar 105 (Fig. 9) carries the single type 106, while the type bar 107 (Fig. 8) carries, in addition to one of the types 106, another type 108 which is mounted immediately below the type 106.

In order to support the type bars 105 and 107, we provide a plurality of levers 109 which are pivotally mounted on a shaft 110 which extends between plates 95 and 96 and is rotatably mounted in these plates. These levers are substantially vertical in position and carry the type bars at their upper ends. The type bars 105 are fixed to the levers 109 in any desirable manner, as by tightly riveting them to the levers at 111. The type bar 105 is mounted substantially horizontal and when the lever 109 carrying it rocks in a counter-clockwise direction, as viewed in Fig. 9, the type 106 will move towards the platen 19 striking the ribbon 21 against the paper 20 and causing the type to print thereon.

The type bars 107 are mounted pivotally on the levers 109 by suitable rivets 112 which will permit rotation of the type bars with respect to the levers. Each type bar 107 has an extension 113 toward the right thereof terminating in a circular end which fits into a channel member 114 extending from front to back of the machine and mounted for vertical movement in a manner to be hereinafter described. Rotation of the lever arm 109 supporting the type bar 107 will cause that type bar, when in normal position, to move the type 106 towards the platen, to print the type on the paper, at the same time permitting the end 113 to slide towards the left in the channel member 114. Upon downward movement of the channel 114, however, the end 113 of the type bar is moved downwardly which raises the left end of the type bar carrying the type and raises the second type 108 into position to be printed when the lever 109 is swung towards the left about its pivot point.

In order to move the levers 109, we provide auxiliary levers 120 which are pivoted on a shaft 121, mounted between the plates 95 and 96. Each of the levers 120 is also mounted substantially vertically in the machine and carries a cam extension 122 which is adapted to engage a roller 123 rotatably mounted on the adjacent lever 109 a little more than half way up the lever. The arrangement of the cam 122 and roller 123 is such that when the lever 120 is rotated in a clockwise direction, as viewed in Figs. 8 and 9, the lever 109 is first caused to rotate rapidly about its pivot 110 in a counter-clockwise direction, as viewed in Figs. 8 and 9, and to thereupon slow down as the point of the cam rounds the end of the roller and to move slower and with greater force against the platen as the lever 120 is further rotated.

The shafts 110 and 121 are secured in the plate 95 and 96 by means of a key 118 which is held against the plate 96 by a screw 119, the ends of the key fitting into slots cut into the shafts adjacent the ends thereof.

The levers 109 are spaced from each other in regular order from front to back of the machine and in order to maintain the proper spacing and to keep the levers in their respective planes, we provide a comb 124 (Figs. 9 and 15) for the lower ends of the levers and a comb 125 for the upper ends thereof (Fig. 9). The comb 124 is mounted at the bottom of the plates 95 and 96 and com-

prises a flat plate having end extensions 126 which fit tightly into suitable slots provided for that purpose in the bottom edges of the plates, as indicated. The right side of the comb 124 is provided with slots 127, there being one slot for each of the levers 109 which rock in the slots and are thereby maintained in position.

The upper comb 125 comprises a flat plate which extends slightly beyond the plates 95 and 96, being mounted upon flanges 128 which extend outwardly from the lowest point of the cut-out portion 129 of the plates 95 and 96, the comb being held in position against the flanges by means of long screws 130 which also act as guides for the ribbon 21. The right side of the comb 125 is bent upwardly and is provided with slots 131 to receive the upper ends of the levers 109 between the rollers 123 and the type bars 105 and 107, thus permitting each lever 109 to swing about its pivot from side to side of the machine while kept in its individual plane. An angle plate 132 is welded to the lower surface of the comb 125 and is provided with a plurality of holes along the lower edge for securing the upper ends of a plurality of springs 133, the lower ends of which are attached to arms 134 formed integral with and extending to the left of the lower ends of the levers 109.

A tube anchor bar 136 extends across the machine between the plates 95 and 96 and is attached to the feet 36 and 37 by means of suitable flanges 137 which are bent over the edges of the plate 26 and are secured in place by means of suitable screws 138. The lower end of each of the tubes 80 is secured in this anchor bar 136, the tubes passing through suitable holes in the bar and having their ends belled over to secure the tubes in place. Each of the tubes is secured in the tube anchor bar at a point in alignment with one of the levers 120 and the other end of each of the cables 82 extends out of the end of its guide tube 80 and is secured to the edge of the aligned lever 120 by suitable clamping means 139.

