Jan. 11, 1966 S. H. YOUNG 3,228,507

HAND OPERATED PRINTER WITH TRANSLATABLE KEYBOARD

Filed Nov. 6, 1961 5 Sheets-Sheet 1

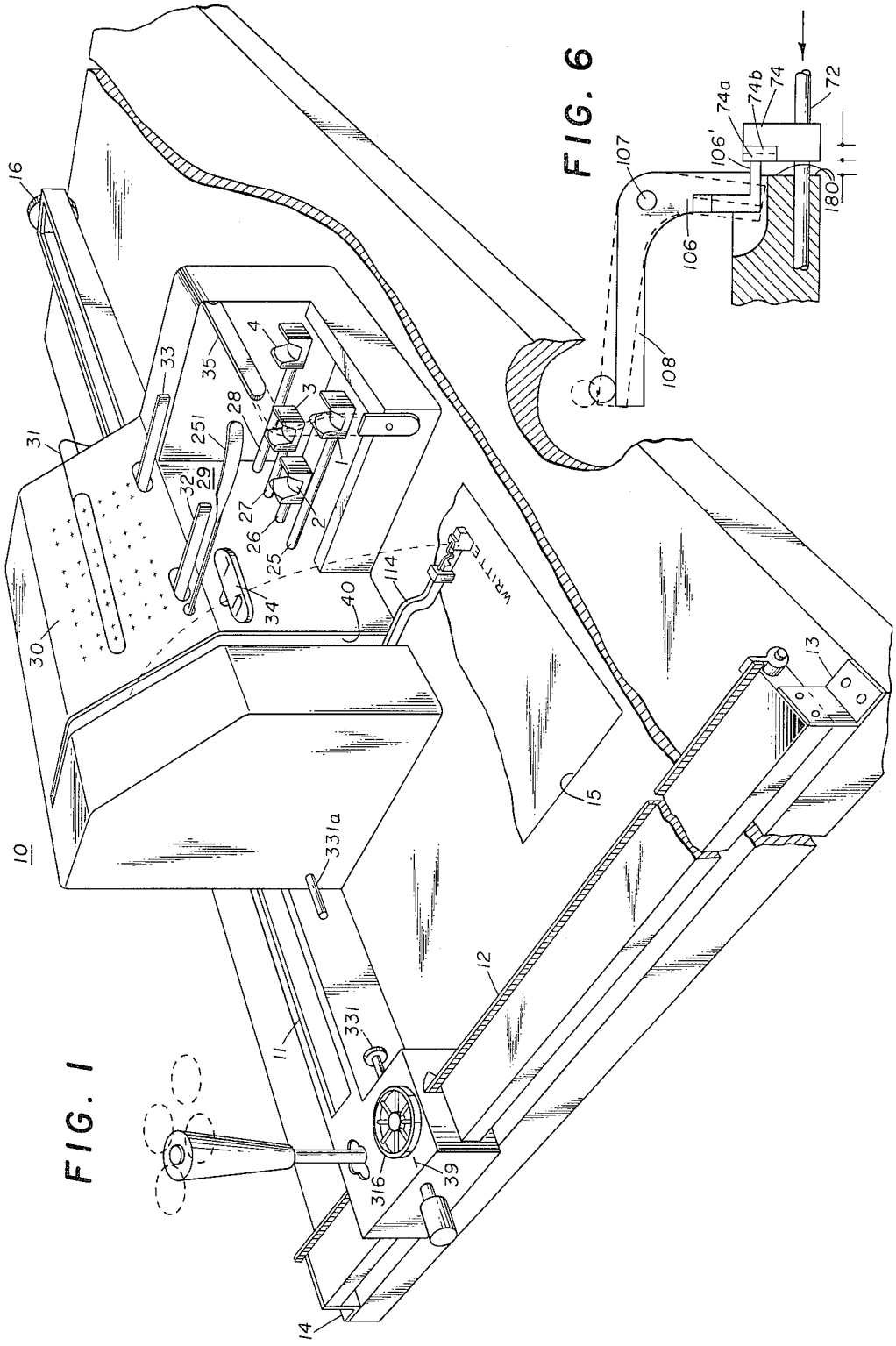


FIG. 1

FIG. 6

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HAND OPERATED PRINTER WITH TRANSLATABLE KEYBOARD

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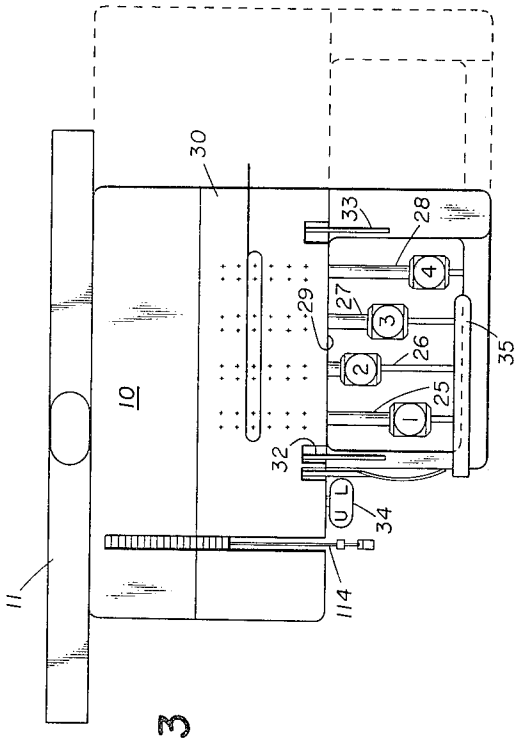


FIG. 3

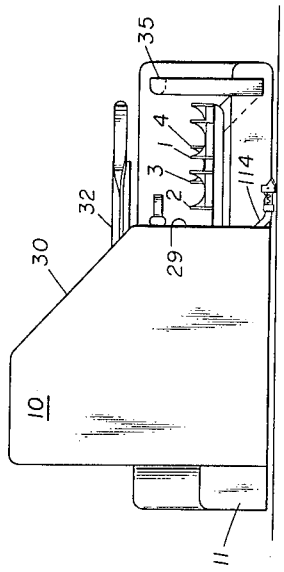


FIG. 4

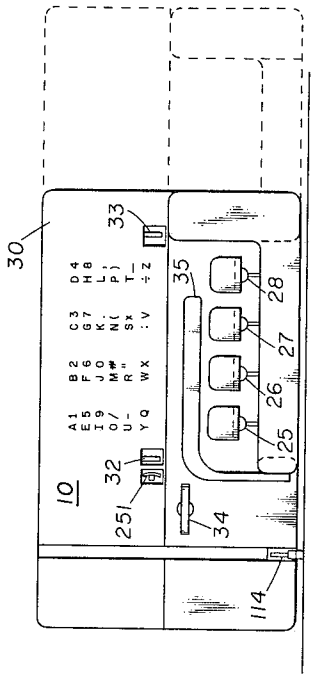


FIG. 2

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HAND OPERATED PRINTER WITH TRANSLATABLE KEYBOARD

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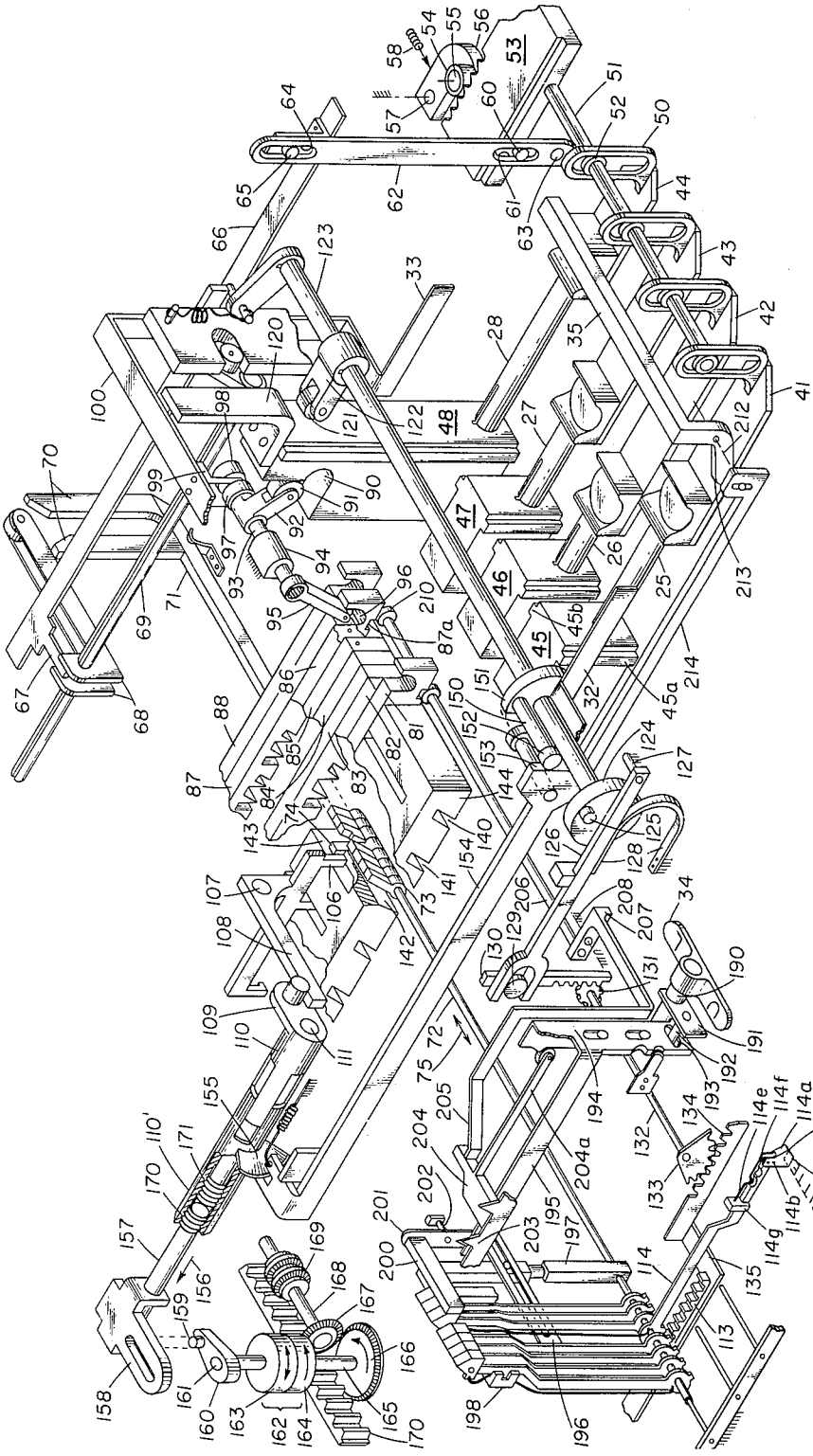


