UNITED STATES PATENT OFFICE.

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LISTING-MACHINE.

1,336,840. Specification of Letters Patent. Patented Apr. 13, 1920.

Application filed January 4, 1918. Serial No. 210,301.

To all whom it may concern:

Be it known that I, OLIVER D. JOHANTGEN, a citizen of the United States, and resident of Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Listing-Machines, of which the following is a specification, and which are illustrated in the accompanying drawings, forming a part thereof.

The invention relates to calculating machines, and more particularly to machines having recording attachments, though some of the features of improvement provided by the invention are not limited in their application to machines which are thus equipped. One of the principal objects of the invention is to provide an efficient calculating machine which is of inexpensive construction. To this end the invention contemplates improvements which promote simplicity of construction and reliability in operation, without requiring that extreme accuracy be obtained in the formation or finishing of the parts. Other objects of the invention are to provide improved devices for indicating upon the record that the machine has been cleared before the beginning of a new operation, and for preventing any improper manipulation of the machine.

In the accompanying drawings—

Figure 1 is an elevation showing one side of a listing machine embodying the features of improvement provided by the invention, the case or cover and the actuating handle being removed and the accumulating mechanism being omitted;

Fig. 2 is similar to Fig. 1, but shows the other side of the machine and includes the actuating handle and the accumulator;

Fig. 3 is a vertical longitudinal sectional view of the machine, the plane of section being indicated by the line 3—3 on Fig. 5;

Fig. 4 is a front elevation, the accumulator being omitted and some of the parts being shown in section on the plane indicated by the line 4—4 on Fig. 3;

Fig. 5 is a rear elevation of the machine, some parts being omitted;

Fig. 6 is a detail side elevation showing the printing frame and some of the parts mounted thereon, the control shaft being shown in section and a different position of some of the parts being indicated by dotted lines;

Fig. 7 is a detail elevation showing the control shaft separated from other parts;

Fig. 8 is a side elevation similar to a detail of Fig. 2, but having some parts omitted while other parts are shown in a different position;

Fig. 9 is a side elevation also similar to a detail of Fig. 2, but showing another position of the parts and with some features omitted;

Fig. 10 is a detail elevation showing the locks for the printing hammers and some associated parts;

Fig. 11 is an elevation showing a controlling element for the signal printing mechanism separated from other parts;

Fig. 12 is a detail side view of the controlling link for the signal printing mechanism, the control shaft and a detail of the frame being shown in section;

Fig. 13 is a detail sectional view of the machine showing the printing elements, some parts being omitted;

Fig. 14 is a detail side view showing the repeat key and some associated parts, a different position of the parts being indicated by dotted lines;

Fig. 15 is a detail side view showing the key-board lock, the frame being omitted to expose one of the key controlling elements and a different position of one of the parts being shown in dotted lines;

Fig. 16 is a detail plan view showing the key guides, and an associated part of the frame, some of the key stems being shown in section;

Fig. 17 is a detail side view of the parts shown in Fig. 16, the key stems being omitted;

Fig. 18 is a plan view, partly in section, showing the main actuating link separated from other parts;

Fig. 19 is a side elevation similar to Fig. 2 but showing a modified form of construction and having the printing mechanism omitted;

Figs. 20 and 21 are each similar to a detail of Fig. 19, but show a further modification with the parts in different positions;

Fig. 22 is a detail rear elevation showing a pair of relatively movable sliding plates used in the form of construction illustrated in Figs. 20 and 21; and

Figs. 23, 24 and 25 are details of a modi-

fied form of construction of the printing mechanism.

The particular listing machine which has been selected for the purpose of illustrating the invention includes the accumulator which forms the subject of Patent No. 1,306,112, issued to me under date of June 10, 1919.

The machine is provided with a sheet metal frame shown as oblong rectangular, open at the bottom and having an inclined cover plate upon which the keyboard is mounted. The keys are arranged in seven rows, each extending from front to rear and composed of keys numbered, respectively, from 1 to 9. These keys comprise finger pieces and stems, the latter reciprocating through slots in the cover plate, and may be depressed against the resistance of springs to coöperate with and determine the movement of a series of rack bars, one for each row of keys, these bars being adapted to turn a set of accumulator wheels located at the front end of the case, the several keys determining the range of movement of the rack bars. There is also provided an operating handle for actuating the rack bars and other movable parts of the machine, and printing mechanism at the rearward end of the casing arranged to be set by means of the keys and operated by the handle. Suitable keys are also provided whereby the mechanism may be set for taking totals or sub-totals and clearing the accumulator.

As thus outlined the machine is of a common and well known type, but as to various features, as hereinafter pointed out, it presents elements of novelty in structure and function.

In the accompanying drawings the accumulator is generally designated 25. Its parts are assembled upon a bracket 26, hereinafter referred to as the accumulator bracket. This bracket has the form of an inverted bail, and it extends across the main frame of the machine at one end.

The recording mechanism, generally designated 27, is located at the remote end of the machine from the accumulator 25, its parts being principally held between a pair of side plates 47 and 48. This recording mechanism serves for printing against a platen roller, represented in diagram at 28. The ribbon guides 29 and 30 are located directly in front of the platen roller 28 and at opposite ends of a row of type bars, designated 31 to 38 inclusive. To permit the printing of items and totals in different colors, the ribbon guides 29 and 30 are shiftable for use with a two colored ribbon (not shown). The construction also contemplates a movement of the ribbon guides 29 and 30 for printing the upper and lower portions of so-called non-add items from the differently colored parts of the ribbon.