By depressing one of the keys in the typewriting machine, the lever 46 to which that key is operatively connected acts to depress the cable 82 connected to it and to force the cable through the tube 80, thus pushing the other end of the cable out of the other end of the tube and rotating the lever 120 in a clockwise direction, as viewed in Figs. 8 and 9. This causes the cam 122 to rotate over the roller 123, thus causing the lever 109 to rotate in a counter-clockwise direction towards the platen and to press the type against the platen. The lever arms 109 are caused to move to their normal positions again by means of the springs 133 when pressure is removed from the keys. This pushes the lever 120 towards the right and the cables 82 back up through their guide tubes 80. The key levers are at the same time returned to their normal positions by the springs 60, already described.

The use of the cables 82 and guide tubes 80 provides connections between the keys and types which occupy very little space in the machine and the space which is occupied may be space that would otherwise be wasted, since the tubes can be bundled together in any desired manner. As will be seen in Fig. 9, the tubes 80 enclosing the cables extend outwardly towards the right of the machine from the anchor bar 136 substantially in a single plane, and each tube is bent out of that plane towards the rear of the machine to reach its particular location in the Z bar 64. In addition the tubes are dustproof and protect the cables against mechanical injury making it difficult for them to get out of order.

Every time one of the keys is depressed the paper strip 20 is caused to move in the machine in the direction of the arrow, the platen 19 rotating in a counter-clockwise direction, as viewed from the front of the machine. In order to accomplish the feeding of the paper, we provide a pair of rollers 135 (Figs. 1, 7, and 10) mounted on spindle 143 which are arranged parallel to the shaft 100 and which are mounted on a frame 143a pivoted on an auxiliary shaft 144. The shaft 144 is mounted on brackets 144a which are secured, one adjacent each of the plates 95 and 96 to a shaft 140 rotatably mounted in upstanding members 141 and 142 of the plates 95 and 96 respectively. The shaft 144 is thus positioned above the shaft 140 so that when the shaft 140 is rotated in a counter-clockwise direction as viewed from in front of the machine, the frame 143a will be moved towards the left.

The rollers 135 are provided with one-way ball clutches, as illustrated in Figs. 12 and 13. Each of the spindles 143 is provided with a sleeve 145 which has ratchet-like teeth 146, as seen in Figs. 12 and 13. The roller is made in two parts, a cylindrical shell 147 closed at one end and a disc 148 which closes the other end. Balls 149 are provided between every two ratchet teeth within the shell 147, as shown. A rubber rim 150 is fitted over the shell 147.

Rotation of the roller in a clockwise direction is freely permitted, because the balls tend to roll towards the large ends of the ratchet teeth, while rotation in a counter-clockwise direction is prevented because the balls tend to wedge in between the sloping teeth of the ratchet and the outer shell 147 of the roller. When the rollers 135, therefore, move towards the left they do not roll but push the paper together with the platen 19 towards the left, thus causing the platen to rotate and the paper to feed a predetermined distance through the machine. When the rollers move to the right they roll freely and the paper is not moved.

The movement of the rollers 135 is controlled by means of a rack 151 (Figs. 2, 8, and 10) which meshes with a gear 152 rigidly attached to the shaft 140. The rack 151 is at the upper end of a bell crank lever 153 mounted on a pin 154 secured to the plate 96 by a nut 155. The lower arm 156 of the bell crank lever extends to the right through a slot 157 (Figs. 3 and 8) provided to receive it in the plate 26. The arm 156 extends slightly beyond the plate 26 and has attached to it the end of a cable 158, which passes through a tube 159 which has its forward end anchored in a small bracket 160 secured to the plate 26 by suitable screws 161. The tube 159 extends upwardly and rearwardly, close to the plate 26, and the rear end is anchored in a clamp 162 secured to the horizontal portion 68 of the Z bar 64 by means of a screw 163. The tube 159 and cable 158 are similar to tubes 80 and cables 82.