FIG. 5

HAND OPERATED PRINTER WITH TRANSLATABLE KEYBOARD

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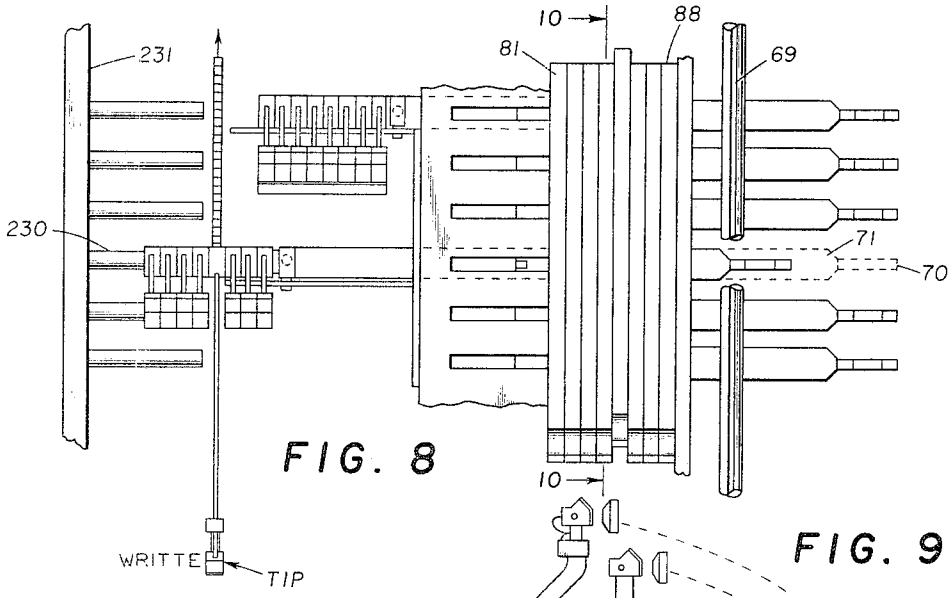


FIG. 8

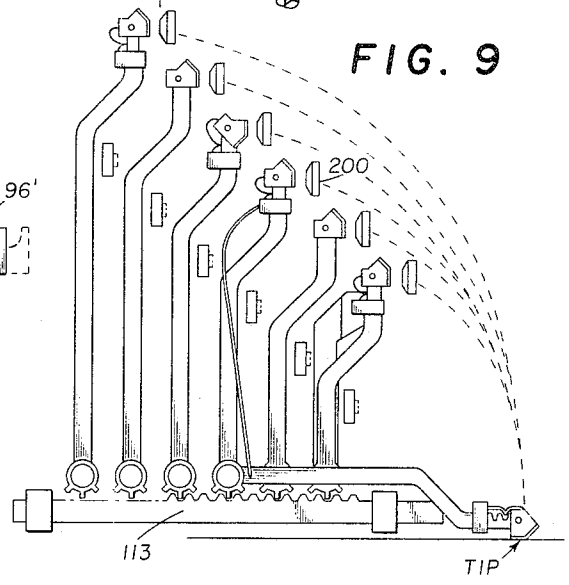


FIG. 9

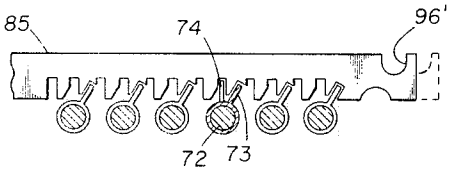


FIG. 10

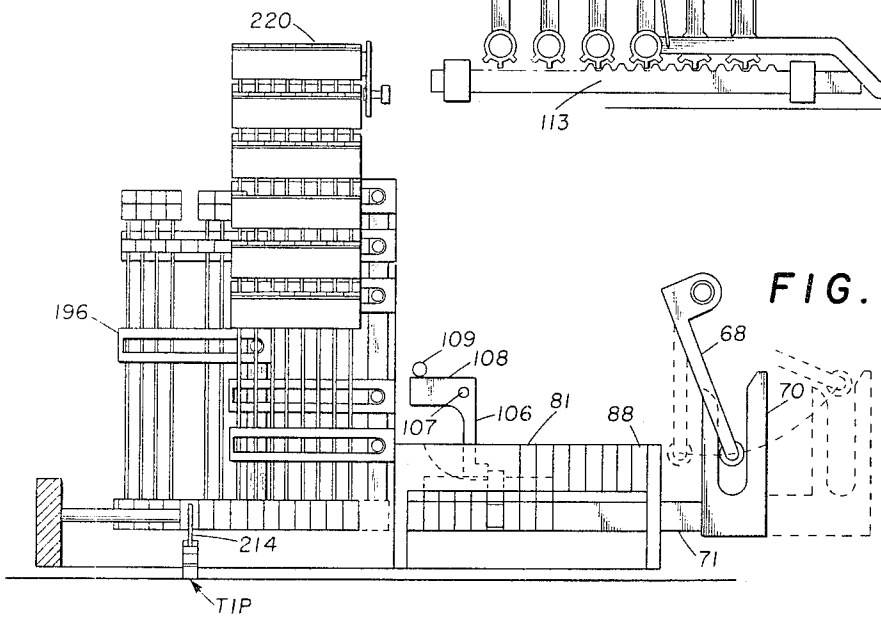


FIG. 7

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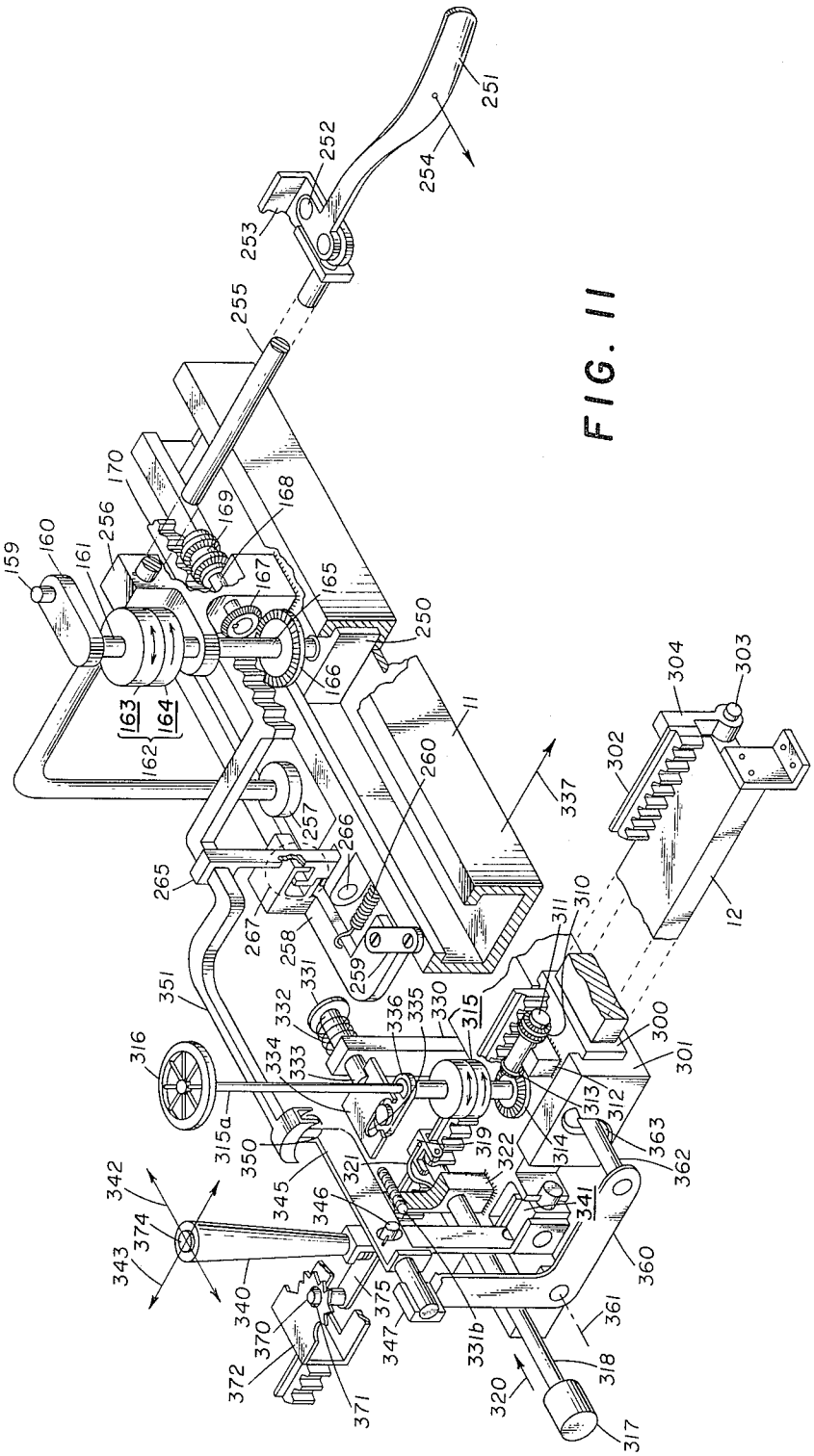


FIG. 11

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Patented Jan. 11, 1966

3,228,507

HAND OPERATED PRINTER WITH TRANSLATABLE KEYBOARD

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Filed Nov. 6, 1961, Ser. No. 150,410
18 Claims. (Cl. 197—2)

This invention relates to a machine for printing numbers or characters on any firm surface and at any desired location on such surface and more particularly to a platenless printer operated by one hand.

In the preparation of machine drawings and the like various expedients have been resorted to in order to print letters, reference characters and other symbols which are neat and are of uniform appearance. In some cases typewriter carriages have been so designed as to accommodate sheets of drawing paper of substantial size in order that such legends can be applied directly through use of conventional type. However, such machines are not adaptable to special tasks without an undue amount of labor and time-consuming effort. Since in technical drawing much of the work involves the application of legends and various operations other than line work, it has been found desirable to provide a printing device which may have some of the attributes of the more well-known typewrtter but which can be positioned at any point over a drawing board, clip board or other sheet material and operated to provide clear, concise and uniformly appearing legends. At the same time the device must be capable of being readily moved from one location to another and must be adaptable to various environments in order to be of greatest utility.

In accordance with the present invention, there is provided a platenless printer which comprises a plurality of rows and columns of type bars forming a grid having ranks and colums. Each rank is mounted for independent lateral movement relative to any other rank. A first linkage extends to the grid for moving a selected rank out of the grid along the line of the rank. A second linkage is provided for actuating a selected key column in the selected rank for imprinting at a selected location a symbol corresponding with the selected rank and column.

In accordance with a further aspect of the invention there is provided a printer which is movable over a work surface stepwise in either of two mutually perpendicular directions and operable under the control of one hand for selecting any symbol in a grid of symbols.

For a more complete understanding of the present invention and for further objects and advantages thereof, reference may now be had to the following description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a perspective view of the fourprinter of the present invention;

FIG. 2 is a front view of the printer;

FIG. 3 is a top view of the printer;

FIG. 4 is an end view of the printer;

FIG. 5 is a diagram illustrating linkages in the printer mechanism;

FIG. 6 illustrates a linkage for controlling the spacing for successive symbols;

FIG. 7 is a front view of the type bar array with one row of bars moved to a printing position;

FIG. 8 is a top view of the system illustrated in FIG. 7;

FIG. 9 is a side view showing six ranks of bars with one bar in a printing position;

FIG. 10 illustrates a character selector linkage; and

FIG. 11 illustrates the mechanical linkage for a carriage shift operation.

Referring now to FIGS. 1–4, there is illustrated a printer unit **10** which is mounted on a guide bar **11**, FIG. 1. Guide bar **11** is coupled to a side bar **12**. In the application illustrated the side bar **12** is secured by brackets **13** and **14** to one edge of a drafting table over which the printer **10** is to be operated for application to a sheet **15** of selected symbols and numerals. The guide bar **11** is terminated at the right hand end thereof as viewed in FIG. 1 in a linkage to a roller **16** which is adapted to carry the weight of the guide bar **11** and the printer **10** as the printer is moved over the surface of the paper **15**. The bar **12** extends through a slot in the guide bar **11** where a mechanism is provided as will hereinafter be described which is adapted to permit movement of the printer **10** to any vertical position on the paper **15** and to any lateral position thereon.

The fourprinter includes a keyboard on which four keys **1–4** appear. The keys are supported at the ends of rods **25–28**, respectively. The rods **25–28** are slidable into and out of elements within the frame plate **29** in order to select one of the six ranks of symbols, the nature of which appear on the top plate **30**, FIG. 2. It will be noted that the letters A, B, C and D form the top rank along with the numerals **1, 2, 3** and **4**. It will also be noted that there are eight columns where not only are the symbols A–D and numerals **1–4** the elements of the first rank but also are the first elements of the eight columns.

In accordance with the present invention the Key **1** serves to control or select the letter or symbol from the two left hand columns headed by symbols A and **1**. The Key **2** is provided for selecting the third and fourth columns headed by the letter B and the numeral **2**, respectively. Key **3** is provided for selecting the fifth and sixth columns headed by the letter C and the numeral **3**, respectively. In a like manner, the Key **4** is provided for selecting the seventh and eighth columns headed by the letter D and the numeral **4**, respectively.

By moving the keys as a unit into and out of the printer **10**, the rank is selected, the selection being indicated visually by the marker **31**. A given key is then depressed to select one of the four pairs of columns. The left hand column in each pair may be selected prior to depressing a key by moving the lever **32** to the left. The right hand column of each pair similarly may be selected by actuating the lever **33** to the right. Levers **32** and **33** extend forward from the frame plate **29** immediately above the Keys **1–4** and may be operated by a slight movement thereof to the left and to the right respectively for the selection of letter or numeral columns. As will further be explained, the type bars are provided for printing either upper case or lower case letters and large or small numerals. A selector lever **34** positioned in the upper left hand corner of the front plate **29** and operated by the forefinger selected upper case or lower case letters or large or small numerals.

Spacer bar **35**, partially broken away in FIG. 1, extends across the front of the keyboard in the area that would be occupied by the palm of the hand when cupped to place the fingers into contact with the keys. Depression of the spacer bar will move the entire printer unit **10** one space along the bar **11**. It will be noted that the bar **11** in the form of a rectangular tube is slotted along the top face thereof. Tube or bar **11** includes an internally supported rack in which a spiral gear operates to effect the stepwise movement of the unit **10** across the face of the paper **15**.

A vertical slot **40** in the left hand portion of the unit **10** extending from the base in the front plate and through the top plate almost to the rear wall is provided to permit the selected type bar to be rotated downwardly to

strike the paper **15** for imprinting thereon a given legend. As indicated in each of FIGS. 1–4, a type bar **114** has been illustrated in a printing position indicating that a legend is being impressed upon the paper **15** at a type impact point hereinafter referred to as "TIP."

Before turning to the more detailed mechanisms illustrated in FIGS. 5–11, it may be of assistance in order to follow the linkages and the force paths in the detailed system to explain further the logic or the basis upon which a printing operation is performed.

As previously noted, Keys **1–4** select the first, second, third or fourth pairs of columns of symbols, respectively. The Keys **1–4** are linked together for common movement toward and away from the operator so that any one of six ranks of type bars may be selected. An operator wishing to print out an A (capital form) first operates the lever **34** to depress it to the upper case position U; then, with fingers in all four of the Keys **1–4**, moves the keys toward the body of the unit **10** so that the loop marker **31** indicates a selection of the top rank. The column selector **32** is actuated to select the left hand column. Key **1** is then depressed. The depression of Key **1** bodily moves an entire rank of type bars forming the upper rank, i.e., A1, B2, C3, D4, leftward from a storage position to a print position. A stop element preselects a stop position for the rank such that a type bar carrying the legend A is in registration with the slot **40**. The further depression of Key **1** causes the type bar to rotate downwardly through the slot **40** to strike the paper **15**. Upon release of Key **1**, the type bar carrying the letter A, under spring pressure, is rotated back into its position in the first rank and the rank is then returned to its storage position. In accordance with the present invention and as will hereinafter appear, the amount by which the unit **10** is spaced during key depression for printing each symbol depends upon symbol size, there being provided three different lengths of steps for such operation to accommodate three different widths of letters. After having written one line, the unit **10** and bar **11** may be moved as a whole either upward or downward over the paper to a second line position, the position being indicated by an index line **39** on top of bar **11** next to wheel **316** so that a second line may be written. The entire carriage or unit **10** may be returned horizontally along bar **11** to adjust the lateral position of the TIP.