The rear end of the cable 158 is attached to a bail 165 which is mounted on two lever arms 166 pivotally supported on the rod 34, there being one lever arm adjacent the plate 26 at one end of the machine and the other adjacent the plate 27 at the other end. The cable 158 is attached to the arm 166 adjacent the plate 26 by means of a clamp 167 and screw 168. The bail 165 comprises a channel shaped member with a pad 169 of felt within it, the channel being mounted so that the pad faces the rear of the machine. Movement of

the bail towards the front, pivoting about the rod 34, will cause the cable 158 to be pushed through the tube 159, which rotates the bell crank lever 153 in a clockwise direction, as viewed from in front of the machine, so as to move the rack 151 to the right under the pinion 152. This rotates the pinion in a counter-clockwise direction, thus moving the rollers 135 towards the left and feeding the paper. The bell crank lever 153 is urged towards its normal position by means of a spring 170 (Fig. 8) on the left side of the plate 26 which has its lower end connected to the arm 156 of the bell crank lever and its upper end connected to a pin 171 attached to the plate 26.

The bail 165 is caused to move when any one of the keys is depressed and also when the shift mechanism is operated. To this end each of the lower lever arms 47 is provided at its rear end with an upstanding arm 172 which is adapted to engage the felt pad 169 of the bail 165. When any one of the keys is depressed the corresponding lower lever arm 47 is rotated in a clockwise direction, as viewed in Figs. 3 to 6, inclusive, and 10, which causes the arm 172 on that particular lever arm to press against the felt pad 169 and thus causes the bail to swing forward, pivoting about the rod 34. The forward movement of the bail 165 is cushioned by means of a pair of cups 173 (Fig. 4) positioned at spaced intervals along the Z bar 64 and containing felt pads 174. The bail 165 is urged towards its normal position by means of a spring which is similar to the springs 60 and is connected between a rearwardly extending portion of the lever 166 adjacent the plate 27 and the lowermost rod 33.

The above arrangement provides for movement of the paper forward in the machine when any of the keys is depressed. In order to prevent the paper from moving back again when the feeding rollers 135 return to their normal position, we provide another roller 175 which is mounted on a bracket 176 which extends across the machine between the plates 95 and 96. The bracket 176 has two downwardly depending arms 177 and 178 at the back and front respectively which are rotatably mounted on the shaft 140. The central portion of the bracket is cut out forming side members 180 which extend towards the left and then downwardly and are formed integral with a toothed member 181, against which the paper may be torn when it is desired to remove a portion of the paper from the machine. At the center of the bracket 176 we provide a downwardly extending flange 182, which supports the bearing 183 for the roller 175. The roller 175 is provided with a one-way clutch mechanism similar to the rollers 135 already described.

The flange 177 is provided with a downwardly extending lug 184 (Fig. 9), to which is connected one end of a spring 185, the other end of the spring being connected to a pin 186 attached to the plate 26. This spring urges the bracket towards its lowermost position with the roller 175 in contact with the paper which passes over the platen 19.

Two fine wire springs 187 are attached to the rearmost portion of the bracket 176, and these springs extend towards the left as indicated in Figs. 7, 8, and 9, to bear against the bearing pins 143 of the rollers 135, so that as these rollers move back and forth to feed the paper, they are urged towards the paper by means of the wire springs 187.

A cover plate 188 is provided between the top of the plate 26 and the right hand edge of the bracket 176. This plate is pivoted on a shaft 189 which is secured by brackets 190 to the top of the plate 26 and is just wide enough to catch the edge 191 of the bracket 176, as indicated in Figs. 8 and 9. The plate 188 is urged downwardly to the position shown in Figs. 8 and 9 by means of a spring 192 which is wound around the shaft 189.

If it is desired to raise the rollers 135 and 175 from the platen 19, the cover plate 188 may first be raised by means of an offset portion 193 provided in the center thereof, whereupon the bracket 176 may be raised, and subsequently the frame 143a may be raised as shown in Fig. 7. The pin 143 at the forward end of the frame 143a may be provided with a knob 194 (Figs. 1 and 12) to facilitate raising the rollers.

It has been stated that the type bars 107 can be rotated about their pivots 112 to shift to a different set of types by movement of the channel member 114. The channel member 114 is mounted on a vertically extending plate 200 (Figs. 3 and 8) which is provided at its upper end with a pair of upstanding guide fingers 201 which are guided in a block 202 secured to the plate 26 by means of a screw 203. The block 202 is provided with grooves on opposite side edges to fit the fingers 201, and acts to space the plate 200 a short distance from the member 26 although permitting vertical reciprocation thereof. In a similar manner, the lower end of the plate 200 is mounted for vertical reciprocation in a block 204 which is supported at the lower end of the plate 26 by means of a screw 205. The block 204 is similar to the block 202 and is provided with grooves on the side edges thereof which receive downwardly extending fingers 206 of the plate. The plate 200 is thus mounted for vertical reciprocation through a limited distance. The channel member 114 is secured to the plate 200 by means of an upwardly extending member 207 which is welded or otherwise rigidly secured to the channel 114 and is held in place against the plate 200 by a screw 208.