With the foregoing brief description, it will now be of interest to consider the detailed mechanical linkages illustrated in FIGS. 5–11 in order that an understanding of the structure of the printer system may be had. In all of the figures where a type bar has been moved out to the TIP position, the letter N has been selected. It will be noted that the letter N is in the fourth rank from the top and is in the fifth column from the left as viewed in FIG. 2. All of the following explanation will be based upon the selection of the letter N. The elements of the system have been shown fragmentarily in order to illustrate the selection of the symbol N. It will be understood that the additional elements are included for selection of all of the elements. However, it would be difficult to illustrate all such elements and linkages therebetween within the limits of the patent drawing and still render a clear understanding thereof.

In FIG. 5, it will be noted that the Keys **1–4** are connected to bars **41**, **42**, **43** and **44**, respectively, which extend forward of the keys. Extending rearward of the Keys **1–4** are rods **25**, **26**, **27** and **28**. The latter rods are slidably mounted in the actuating columns **45**, **46**, **47** and **48**. The latter columns are journaled in slideways with the ribs, such as rib **45***a* and rib **45***b*, being adapted to guide the bar **45** as it moves upward and downward in its slide upon depression of Key **1**. The ends of the bars **41–44** carry slotted yokes such as the yoke **50**. The shaft **51** carrying suitable mating rollers such as the roller **52** extends through all of the yokes which are upwardly directed from the bars **41–44** respectively. The Keys **1–4** are moved backward and forward in unison since they are all linked to the shaft **51**.

The elongated slots in the yokes, such as yoke **50**, are provided in order to permit a given key to be depressed unaccompanied by movement of the shaft **51** or by the other three keys. Thus, the translation of the shaft **51** as the keys are moved forward or back serves to move a detent follower block **53** slidably mounted in the frame portion (not shown). The detent follower block has six depressions spaced at uniform intervals along the sides thereof. The depressions are numbered **1–6** and represent respectively the positions of Keys **1–4** as they select the ranks **1–6** of the legends. A detent roller **54** is mounted on a shaft **55** which in turn is mounted on an arm **56** which is rotatable relative to shaft **57**. A compression spring **58** urges the arm **56** towards the edge of the block **53** so that the follower **54** will sink into a given groove depending upon the position of the Keys **1–4** and will tend to maintain the Keys **1–4** in one of the six positions. Thus, an operator is provided an indication, which can be readily interpreted through practice, as to the exact selection he has effected through movement of the keys.

The follower **53** carries a stub shaft **60** which operates in a slot **61** in a crank **62**. The crank **62** pivots around shaft **63**. The upper end of the crank has a slot **64** therein which coacts with a stub shaft **65**. The shaft **65** is mounted upon a selector bar **66**. As the Keys **1–4** are moved backward and forward, the selector bar **66** is moved backward and forward in proportion to the movement of the keys.

The selector bar **66** has a tongue **67** at one end thereof which coacts with a clevis device **68** to slide the latter device along the splined shaft **69**. In each of the six positions of the Keys **1–4** the clevis **68** is in registration with the upper ends of a pair of tines **70** forming extensions of a slide bar **71**. There are six such slide bars provided in the completed system, one slide bar for each of the six ranks of keys. Only one slide bar has been illustrated for the purpose of simplicity.

The slide bar body **71** extends laterally across the printer structure and is aligned with and connected to a shaft **72**. The shaft **72** carries eight selector stop tabs such as the tabs **73** and **74**. Normally all eight tabs on a given shaft are in parallel alignment extending upward from shaft **72** and tilted forward toward the keyboard. However, as has been illustrated, one of the tabs, the tab **74**, has been rotated rearward, away from the keyboard, and serves to provide a character selector stop depending upon the one of the Keys **1–4** that has been depressed and the position of the column selectors **32** and **33**. It will be noted that the character tab **74** is the fifth tab from the left hand end of the group of tabs mounted on the shaft **72**. This corresponds with the position in the third rank of keys of the character N. Also mounted on the shaft **72** is the third rank of type bars which include type bar **114**. The type bars of the third rank are journaled at their lower ends on the shaft **72** but are restrained from axial movement relative to the shaft so that as shaft **72** moves laterally in the direction of the arrow **75**, the entire third rank of type bars must move. The slide bar **71** under control of the crank arm **68** pushes the shaft **72** to the left to translate the third rank of keys from the orderly array or the normal position thereof. The distance that the rank of keys is moved is dependent upon the one of the character tabs selected and moved out of its normal position prior to movement of the slide bar **71**.

Thus far there has been described the preliminary selection of a given rank. It has also been indicated that the selected rank is moved laterally to the left from its normal position in the array. There will now be described the linkages for effecting the actual movement of a given rank. More particularly as Key **3** is depressed, for printing the symbol N, action of the following nature takes

place. The depression of the Key 3 serves to move one of eight slide bars in a direction away from the keyboard. The eight slide bars have been identified as bars 81–88. The bar 85 would be moved away from the keyboard in a sliding motion perpendicular to shaft 72 by depression of Key 3.

For clarity in the drawing, such action has been illustrated in detail with respect to movement of the seventh slide bar 87 rather than for the fifth bar 85. More particularly, depression of Key 4 moved the key slide 48 downward. The column 48 has a milled section near the upper end and on the rear face thereof. A cam recess 90 is milled in the back face of the column 48. A cam follower 91 carried by a crank arm 92 and mounted on a shaft 93 is rotated in a clockwise direction when the column 48 is moved downwardly. The shaft 93 is journaled in a bearing unit 94 and carries a crank arm 95 which has a cam follower which is journaled in a cam recess 96 in the end of the selector bar 87. This serves to move the selector bar away from the keyboard. It will be noted that the shaft 93 carries a pair of rings 97 and 98 between which there extends a follower arm 99 which is connected to a column selector bar 100. The selector bar 100 is connected to the arm 33. It is also connected to the arm 32, but the latter is not shown in FIG. 2. Movement of the bar 100 to the right will shift the shaft 93 so that the crank arm 95 will be in registration with the right hand selector bar 88 of the right hand pair of selector bars. A similar selection means is provided for each of the pairs of selector bars so that when Key 3 is depressed, selector bars 85 or 86 will be moved away from the keyboard, depending upon the position of the keys 32 and 33.

The selector bars 81–88 are provided with a plurality of aligned grooves in the under-surface thereof. The shape of the latter grooves is best shown in FIG. 10. More particularly, the bar 85 shown in FIG. 10 has six sloping grooves and six grooves oriented perpendicular to the length of the bar in FIG. 5. It will be noted that the selector stop 74 has been rotated to a vertical position whereas the remainder of the stops on the shaft 72 remain in their normal tilted position. All of the selector bars 81–88 have identical sets of grooves. In their normal position all of the grooves are in alignment so that a rank of type bars can be moved laterally with the selector stops free to move in the grooves. The movement of one of the selector bars rotates the given selector stop into alignment with a vertical groove. As indicated in FIG. 5, the selector stop 74 then is moved laterally with the shaft 72 until it strikes a shift arm 106. The shift arm 106 forms a part of a crank mechanism which is mounted for rotation about shaft 107. As the selector stop hits the shift arm 106, it rotates the crank arm 108 which in turn rotates a second crank 109. Crank 109 is connected to a sleeve 110 which is mounted for rotation about a shaft 111. The latter movement serves to modify the spacing movement of the unit 10 relative to the bar 11. However, as the shaft 72 continues its movement in the left hand direction by rotating the crank 108, it carries the stop 74 with it until it strikes the end of the groove. At that point the entire rank of keys is arrested in its travel. Thus, a given key, for example, the character N, is moved out so that the bottom gear portion of the key bar 114, extending below the shaft 72, is in registration with a rack 113. Rack 113 is a type bar actuating member or element which engages the lower end of any type bar in registration therewith.

Movement of the rack away from the keyboard, as will now be explained, rotates the type bar 114 in a clockwise direction so that the type face thereon strikes the paper 15 at the TIP. The actual striking action is produced by the continued depression of the key. Note that as Key 4 descends, the column 48 continues its downward travel until the arm 120 strikes a follower 121 which is mounted on a crank arm 122. The crank arm 122 is journaled on a shaft 123. The shaft 123, which is normally urged in a clockwise direction by a spring (not shown), carries a disk 124 at its left end which in turn carries a stub shaft 125. The stub shaft 125 strikes the upper surface of a striker bar 126. The bar 126 is pivoted around shaft 127 and is maintained in an up position by the force of a spring 128. The end of the bar 126 is forked to engage a stub shaft 129 which is integrally connected to a rack 130. The rack 130 engages a pinion 131 mounted on a shaft 132 which in turn is connected to a sector gear 133. The gear 133 meshes with a rack 134 which in turn is coupled by way of the strap 135 to the rack 113. The shaft 132 carrying the pinion 133 rotates in a clockwise direction, moving the rack 113 away from the keyboard thereby to cause the type bar 114 to rotate down into a striking position.

It will be noted that the character stops, such as the stops 73 and 74, slide into tilted grooves or channels such as the channels 140 and 141 when they are tilted toward the keyboard. The character stop 73 is thus illustrated in the forward tilted position and is inside the channel 142. On the other hand, the movement of the selector bar 85 away from the keyboard erected the character stop 74 so that it travels into a vertically oriented channel 143. Channel 143 is immediately adjacent the channel 142. The orientation of such channels is the same as that shown in FIG. 10. In FIG. 10 the end character stop 73 may be seen tilted forward into the vertical slot with a sloping side. The character stop 74 is vertically oriented and is erect within the vertical channel. Each vertical channel, such as the channel 143, is provided adjacent a sloping channel and is provided with a shoulder therein about midway of the block 144. Thus the slide bar 71 will move the shaft 72 transversely until a given character stop registers against the shoulder at the end of the vertical slot, such as the slot 143.

A spacing operation is carried out immediately prior to the striking action which causes the key to impinge the paper 15 at TIP. This is accomplished through the crank arm 150 which is mounted on a crank wheel 151 which in turn is mounted on shaft 123. The crank arm 150 has a follower 152 which bears against a surface 153 of a pusher bar 154. The bar 154 is linked to a protrusion 155 on the splined sleeve 110 to move the unit 110 in the direction of arrow 156. A rod 157 extending from the sleeve 110 carries a slotted arm 158 which engages a shaft extending from the shaft 159. Shaft 159 is mounted on a crank arm 160 which is secured to a shaft 161. The shaft 161 drives a clutch 162. The upper element 163 of the clutch may be moved in either forward or reverse direction as the arm 158 moves backward and forward under control of the push bar 154. However, the lower element 164 is ratcheted by means not shown so that it will move only in one direction. The lower element is coupled to a shaft 165 which in turn is coupled to a bevel gear 166 which drives a second bevel gear 167 mounted on a shaft 168. A spiral or worm gear 169 is mounted on shaft 168 and cooperates with a rack 170. Thus, as any of Keys 1–4 is depressed, unit 10 is moved to the right one space by the action of the pusher bar 154 and the clutch unit 162.

Provision is made for varying the spacing of unit 10. More particularly, the sleeve 110′ is threaded internally. The threads at location 170 are of one sense and the threads at location 171 are of opposite sense. Rotation of the crank 108 under the forces developed by the character stop 74 will rotate the crank 109 and thus rotate the sleeve section 110 to either shorten or lengthen the distance between the protrusion 155 and the arm 158. This serves to modify the stroke of the spacing mechanism effected by the pusher bar 154.

The extent of the modification of the spacer operation is controlled by the shape of the character stops 73–74, etc. This is best illustrated in FIG. 6 where the character stop 74 is shown in contact with the arm 106. The shaft

72 carries the character stop to the left, as viewed in FIG. 6, until it is arrested in its travel by the shoulder 180. However, before the character stop 74 strikes the shoulder 180, it strikes the extension 106' of the arm 106. Some of the character stops, such as stop 74, will be a solid block of rectangular configuration as shown in FIG. 6. Others will be milled in the upper end thereof to either of two degrees. More particularly, a stop milled for intermediate spacing would be milled to a depth represented by line 74*a* and stops for minimum spacing would be milled to a second depth represented by line 74*b*.

If the character stop 74 is not milled at all, it will effect a greater rotation of the arm 103 about shaft 107 to modify the spacer action to a substantial extent. If it is milled to the extent represented by the dotted line 74*a*, it will modify the spacer movement to an intermediate degree. If it is milled to the point represented by line 74*b*, it will not modify the spacer movement at all. One extremity of modification represents a letter or symbol of substantial width. Modification to an intermediate degree as represented by the line 74*a* is for a normal size letter. Modification as represented by the other extermity is to accommodate characters or symbols of narrow space configuration. Thus, the spacing effected is proportional to the size of letter or character being imprinted and each of the character stops is individually tailored in dependence upon the particular letter or symbol with respect to which it is associated.

It will be noted that each of the type bar heads is pivotally mounted at the end of the type bar. An indicated, the type bar 114 has a head 114*a* which is pivoted about a shaft 114*b*. The head has two type faces 114*c* and 114*d*. Rotation of the head about the axis 114*b* may be effected to select either upper or lower case letters of the alphabet or large size or small size numerals. The rotation of the head is produced by a linkage including a spring 114*e* which is connected to the rear extensions 114*f* of the head and to a slider block 114*g*. The spring 114*e* is curved to be received in the pair of depressions which are spaced apart along the back or the spine of the type bar structure. When spring 114*e* is in the lower of the slots, as illustrated in FIG. 5, the symbol on the face 114*c* will be impressed on the paper. If the slide block 114*g* is urged outward toward the tip of the key to move the spring detent into the groove nearest the end of the key, then the symbol on the face 114*d* will be impressed upon the paper. The slide block 114*g* may be preset or preselected by operation of the tab 34. The tab 34 is mounted on a shaft 190 which is journaled as to be fixed in its position. However, as it rotates, it serves to move a crank arm 191 which is secured thereto. The crank arm 191 carries a handle or extension 192 which operates in a slot 193 in a slide bar 194. As the tab 34 is rotated in one direction or the other for the selection of upper or lower case letters, the slide bar 194 moves upwardly or downwardly depending upon the selection made. The slide bar 194 carries a rearwardly extending arm 195 from which there extends a plurality of slotted bars 196. The bars, such as bar 196, extend parallel to the shaft 72. Only one of the bars, bar 196, has been illustrated in FIG. 5, the remaining five like bars being shown in FIG. 7. The bars normally are positioned immediately in front of a given rank of type bars with respect to which they are to operate. The bar 196 serves to couple the upward or downward movement of the slide bar 194 to a linkage which is coupled to the slide tabs, such as the tab 114*g* on type bar 114. More particularly, a standard 197 is mounted on shaft 72 and extends upwardly where it supports at its upper end a bar 198, having a channeled front surface. The bar 198 is normally positioned immediately behind the rank of keys in registration with the tabs such as tab 114*g*. The tab 114*g* nests within the front facing channel of the bar 198. The standard 197 is telescopically adjustable so that as the slotted bar 196 moves upward or downward into one of the two positions, the telescoping action in the standard 197 permits the channel 198 to move upward or downward. The rotation of the tab 34 from upper case to lower case serves to raise all of the bars, such as bar 196, and all of the channels, such as channel 198, simultaneously to rotate all of the heads of all of the type bars from upper case to lower case position.

The symbols on the heads of the type bars may be formed from rubber or other resilient type or they may be metallic in character. In order to provide a quietly operating device, it is found preferable to select a resilient material. This also lends to economy in construction. Immediately in front of each of the heads of the type bars there is provided an ink pad, such as the pad 200. Such a pad is provided for each of the ranks, only one of them having been shown.

The ink pad 200 is mounted at the upper end of the crank arm 201 which is pivoted relative to a shaft 202. The lower end of the crank arm 201 engages a rack device 203 so that it will be rotated about shaft 202 upon translational movement of the rack 203. The rack 203 is coupled to a horizontally extending arm 204 which is engaged by a pusher rod 205. The pusher rod 205 is coupled to a shaft 206 by way of a crank arm 207. The crank arm 207 is mounted for rotation about axis 208. The shaft or arm 206 is actuated under the control of the selector bars. More particularly, as illustrated, the selector bar 87 has an undercut groove 87*a* in the bottom surface thereof in which a follower 210 normally is positioned. Normally the ink pad 200 is in contact with the rank of keys with which it is associated in order to maintain each rank in readiness for printing operations. However, as one of the selector bars 81–88 is moved away from the keyboard for the selection of a given type bar, the movement of the bar forces the follower 210 downwardly out of the groove, thus rotating the crank arm 207 in a counterclockwise direction which moves the pusher bar 205 away from the keyboard, thereby retracting the ink pads from contact with the rank of keys.

It will be noted that an arm 204*a* extends into engagement at the right hand end with an edge of the member 194. This serves as an auxiliary actuator for the ink pad 200 and serves to retract the ink pad when the capital shift lever 34 is operated to change between upper and lower case letters. This will permit the type block such as block 114*a* to rotate about axis 114*b* without interference by the ink pad.

Finally, it will be noted that the spacer bar 35 is rotatable about an axis 212 and is coupled by way of linkage 213 to an extension 214 of the slide bar 154 which is provided for spacing operations. Actuation of spacer bar 35 causes translation of bar 214 to space the unit 10.

From the foregoing it will be seen that this printing machine consists of several interrelated systems which are coordinated in their operation to effect the ultimate printing of a selected key. The entire printing operation results from key movement toward or away from the operator and key depression. The Keys 1–4 are held upward in their normal positions by springs (not shown). A first system selects the column in which the desired character is located and retracts the inking pads. The second system selects the row or rank of keys in which the selected character is located. It is this second system which is operated by the tabs 32 and 33. The third system provides a spacing action which is proportioned to the normality of the character desired. The fourth system provides the means of striking the type at the TIP. The systems are interlocked mechanically to provide proper timing. The fifth system provides for shifting of the type characters to provide upper or lower case letters or numerals. A sixth system provides for the actual shift of the system relative to the paper.