The plate 200 carries a roller 209 which extends out towards the right of the machine and lies in a cam slot 210 formed in an irregularly shaped plate 211 which is pivotally mounted on the left side of the plate 26 by means of a screw 212 which is shown exaggerated in length in Fig. 10. On the right side of the plate 26 and pivotally mounted on the plate by the same screw 212 is a segment of an internal gear 213, this gear being secured to the plate 211 by means of a pin 214 (also shown exaggerated in length in Fig. 10), so that the two always move together. The gear 213 is provided with an arc of internal teeth 215. The pin 214 passes through a suitable opening 216 in the plate 26 so as to permit the plate 211 and the gear segment 213 to rotate through a limited angle.

A shaft 217 is rotatably mounted between the plates 26 and 27 at a point just in front of the lower lever arms 47, the shaft extending through the opening in the internal gear member 213. The left end of the shaft adjacent the internal gear member is provided with a pinion 220, preferably made of fibre and having teeth at each end, the teeth at the left end being arranged to mesh with the teeth 215 in the gear member 213, so that when the shaft 217 is rotated in the proper direction, the gear member 213 is rotated about its pivot 212 to rotate the plate 211 causing the

cam slot 210 to move with respect to the roller 209 so as to cause the plate 200 to move downwardly. Rotated in the opposite direction, the shaft 217 will cause the gear member 213 to return to its normal position thus causing the cam slot 210 in the plate 211 to raise the roller 209 and the plate 200 which is attached to it.

In order to rotate the shaft 217, we provide a bar key 225 which is mounted to the rear of the keys 15 and can be depressed simultaneously with any one of those keys in the rear row. This bar key is mounted on two members 226 and 227, the former at the left side of the machine, shown in Figs. 4 and 10, and the latter at the right side of the machine, shown in Fig. 5. These members are alike and each has a horizontal portion 228 extending forwardly and another vertical portion 229 integral with the forward end of the horizontal portion 228. The forward edge of the vertical portion 229 is provided with rack teeth 230 arranged in an arc so as to mesh with the teeth 231 on the right end of the pinion 220, in the case of the member 226, and to mesh with a pinion 232 fixed on the other end of the shaft 217, in the case of the member 227. The members 226 and 227 are each mounted upon two of the levers 46 and 47, the upper end of the vertical portion 229 being pivoted to the forward end of the lever 46 at 232 while the lower end of the portion 229 is pivoted to the forward end of the lever 47 at 233. The levers 46 and 47 supporting the members 226 and 227 are pivoted on the rods 35 and 34 respectively, as already described in connection with the key supports, and therefore when the key 225 is depressed, the portion 229 containing the rack teeth 230 moves downwardly and the arc of the rack teeth is so designed that it will maintain the teeth in contact with the teeth on the pinions 220 and 232, irrespective of the slight rocking movement of the members 226 and 227 caused by the lever arms 46 and 47 moving about their pivot points. Therefore, when the bar key 225 is depressed, the shaft 217 is rotated and the channel 114 is lowered, thus rotating the type bars 107 and causing the lower type 108 on any one of them to print when the associated key is depressed. The springs 60 attached to the rear ends of the particular levers 47 return the bar key 225 to its normal position after the pressure of the finger has been removed from it.

It will be noted that since the lever arms 47 have the upwardly extending arms 172 at the rear thereof, the bail 165 which operates the paper feed mechanism will also be moved when the bar key 225 is depressed. Thus the bar key 225 is used to advance the paper strip when operated alone. When so operated, the rotation of the type bars 109 will have no effect, since these type bars are not moved towards the platen. It is only when the bar key 225 is depressed simultaneously with one of the keys 15 that the lower types 108 on the type bars 107 are printed.

The ribbon 21 is arranged to move between the platen and the types any time one of the keys is depressed, so that during operation of the machine, the ribbon is intermittently moved with respect to the type to present a different place on the ribbon each time the types strike. In the machine illustrated, we use a continuous ribbon which passes completely around the machine and is driven by a roller 235 (Figs. 1 and 11) which is rotatably mounted at the forward corner of the machine on a vertical shaft supported between the foot 40 on the forward edge of the plate 27 and a bracket 236 attached to that plate. The plate 27 is cut out at 237 in order to receive the roller. The roller is provided with a bevel gear 238 at its upper end which meshes with another bevel gear 239 on a clutch member 240 rotatably mounted between a portion of the bracket 236 and another bracket 241 which is also secured to the plate 27. The clutch member 240 is a one-way clutch, similar in construction to the clutches on the paper feed rollers 135, and is driven by an arm 242 which extends downwardly from the left end thereof. A link 243 is pivotally connected to the lower end of the arm 242 and its other end is pivoted to one arm of a bell crank lever 244 which is pivotally mounted on the plate 27 by means of a pin 245 on the left of the plate. The pin 245 is long enough to space the bell crank lever 244 so as to align with the link 243. The other arm 246 of the bell crank lever 244 is pivotally connected to the forward end of a link 247 which extends towards the rear of the machine where its other end is pivoted to a lug 248 attached to the paper feed bail 165.

The arrangement is such that every time the bail 165 moves towards the front of the machine when any one of the keys is operated, the link 247 is pushed forward thus pushing the lever 243 and causing the clutch arm 242 to rotate through a limited angle in a clockwise direction, as viewed in Fig. 6. This causes the bevel gear 239 to rotate by virtue of the one-way clutch, which in turn rotates the roller 235 which advances the ribbon. Upon the return of the paper feed bail 165 to its normal position, the link 247 is withdrawn towards the rear and the link 243 pulls the clutch arm 242 rearwardly. However, by virtue of the clutch operation, the gear 239 does not turn during this return movement, and therefore the roller 235 does not turn and the ribbon is stationary.

It will be noted from an inspection of Fig. 6, that the bell crank lever 244 only has to rotate a short distance before the link 243 has reached its forward limit of movement and further slight rotation of the bell crank 244 does not move the link 243. By means of this toggle the ribbon is caused to stop moving before the full stroke of the key has been reached and before the types strike against the platen. Therefore, the ribbon is stationary when the type strikes and there is no tendency to tear the ribbon at this time.

The ribbon is guided across the front of the machine by means of two large rollers 250 and 251, these rollers being mounted for free rotation on brackets 252 and 253 respectively which are respectively supported on the plates 27 and 26. The roller 250 is preferably arranged to carry a thick ink pad 254 (Fig. 5) which may be of felt or other desirable absorbent material and which may be supplied with ink by means of a dropper through holes 255 in the upper plate 256 of the roller. The felt pad absorbs the ink and inks the ribbon as the ribbon passes over it. The roller 251 merely has a felt periphery which absorbs any excess ink from the ribbon as it passes over it.

At the left end of the machine, we provide a ribbon guide 257 mounted on the corner of the plate 26 which guides the ribbon over the corner of the plate. From the guide 257 the ribbon passes over the pins 130, these being so arranged that the ribbon can move between the platen and the types without touching either.

At the rear of the machine we provide a ribbon guiding channel member 258 which extends slightly beyond the plates 26 and 27 and is pro-

vided at the extreme ends with curved portions 259 and 260 to guide the ribbon over the edges of the plates 26 and 27. From the curved portion 260 of this plate, the ribbon moves across the right end of the machine to the driving roller 235.

The casing 23 is preferably made in two parts which clamp together at the right side of the machine by means of the clamp 263 and is secured to flanges 264, 265, 266, and 267, formed on the feet, by means of screws 268, 269, 270, and 271, respectively. A plate 272 (Figs. 3 to 6, 8, and 9) is preferably mounted on the bottom of the machine and is held against the plates 26 and 27 by means of the rubber feet. This plate, as shown, is provided with overturned flanges 273 and 274 at the sides thereof, so as to act as a guide for the paper strip which then may be fed into the right side of the machine from a stack of paper kept at that side, the left end of the plate delivering the paper to the platen, as indicated in Fig. 9. A curved plate 275 is mounted beneath the platen 19 for guiding the paper strip onto the right side of the platen. This plate has side flanges 276 which are rotatably supported on a shaft 277 extending between the plates 95 and 96.