Preferably, as indicated in FIG. 3, the keyboard is so coordinated that the letters desired are located in the odd numbered columns operated by the odd numbered selector bars **81**, **83**, **85** and **87**. Provision is made for rapidly shifting from odd numbered to even numbered columns by striking the tabs **32** or **33**.

In FIGS. 7, 8 and 9 like parts have been given the same reference characters as in FIGS. 5 and 6 and are included for providing a better understanding of the construction of the system.

In FIG. 7 the relative positions of the ranks of keys in their normal position as well as the position of the fourth rank for the printing of the character N is illustrated. In the outline at point **220** there is illustrated the position of the first rank of keys prior to being translated from their normal position out to the position necessary for printing the symbol No. 4.

As best seen in FIG. 8, the shafts, such as shaft **72**, are hollow in the ends thereof so that they telescope over axially aligned confronting rods. More particularly, the shaft **72** telescopes over a rod **230** which extends from a frame element **231** and is normally coaxial with the shaft **72**. However, the end of the rod **230** stops short of the end of the shaft **72** in its normal position. However, when the rank of type bars carried by shaft **72** is moved out for printing, the end of the shaft is supported by the rod **230**. The rods, however, stop short of the location of the printing line so that a type bar in any one of the ranks can be actuated for printing operation without being impeded by the shafts.

As illustrated in FIG. 9, the type bars stand in ranks of different heights, the heights being proportional to the distance from the type impact point, TIP. The rack **113** is slidably mounted beneath the ranks of type bars and at the position of the printing line in order to actuate any key moved into registration therewith. It will receive and cooperate with any key in any rank.

While the foregoing has been illustrated and described in terms of a completely manually operable system, it is to be understood that a motor-driven unit may be provided in accordance with the general principles aforementioned in order that the motive power for all of the translational operations in the various functions carried out may be keyed by the depression of a given one of the Keys **1–4**. However, the selection of row, column and key, as well as upper and lower case selection, will be a manual function and will require the familiarity for which the operator will readily develop dexterity in use of the device.

Referring now to FIG. 11, there is illustrated, in enlarged scale, a mechanism relating to spacing both along the length of the bar **12**, FIG. 1, and along the length of the bar **11**, FIG. 1. The bar **12** has been shown cut away with some parts omitted. The first function to be described relates to the return of the printer **10** to the left margin. A linkage is provided which is adapted to permit free movement of the unit **10** along the bar **11**. It will be recalled that the worm gear **169** operates in a rack **170** which is mounted at the back of the unit **10**. The rack **170** forms a part of the guide bar **11**. The unit **10** is securely fixed with respect to the slide unit **250** so that it must move therewith. The shaft **165** is journaled in the slide unit **250** so that rotation of the shaft will rotate the worm gear **169**, thereby to move the unit **10** along with the slider **250**. If the unit **10** is to be moved freely along the length of the bar, it is necessary to disengage the worm gear **169** from the rack **270**. The following structure is provided for accomplishing the foregoing function. A handle **251** is pivotally supported on shaft **252**. The shaft **252** is to be connected (by means not shown) to the frame **253** of the unit **10**. Rotation of the lever **251** in the direction of arrow **254** moves the bar **255** rearwardly. The bar **255** passes slidably through block **256** which is connected to the slide unit **250**. Bar **255** extends rearwardly of the block **256** where it extends downwardly and carries at the end thereof a rotatable follower **257**. The follower **257** engages the front of surface of a bar **258** which extends the length of the guide bar **11**. The bar **258** is linked to the guide bar **11** by means of the link **259** and a similar link at the opposite end (not shown). Bar **258** is urged toward the bar **11** by means of a spring **260**.

The bar **258** is linked to the rack **170** by means of a standard **265**. The standard **265** is rotatably mounted on shaft **266**. The shaft **266** is supported by the guide bar **11**. When the standard **265** is rotated about the axis **266**, the rack **170** is lifted from engagement with the worm gear **169**. The bar **258** is linked to the standard **265** in the slidable linkage within the dotted outline **267**.

When the lever **251** is rotated in the direction of arrow **254**, the follower **257** urges the bar **258** away from the guide bar **11**. The linkage **267** serves to rotate the standard **265** about axis **266** to disengage the worm gear **169** from the rack **170**. Thus, the unit **10** may be freely moved along the length of the bar **11** while the rack **170** is disengaged.

There will now be described the mechanism illustrated in FIG. 11 for permitting movement of the unit **10** along with the guide bar **11** relative to the side bar **12**. The side bar **12** has been shown mostly cut away in order that the functions may be clearly shown. The side bar **12** is mounted within a nested slide unit. More particularly, the bar **12** extends through a first slide member **300** which in turn is nested within a second slide member **301**. The bar **12** is fixed with respect to a work piece such as the table of FIG. 1. Any movement of the bar **11** along bar **12** must be by means of a sliding action of the unit **300** over the surface of the bar **12**.

The bar **12** supports a rack **302** which is pivotally mounted for rotation about axis **303** and is supported on a crank arm **304** at one end and on a similar crank arm (not shown) on the other end of the bar **12**. In normal operations the slide unit **300** is moved relative to the bar **12** by operation of the worm gear **310**. Worm gear **310** is mounted on a shaft **311** which is journaled in a bearing block **312**. A pair of bevel gears **313** and **314** couple the worm gear **310** to a clutch unit.

The wheel **316** is mounted rigidly to the shaft which is keyed to bevel gear **314** and provides fine adjustment of the position of bar **11**. Wheel **316** rotates incidentally when the automatic system from bar **331** operates but is capable of repositioning bar **11** in either direction whereas the clutch system works only to bring bar **11** toward the operator for ordinary line-to-line printing.

The rack **302** may be retracted from engagement with the worm gear **310** by rotation on shaft **303**. This is accomplished by use of a push button **317** which is connected by way of rod **318** to a linkage **319**. By pushing the rod **317** in the direction of arrow **320**, the rack **302** will be rotated out of the engagement with the worm gear **310**. The rack is maintained normally enmeshed with the worm gear **310** by a spring **321** which is mounted in the bearing block **322** through which the shaft **318** passes. The block **322** is mounted to slider unit **300**.

A linkage is provided for moving the guide bar **11** relative to the side bar **12** with uniform spacing in order to place one line uniformly below the next preceding line in the following manner.

A standard **330** is a part of and secured to the slide unit **300**. At the upper end thereof there is provided a button **331** which normally is biased in a retracted position by a spring **332**. Actuation of button **331** is by bumper **331***a* on unit **10**, FIG. 1. The shaft **333** coupled to the button **331** extends through the upper end of the standard **330** and carries a slotted plate **334**. The slot **335** in the plate **334** cooperates with a crank arm **336** to impart rotational motion to the outer shaft tube which is connected to the upper or driving element of the clutch **315**. By pushing the button **331** through a maximum stroke, there will be imparted through the clutch **315** a rotational movement to

the worm gear **310** to move the spacer bar **11** a uniform preset space in the direction of the arrow **337**. The limit of such spacing action is preset and is adjustable through use of screw **331***b* which is threadedly mounted in standard **322** and serves to limit motion of plate **334**.

It will be noted that the guide rod **11** is mounted on the side bar **12** by means of the intermediary slide unit **300**. The outer slide bar **301** is integrally connected to the guide bar **11**. This structure is provided in order to permit a unique spacing operation as would permit printing of fractional numbers. For this purpose there is provided a control stick **340**. The control stick **340** is pivotally mounted so that it can be moved universally. More particularly, a universal coupling **341** interconnects the stick **340** to the inner slide member **300**. The stick **340** may be moved in the direction of arrow **342** or arrow **343** in varying degree and combinations thereof.

Movement in the direction of arrow **342** is for the purpose of moving the rack **170** laterally with respect to the guide bar **11**. More particularly, it will be noted that a bar **345** is coupled by way of a pin **346** to the stick **340**. The bar **345** is slidable with reference to the bearing **347**. The end of the bar **345** engages an arcuate channel **350** in an arm **351** which slides in the standard **265** and is coupled to the rack **170**. Movement of the stick **340** in the direction of arrow **342** thus moves the rack **170** in the direction of arrow **342**. With the worm gear **169** enmeshed in the rack **170**, the unit **10** as coupled to the slide unit **250** will move.

The movement of the stick **340** in the direction of arrow **343** serves to move the second slide element **301** relative to the slide element **300**. It will be remembered that the slide element **300** is linked to the rack **302** by the worm gear **310**. The slide movement of the unit **301** relative to unit **300** carries the guide bar **11** with it along with the print device **10**.

The foregoing operation is performed as follows. As the stick **340** is pivoted in the universal coupling **341**, the shaft ni the bearing **347** will move in the direction of arrow **343**. Bearing **347** is mounted on the upper end of a crank arm **360** which is pivoted about an axis **361**. The crank arm **360** carries a pin **362** which engages an S-shaped cam slot **363** in the left hand face of the slide follower **301**. With the rod **340** in a normal position, that is, straight up or vertical, the pin **362** will be positioned at a midpoint in the slot **363**. As the stick **340** is pushed away from the front of the unit, that is, towards the back of the table, the pin **362** is moved upward, thus forcing the follower **301** toward the back of the table. In this position, numbers, for example, representing the numerator of a fraction, may be printed. Immediately following this, the stick **340** may be pulled toward the operator and toward the front of the table, in which case the pin **362** moves downwardly. This forces the slide follower **301** toward the front of the table. In this position the denominator of a fraction may be printed immediately under the numerator. A fraction having two numbers in the numerator and denominator may be printed by moving the stick **340** to the four corners of the limits of its trajectory. With the automatic spacing action of the printer disengaged, all four of the parts of a fraction may be printed merely by the spacing effected through operation of the stick **340**.