From the above description it will be apparent that we have provided a typewriting machine in which the novel arrangement of transmitting force from the keys to the types by means of the flexible cables permits the types to be positioned anywhere with respect to the keys and in an order entirely independent of the order of the keys, since the tubes containing the flexible cables may be bent and turned in any direction. This is an important feature of the invention because it permits the working out of a keyboard which is the most efficient for speed and ease of manipulation of the fingers without interfering with the necessary order of the types for printing across the paper. At the same time, the arrangement permits the types to be placed in any way with respect to the keys, thus allowing the whole machine to be made in a compact form as will be evident from the various figures which indicate that the machine illustrated is but little larger than the keyboard itself. Attention is also drawn to the arrangement of the key lever assemblies which eliminate the use of a comb to guide the keys and yet support the keys against substantial sidewise movement and at the same time give them a substantial straight-line movement which is an aid to faster and smoother manipulation thereof. Transmission of force between the key and the type bar is such as to increase the force of the type against the platen towards the end of the downward stroke of the key, and the whole assembly provides a substantially silent operation with a feather touch, requiring very little effort on the part of the operator to depress the keys.

Since certain changes may be made in the above construction and different embodiments of the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which as a matter of language might be said to fall therebetween.

We claim:

1. In a typewriting machine a key, means to mount said key for limited movement in said machine, a member forming a part of said key mounting means operatively connected to said key, a coil spring cable having one end attached to said member, clamping means on said member having threads to engage the coil of said cable, a type bar, means to mount said type bar for limited movement in said machine, means to secure the other end of said cable to said type bar, and a tubular guide for said cable.

2. In a typewriting machine a type bar, a lever pivoted in said machine and supporting said type bar, a second lever pivoted in said machine, said second lever being in camming relation with said first lever, whereby movement of said second lever about its pivot will cause movement of said first lever and therefore movement of said type bar with an increasing force as said type bar moves in the printing direction, and means to move said second lever.

3. In a typewriting machine a lever pivoted in said machine, a type bar supported on said lever, a second lever pivoted in said machine and having a cam surface thereon, means on said first lever adapted to be engaged by said cam surface when said second lever is moved about its pivot, said cam surface having a configuration such that said type bar supporting lever will move rapidly for a portion of the movement of said second lever and then slowly with greater force for another portion of said movement, and means to move said second lever.

4. In a typewriting machine a lever, means to pivot said lever in said machine, a type bar supported on said lever, means to urge said lever to move in one direction about its pivot, a second lever, means to pivot said second lever in said machine, said levers having camming relation with each other, whereby said type bar supporting lever will move rapidly in opposition to said urging means during a portion of the movement of said second lever and move slowly and with greater force for another portion of said movement, and means to move said second lever.

5. In a typewriting machine a frame, a lever pivotally mounted in said frame, a type bar supported on said lever, means to urge said lever in one direction about its pivot, a second lever pivotally supported in said frame adjacent said first lever, a cam surface on said second lever adapted to engage said first lever so as to move said first lever in opposition to said lever urging means when said second lever is moved, said cam surface being such that the force transmitted to said first lever by said second lever is increased as said first lever moves said type bar in the printing direction, and means including a cable connection for moving said second lever.

6. In a typewriting machine a frame, a lever having one end pivoted in said frame, a type bar supported at the other end of said lever, a second lever having one end pivoted in said machine, said second lever being mounted adjacent said first lever, a cable connected to the other end of said second lever, a cam surface on said second lever, a projection on said first lever adapted to be engaged by said cam surface, means to urge said first lever about its pivot so as to maintain said projection against said cam surface, said cam surface being such that said first lever will move rapidly during a portion of the movement of said second lever, and manually operated

means to move said cable so as to move said second lever.

7. In a typewriting machine a frame, a lever pivoted in said frame, a type bar pivotally supported on said lever, a pair of types on said type bar, an extension on the end of said type bar opposite to said types, a guide for said extension so as to permit movement of said lever while maintaining a substantially straight line movement of said type bar, and means to shift the position of said guide so as to shift said type bar into either of two positions for printing either of said types.

8. In a typewriting machine, a frame, a plurality of levers pivotally mounted on the same axis in said frame, means to move said levers selectively through a limited distance about the pivots thereof, a type bar pivotally mounted on each of said levers, a plurality of types on each of said type bars, an extension on each of said type bars, means to guide said extensions so as to insure substantially straight line movement of said type bars when said levers are moved, and means to shift said guiding means so as to change the position of said type bars on said levers.

9. In a typewriting machine, a frame, a plurality of levers pivotally mounted in said frame about the same axis, a type bar pivotally supported on each of said levers, said type bars being in substantial alignment, a plurality of types on each of said type bars, the types on different bars being in substantial alignment, an extension on each of said type bars, said extensions being in substantial alignment, a channel member adapted to receive and guide said extensions, and means to shift said channel member so as to change the position of said type bars with respect to said levers.

10. In a typewriting machine, a frame, a key mounted for movement in said frame, a lever pivotally mounted in said frame, a tube extending from a point adjacent said key to a point adjacent said lever, means within said tube to transmit motion between said key and said lever, a second lever pivotally mounted in said machine adjacent said first lever, camming means on one of said levers adapted to cooperate with the other of said levers so as to move said second lever when said first lever is moved, and a type bar supported on said second lever.

11. In a typewriting machine, a frame, a key mounted for movement in said frame, a lever pivotally mounted in said frame, a tube extending from a point adjacent said key to a point adjacent said lever, means within said tube to transmit motion between said key and said lever, a second lever pivotally mounted in said machine adjacent said first lever, camming means on one of said levers adapted to cooperate with the other of said levers so as to move said second lever when said first lever is moved, and a type bar supported on said second lever, said camming means being so formed that said second lever will move rapidly for a portion of the movement of said first lever.

12. In a typewriting machine, a frame, a key mounted for movement in said frame, a lever pivotally mounted in said frame, a tube extending from a point adjacent said key to a point adjacent said lever, means within said tube to transmit motion between said key and said lever, a second lever pivotally mounted in said machine adjacent said first lever, camming means on one of said levers adapted to cooperate with the other of said levers so as to move said second lever when said first lever is moved, a type bar supported on said second lever, and means for normally maintaining said second lever in camming relation with said first lever.

13. In a typewriting machine, a frame, a key mounted for movement in said frame, a lever pivotally mounted in said frame, a tube extending from a point adjacent said key to a point adjacent said lever, means within said tube to transmit motion between said key and said lever, a second lever pivotally mounted in said machine adjacent said first lever, camming means on one of said levers adapted to cooperate with the other of said levers so as to move said second lever when said first lever is moved, and a type bar supported on said second lever, said motion transmitting means being a flexible cable.

14. In a typewriting machine, a frame, a key mounted for movement in said frame, a lever pivotally mounted in said frame, a tube extendtending from a point adjacent said key to a point adjacent said lever, means within said tube to transmit motion between said key and lever, a second lever pivotally mounted in said frame, cam means operatively connecting said levers so as to cause said second lever to move with increased force when said first lever is moved, a type bar pivotally mounted on said second lever, a plurality of types on said type bar, and means for selectively changing the position of said type bar with respect to said second lever.

15. In a typewriting machine, a frame, a plurality of keys mounted for limited movement in said frame, a plurality of levers pivotally mounted on the same axis in said machine, said levers being positioned at one side of said keys and said axis extending from front to back of said frame, a type bar pivotally supported on each of said levers, a plurality of types on each of said type bars, an extension on each of said type bars, said extensions being in substantial alignment, a channel member positioned adjacent said type bars and adapted to receive and guide said extensions whereby the positions of said type bars on said levers are controlled, means to shift the position of said channel member, and means including flexible cables for transmitting motion between said keys and said levers.

16. In a typewriting machine, a key, means to guide said key in a substantially straight line in a predetermined direction, a lever forming a part of said last mentioned means and having one end operatively connected to said key, means for pivotally supporting the other end of said lever, a type bar, and flexible means connected to said lever for transmitting motion from said key to said type bar.

17. In a typewriting machine, a key, means to mount said key for substantially straight line movement in a predetermined direction, a lever forming a part of said last mentioned means and having one end pivotally connected to said key, means for pivotally supporting the other end of said lever, a type bar, means to mount said type bar for movement in a predetermined direction, and a cable connecting said type bar with said lever whereby movement of said key will cause movement of said type bar.

18. In a typewriting machine, a frame, a key, means to mount said key in said frame for movement in a predetermined direction, a lever forming a part of said last mentioned means and having one end operatively connected to said key and the other end pivotally supported in said frame, a type bar, means to mount said type bar

for movement in a predetermined direction, a tube extending between said lever and said type bar and rigidly secured to said frame, and means within said tube to transmit motion from said lever to said type bar.