Normally the stick **340** is fixed in position by pin **370** engaged in a hole **371** in the upper surface of the frame element **372**. Frame element **372**, although shown fragmentarily, is fixed for movement with the unit **300**.

Pin **370** is retracted from hole **371** by depression of button **374** in the top of stick **340**. This moves arm **375** downward, permitting movement of the stick as indicated by arrows **342** and **343**.

From the foregoing it will be seen that there are five basic control actions in the system which are as follows.

First, the printing machine frame is located such that the TIP will be adjacent to the point at which a symbol is to be impressed on the receiving medium.

Second, the capital shift lever **34** is actuated to the desired position for upper or lower case letters or for small or large numerals or other legends or characters as indicated on the upper front plate, FIG. 2.

Third, the column selector tabs **32** or **33** are actuated for selecting the column containing the desired symbol.

Fourth, the keyboard comprising the four keys is moved as necessary, either forward or backward, until the loop **31**, FIG. 1, indicates the row which includes the desired symbol.

Fifth, the key associated with the column in which the desired symbol is located is depressed. When the key is depressed, the following actions take place:

(1) all six of the ink pads (such as pad **200**, FIG. 5) move away from the type faces on the type bars;

(2) the frame of the unit **10** begins movement toward the right to space the TIP from previously printed symbols;

(3) one of the selector bars (**81–88**, FIG. 5) moves rearward to move the selector stop in the column linked to the depressed key;

(4) the slide bar **72** carrying a row of type bars moves the left after a delay required for step (3). The slide bar moves until the selector stop meets the stop surface **180** (FIG. 5);

(5) the selector stop acts on link **108** prior to meeting the stop surface **180**, thus actuating the spacer-modifier linkages **110** and **110'**. At this time in the print cycle the spacer motion is completed and modified as at the particular selector stop;

(6) shaft **123**, which is a timing shaft, continues its rotation and is urged by the continued key depressing force to act upon bar **126**. This causes the striker system to force the type bar forward rotating it about its mounting axis **72** to imprint on the paper.

All of the elements involved in the foregoing operations return to normal positions in reverse order after depression of a selected key. After each impression of a symbol on the receiving medium, all six rows of type faces are again in contact with the ink pads where repeated contact provides adequate ink for printing dense, opaque characters without imparting excessive ink in on the type faces.

It will be appreciated that the foregoing control actions and printing operations may be produced from a remote keyboard or may be motor-driven in response to a local keyboard. However, for the purpose of the present description direct mechanical linkages to the local keyboard have been shown.

The machine is characterized as including a multi-key assembly with a type bar grid formed of a plurality of rows and columns of type bars with a striker member extending along the grid at one margin thereof. An indexing linkage operable from the key assembly is provided for selection of any row in the grid. A first linkage is responsive to depression of any one key in the assembly for movement of the selected row from the grid into engagement with the striker member. A stop means is provided for limiting movement of the selected row for registration of a given type bar with the striker member. The selected type bar bears a positional relation in the selected row which is related to the position of the depressed key in the key assembly. A delayed action linkage is responsive to the key depression to actuate the striker member to produce printing action by the given type bar at a type impression point.

Now that the invention as embodied in the printing machine shown in the drawings has been described in detail, it will now be appreciated that there is provided a system which can be operated by one hand and that the operations necessary to select and print any one of 48 different characters or letters can be accomplished by minimal movement of the four fingers primarily backward and forward and then depressing one of the four keys. All operations are carried out with the hand

cupped as to place the fingertips in the key receptacles. The detent mechanism **53–54** of FIG. 5 provides an audible signal or a signal that is sensible through the touch of the fingers as to the position. Alternate grooves into which the wheel **54** falls may be covered with a material or so coated as to give different sound than that produced when the wheel **54** moves into registration with the uncoated or untreated grooves. Thus, the forward and backward positions of the keys can be reduced to essentially three different groups of positions which can be then more easily operated by the secondary senses of an operator. All operations can be carried out without removing the fingers from one key to another. Each finger holds the key without changing to any other key to actuate the characters. This minimizes the travel distance that each finger must traverse from a selection of one character to a selection of another. The forward and backward motion of the keys in practice is limited to about ⅝ of an inch maximum travel. Only one-eighth of an inch movement would be required to select characters in adjacent rows of characters. Eliminated entirely is the need for lateral movement of the fingers as is charatceristic in conventional typewriter keyboards. Thus, it is believed that there is a significant advance embodied in the provision of the keyboard in which all of the fingers move together as a group for positioning or selecting a function. The keyboard arrangement forming a saddle with the spacer bar resting in the palm of the hand permits still further advantages in reduction of movement for carrying out the desired operations.

It will be appreciated that different indicators other than the detent **53–54** may be employed. For example, any one of the keys might be so actuated in traveling from one row position to another as to tilt slightly on alternate rows so that merely by the attitude of a given key would an operator know whether the selection was for an odd or an even row. Furthermore, it will be noted in FIG. 3 particularly that the device is arranged in a normal or natural attitude particularly in comparison to symbols being written in the usual method employing a pen or pencil. In the present case the hand is situated slightly above and to the right of the TIP. Furthermore, as each letter is written, the type bars are retracted, leaving the newly printed symbol or letter clearly exposed to the view of the operator with the hand and the machine in approximately an accustomed writing position relative to the newly printed matter. The printing machine is spaced to the right just prior to the imprintation of each symbol. Thus, all of the movements are natural and yet readily sensible to the operator even though 48 different symbols may be selected through the combination of six rows and eight columns selectable by operation of four keys and the column selector tabs. While the printing machine has been illustrated as mounted on a pair of guide bars to be positioned at any point over the face of the work, it will be further appreciated that different mountings may be designed for the printing machine in order that it may be used in environments other than the formal drafting table environment illustrated in FIG. 1. For example, the machine may be placed on rollers, permitting lateral movement and driven in response to the impression of the key so that it might be moved freely from one environment to another and yet provide linear movement for spacing one letter from another.

Having described the invention in connection with certain specific embodiments thereof, it is to be understood that further modifications may now suggest themselves to those skilled in the art and it is intended to cover such modifications as fall within the scope of the appended claims.

What is claimed is:

1. A printing machine which comprises:

(a) a multi-key assembly,

(b) a type bar grid having a plurality of rows of type bars,

(c) a type bar actuating member extending along said grid at one margin thereof,

(d) an indexing linkage operable from said multi-key assembly for selection of any row in said grid,

(e) a first linkage responsive to depression of any one key in said assembly for movement of the selected row from said grid into engagement with said actuating member,

(f) stop means for limiting movement of said selected row for registration of a given type bar with said actuating member, which given type bar is positionally related in said selected row to the location of said one key in said assembly, and

(g) a delayed action linkage responsive to said depression of said one key for actuation of said actuating member to produce printing action by said given type bar.

2. A printing machine which comprises:

(a) a multi-key assembly,

(b) a type bar grid having a plurality of rows of type bars,

(c) a type bar actuating member extending along said grid at one margin thereof,

(d) an indexing linkage responsive to movement of said key assembly for selection of any row in said grid,

(e) a first linkage responsive to depression of any one key in said assembly for movement of the selected row from said grid into engagement with said actuating member,

(f) stop means for limiting movement of said selected row for registration of a given type bar with said actuating member, which given type bar is positionally related in said selected row to the location of said one key in said assembly, and

(g) a delayed action linkage responsive to said depression of said one key for actuation of said actuating member to produce printing action by said given type bar.

3. In a printing machine in which there is provided a multi-key assembly and multi-row type bar assembly the combination which comprises:

(a) a type bar actuating member coupled to all keys in said key assembly and actuated upon depression of any one of said keys,

(b) a row selection linkage including a translatable support means for said multi-key assembly and operable upon translation of said multi-key assembly to index on one of the rows of type bars, and

(c) type bar translation linkage operable in response to said depression of said one of said keys prior to actuation of said actuating member for translation of said one of the rows of type bars from their normal position in said type bar assembly to an operating position wherein one of said plurality of type bars is in registration with said actuating member.

4. In a printing machine in which four keys and a multi-row type bar assembly are provided the combination which comprises:

(a) a type bar actuating member actuated upon depression of any one key of said four keys,

(b) a type bar selection linkage operable in response to said depression of said one key but prior to actuation of said actuating member for movement of one row from its normal position in said type bar assembly to an operating position wherein one of the type bars in said one row is in registration with said actuating member, and

(c) a row indexing linkage including a translatable support for all of said keys and actuated by translational movement of said keys for indexing said type bar selection linkage with a selected one of the rows in said type bar assembly.