19. In a typewriting machine, a frame, a key, means to mount said key in said frame for substantially straight line movement in a predetermined direction, a lever forming a part of said last mentioned means and having one end operatively connected to said key and the other end pivotally supported in said frame, a type bar, means to mount said type bar in said frame for movement in a predetermined direction, a tube extending between said type bar and said lever and secured to said frame, and a flexible cable having one end attached to said lever adjacent the point of pivot on said frame and extending through said tube, the other end of said cable being operatively connected with said type bar, whereby movement of said key will cause movement of said type bar by means of said cable.

20. In a typewriting machine, a frame, a key, a member to which said key is attached, a lever having one end pivoted to said member and the other end pivoted to said frame, means to guide said member so as to provide for substantial straight line movement of said key, a type bar, means to mount said type bar in said frame for movement in a predetermined direction, a lever operatively connected to said type bar, a tube extending between said type bar lever and said key lever and rigidly supported on said frame, and a flexible cable extending through said tube and having one end connected to said key lever adjacent the frame and the other end connected to said type bar lever, whereby movement of said key will effect movement of said type bar by means of said cable.

21. In a typewriting machine, a frame, a key, a member to which said key is attached, a pair of lever arms spaced apart and parallel to each other and each having one end pivotally connected to said member, the other ends of said lever arms being pivotally supported on said frame, a type bar, means to support said type bar for movement in a predetermined direction, a lever associated with said type bar, a tube extending between said type bar lever and one of said lever arms and rigidly secured to said frame, and a flexible cable extending through said tube and having one end connected to the last mentioned lever arm adjacent said frame and the other end connected to said type bar lever, whereby movement of said key will effect movement of said type bar by means of said cable.

22. In a typewriting machine, a frame, a key, a member to which said key is attached, a pair of lever arms spaced apart and parallel to each other, one end of each of said lever arms being pivotally connected to said member and the other end being pivotally supported on said frame, a type bar, means to support said type bar for movement in a predetermined direction in said frame, a lever operatively connected to said type bar, a tube extending between one end of said lever and one of said lever arms and rigidly secured to said frame, a flexible coiled wire cable within said tube, means to secure one end of said cable to said one lever arm adjacent its pivotal connection to said frame, and means to secure the other end of said cable to said type bar lever, whereby movement of said key will effect movement of said type bar.

23. In a typewriting machine, a frame, a key, a member to which said key is attached, a pair of lever arms each having one end pivoted to said member and arranged parallel to each other, the other ends of said lever arms being pivotally supported on said frame, a type bar, a tube extending between said type bar and a point on one of said lever arms adjacent the place where said arm is pivoted on said frame, and means within said tube to transmit motion between said lever arm and said type bar.

24. In a typewriting machine, a frame, a key, a member to which said key is attached, a pair of spaced parallel lever arms having one end of each pivotally connected to said member, the other ends of said lever arms being pivoted on said frame, a type bar, a tube extending between one of said lever arms and said type bar and rigidly secured to said frame, and a flexible cable attached to said last mentioned lever arm at a point adjacent the pivotal connection thereof to said frame and extending through said tube with its other end operatively associated with said type bar, whereby movement of said key causes movement of said type bar.

25. A typewriting machine for printing type characters simultaneously across a strip of paper, comprising an elongated frame, a keyboard arranged at the top of a frame and of substantially the same length as the frame, said keyboard including rows of depressible keys extending lengthwise of the frame, a platen arranged at one end of the frame and positioned transversely of the rows of keys, a plurality of type characters mounted side by side at the same end of the frame, a type carried by each of said type carriers, said types being arranged in a straight line transversely of the frame and cooperating with the platen, and cables arranged substantially directly beneath said keyboard and operatively connecting said type carriers and keys.

26. In a typewriting machine for printing a plurality of types simultaneously across a strip of paper, a frame, a group of keys mounted in said frame for movement in substantially vertical planes, said frame conforming in shape to the general outline of the group of keys and being slightly larger than said group of keys, a plurality of key levers, each of said keys being mounted on a key lever, a pair of lever arms having one end of each pivotally mounted on said frame and the other end pivotally connected to said key levers, whereby said key levers will have substantially straight line movement and the angularity of the key will not be substantially altered when the key is depressed, a plurality of type carriers mounted side by side adjacent said frame, a type carried by each of said type carriers, said types being arranged in a straight line across and adjacent to one of the sides of said frame, means to hold a paper strip in a position to be struck by said types when said type carriers are moved in the proper direction, and flexible connecting means arranged substantially directly beneath the keyboard and operatively connecting said key levers and type carriers to cause a type carrier to move when its key is depressed, so as to print the type carried by the last-mentioned type carrier.

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