5. In a printing machine in which there is provided a multi-key assembly and a multi-row type bar assembly the combination which comprises:
(a) a frame for support of both of the assemblies,
(b) a type bar actuating member actuated upon depression of any one key in said key assembly,
(c) a type bar selection linkage operable in response to said depression of said one key but prior to actuation of said actuating member for movement of one row of the type bars from its normal position in said type bar assembly to an operating position wherein one of said plurality of type bars is placed into registration with said actuating member,
(d) a row indexing linkage including a translatable support for said key assembly and actuated upon translational movement of said key assembly for indexing said type bar selection linkage with a selected one of the rows in said type bar assembly, and
(e) a row stop selector linkage extending to said one key for limiting movement of said one row in proportion to the position of said one key in said key assembly whereby the type bar placed in registration with said actuating member positionally is related to said one key.

6. In a machine for printing symbols of varying widths on a planar workpiece with uniform spacing therebetween and in which there is provided a multi-key assembly and a multi-element type bar assembly, the combination which comprises:
(a) a frame support of both of the assemblies,
(b) guide means adjustably coupled to said frame for control of the position of said frame over said workpiece,
(c) a type bar striker member,
(d) at least two linkages extending from each of the keys in said key assembly,
(i) one of said linkages from each said key leading to the coupling between said frame and said guide means and being actuated upon depression of any one key to move said frame a step along said guide bar,
(ii) the other of said linkages forming a delay linkage leading to said striker member after said frame moves said step, and
(e) means related to each type bar for modifying the magnitude of said step in dependence upon the width of the symbol characterizing each said type bar.

7. In a machine for printing symbols the combination which comprises:
(a) a frame having a keyboard of four keys at the front thereof,
(b) an assembly of rows and columns of type bars of heights dependent upon distance of each row from the front of said frame,
(c) a type bar actuating member extending along one side of said assembly,
(d) slidable members for individually supporting each of said rows of type bars,
(e) delay linkages coupling each of said keys to said actuating member for delayed actuation thereof,
(f) a row translating mechanism operable by depression of any one of said keys for moving any one row of type bars from its normal position in said assembly to an operating position with one type bar in said one row engaging said actuating member,
(g) an indexing linkage between said keyboard and said translating mechanism for selection of said one row from said assembly, and
(h) linkages between each of said keys and said assembly for limiting movement of any row by said translating means in dependence upon the relative position on said keyboard of said one of said keys.

8. A printing machine which comprises:
(a) a plurality of type bars forming a grid in which each type bar is movable from its position in said grid to a print position,
(b) a translatable keyboard,
(c) a first linkage extending from said keyboard to said grid for establishing a first type bar selection function upon translation of said keyboard, and
(d) a second linkage responsive to movement of any key in said keyboard for establishing a second type bar selection function.

9. A printing machine which comprises:
(a) a frame,
(b) a keyboard including four keys at the front of said frame,
(c) a spacer bar forward of said four keys,
(d) column selector tabs positioned above and to the side of said keys,
(e) a plurality of rows of type bars spaced apart rearwardly of said keyboard with the heights of the rows being dependent upon the distance from the front of said frame, each of said rows being divided into four pairs of type bars,
(f) a slidable support for each of said rows,
(g) a translating mechanism adjustably mounted on one side of said assembly selectively to move any one of said rows of type bars from said assembly,
(h) a type bar actuating member positioned on the side of said assembly opposite said translating mechanism,
(i) a translating mechanism indexing linkage extending from said keyboard for initial selection of one of said rows,
(j) a column stop selector means linked separately to each of said keys and adjustable to either of two positions in response to actuation of said column selector tabs,
(k) a first delay linkage operable following depression of any one of said keys for actuating said translating mechanism, and
(l) a second delay linkage extending from all of said keys to said type bar actuating member for rotating any type bar actuated by said member to a type impression point.

10. A printing machine comprising:
(a) an array of rows and columns of symbol units,
(b) type bars for individually supporting said symbol units in said rows and columns,
(c) a keyboard of four keys adapted selectively to move any one of said symbol units from said array to a type impression point,
(d) an aligning bar supporting said machine on a surface to be impressed with said symbol units,
(e) a linkage to said keys operable to modify stepwise the position of said machine along said bar,
(f) a release mechanism adapted to permit free slide movement of said machine relative to said bar to an indexing station, and
(g) means for engaging said machine at said indexing station to move said machine and said aligning bar a predetermined distance in a direction over said surface perpendicular to said aligning bar.

11. In a key operated machine having more than four symbol impressing elements adapted individually to be moved to an impression point and each responsive to a particular combination of two independent selection functions, the combination which comprises:
(a) four keys disposed in an array corresponding with the positions of finger tips of a relaxed cupped human hand,
(b) slide mounting means for said keys for movement of said keys in unison toward and away from the heel of said hand upon flexure of the fingers for performing one of said selection functions, and
(c) individual linkages from each of said four keys operable upon depression of a given key for performing the second of said selection functions.

12. In a key operated machine having more than four symbol impressing elements adapted individually to be moved to an impression point and each responsive to a particular combination of two independent selection functions, the combination which comprises:

(a) four keys disposed in an array corresponding with the positions of finger tips of a relaxed cupped human hand,

(b) slide mounting means for said keys for movement of said keys in unison toward and away from the heel of said hand upon flexure of the fingers for performing one of said selection functions,

(c) means operable upon the slide movement of said keys to each of a plurality of positions to produce a position designating sensible indication, and

(d) individual linkages from each of said four keys operable upon depression of a given key for performing the second of said selection functions.

13. In a key operated machine having more than four symbol impressing elements adapted individually to be moved to an impression point and each responsive to a particular combination of two independent selection functions, the combination which comprises:

(a) four keys disposed in an array corresponding with the positions of finger tips of a relaxed cupped human hand,

(b) slide mounting means for said keys for movement of said keys in unison toward and away from the heel of said hand upon flexure of the fingers for performing one of said selection functions,

(c) indicating means operable upon the slide movement of said keys to produce an audible position designating sensible signal, and

(d) individual linkages from each of said four keys operable upon depression of a given key for performing the second of said selection functions.

14. In a key operated machine having more than four symbol impressing elements adapted individually to be moved to an impression point and each responsive to a particular combination of two independent selection functions, the combination which comprises:

(a) four keys disposed in an array corresponding with the positions of finger tips of a relaxed cupped human hand,

(b) slide mounting means for said keys for movement of said keys in unison toward and away from the heel of said hand upon flexure of the fingers for performing one of said selection functions,

(c) means operable upon slide movement of said keys to each of a plurality of positions to produce a touch sensible position designating indication, and

(d) individual linkages from each of said four keys operable upon depression of a given key for performing the second of said selection functions.

15. In a key operated machine having symbol impressing elements arrayed in rows and four primary columns and adapted selectively to be moved to an impression point in response to a unique combination of two independent selection functions for each of said elements, the combination which comprises:

(a) four keys disposed in an array corresponding with the positions of finger tips of a relaxed cupped human hand,

(b) slidable supports for said keys adapted for movement of said keys in unison toward and away from the heel of said hand upon flexure of the fingers for selecting one of said rows as one of said selection functions,

(c) individual linkages from each of said four keys operable upon depression of a given key for selecting one of said four primary columns as the second of said selection functions, and

(d) a linkage from each of said keys to move the one of said elements corresponding in position with the conjunction of said one of said rows and said one of said four primary columns to said impression point upon depression of said given key.

16. In a machine having means for carrying out a plurality of operable functions which may be selectable from any one of a plurality of subgroups of functions, the combination which comprises:

(a) a keyboard having four keys,

(b) means for supporting said keys for movement as a body toward and away from an operator,

(c) linkages extending between said keys and said means for carrying out said functions and variable in response to said movement toward and away from an operator, and

(d) separate linkages from each of said keys to said means for carrying out said functions and variable upon depression of any one of said keys whereby said functions may be selected individually from said subgroups by selecting the position of said keys and then depressing one of said keys.

17. In a key operated machine having more than four symbol impressing elements adapted individually to be moved to an impression point and each responsive to a particular combination of two independent selection functions, the combination which comprises:

(a) four keys disposed in an array corresponding with the positions of finger tips of a relaxed cupped human hand,

(b) linkages including slide mounting means for said keys for movement of said keys in unison toward and away from the heel of said hand upon flexure of the fingers, said linkages being variable in response to said movement for performing one of said selection functions,

(c) detent-follower means for signaling variations in positions of said keys, and

(d) individual linkages from each of said four keys variable upon depression of a given key for performing the second of said selection functions.

18. A printing machine which comprises:

(a) a keyboard mounted for translation thereof while permitting independent depression of any of the keys therein,

(b) a plurality of rows of type elements forming a type element array,

(c) a first linkage coupled between said array and said keyboard and operable upon translation of said keyboard to move a selected row of elements into a type selector position,

(d) a type bar actuating element mounted for engagement with the element of said array at a printing position, and

(e) a second linkage extending from said keyboard both to said array and to said actuating element for sequentially moving a selected one of said type elements to said printing position followed by engagement thereof by said actuating element to move said selected one from its row to a type impression point.

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