The main frame of the machine includes a pair of side plates 39, 40, a pair of cross tie-plates 41, 42, and a pair of end plates 43, 44, and an inclined cover plate 44ª. The keyboard 45 extends over the main frame throughout its full length. The accumulator bracket 26 is detachably secured to the side plates 39 and 40 at one end, as by set-screws one of which is shown at 46. The side plates 47, 48, of the recording mechanism are held between the main side plates 39 and 40 at one end and project beyond the same. As shown, the side plates 47, 48, are each carried by a pair of studs 49, 50, which project inwardly from the adjacent side plates 39, 40.

The type bars 32 to 38 inclusive (Fig. 5) are each provided with a full set of figure type, and the different types are presented to the platen 28 by vertical movement of the bars. This vertical movement of the bars is controlled by the same sliding rack bars 52, which serve for controlling the indicator wheels 51 of the accumulator 25 (Fig. 3). As shown, each rack bar 52 is forwardly provided with a set of gear teeth 53, for engagement with the corresponding indicator wheel 51 in the usual manner. The connection between each rack bar 52 and the corresponding type bar comprises a link 54 and a bell crank lever 55 (Fig. 3). The several bell crank levers 55 swing in vertical planes. For this purpose they are journaled upon a horizontal tie rod 56, which extends transversely between the side plates 47 and 48 of the recording mechanism at the extreme rear end of the machine. One arm, as 57, of each bell-crank lever 55 has a pivotal connection with the corresponding type bar 32 to 38, at 58, and one of the links 54 extends from the other arm, as 59, of each bell-crank lever to the corresponding rack bar 52. As the spacing of the type bars 32 to 38 and bell-crank levers 55 is preferably less than that of the rack bars 52, the arms 59 of some of the bell-crank levers 55 are laterally offset to extend to the planes of the corresponding rack bars, as most clearly illustrated in Fig. 5.

In the arrangement shown, the keyboard 45 includes a separate set of nine keys 60 for each denomination. Under these circumstances the key stems 61 coöperate as limiting stops directly with shoulders 62 on the rack bars 52, and the movement of the rack bars in one direction, to bring their shoulders to the depressed keys, is accomplished by springs, as 63, in a well known manner. The stems 61 of all of the keys of each set slide between a pair of spring-pressed swinging plates 64, 65 (Fig. 4). These plates serve as a key lock and a rack lock, respectively. As shown, each of the plates 64 and 65 is formed with gudgeons 66 at its opposite ends, and these gudgeons are journaled

in the corresponding end plates 43, 44, of the main frame. The spring movement of the plates is conveniently accomplished by the use of a set of elastic split rings 67, one of which embraces the plates 64, 65, of each set. The effect of these spring rings 67 is to normally close the plates 64, 65, of each pair upon the corresponding key stems 61.

Each of the plates 65 is provided at one end with a depending leg 68. This leg normally extends in front of one of the shoulders 62 of the corresponding rack bar 52, but is moved laterally out of the path of the said shoulder upon the swinging of the plate. Each of the plates 64, on the other hand, is provided with a series of instanding fingers 69, for holding the keys in their depressed positions. As shown, notches 70 and 71 (Fig. 3) are formed in the key stems 61, and these notches register with the fingers 69 in the depressed and elevated positions of the keys, respectively. In order that each plate 64 will be swung outwardly against the effort of the corresponding spring 67, upon the depression of any key 60 in the corresponding row, the upper portion of each finger 69 is formed with an inclined shoulder 72 for cam engagement with that part, as 74, of the key stem which separates the notches 70 and 71. Similarly, each plate 65 is formed with a series of inturned fingers 73, which have cam engagement with the parts 74 of the key stems 61 for swinging the plate 65 outwardly upon the depression of any key in the corresponding row. This construction provides that each rack bar 52 is released upon the depression of any key in the corresponding row, and also that the depression of any key serves to release any previously depressed key in the same row.

Furthermore, all of the keys 60 of the entire keyboard 45 may be locked against movement, if outward movement of the several plates 64 or 65 is prevented. A keyboard lock in the form of a bar 75 is accordingly provided, consisting of a movable strip extending across the machine and having lugs 76 for entering the paths of movement of one of the plates, as 64. At one end the bar 75 projects through an opening 77 (Fig. 1) in the main side plate 39. Preferably it is made in the form of a bail, its two ends 78 and 79 (Figs. 1 and 3) being pivotally secured against the outside of the side plate 39 and the inside of the side plate 40, respectively. When constructed in this way the keyboard lock becomes effective upon an upward swinging movement of the same.

The machine is actuated with the familiar form of forwardly swinging oscillating handle 80, retracted by a main spring 81. The handle 80 is located at one side of the machine, and is fixed on one end of the main shaft 82. The main shaft 82 extends transversely through the machine near its forward end, and has the crank arms 83 or 84 applied thereto at each side of the frame. These crank arms move the transverse sliding rod 104 (Figs. 3 and 4) by which the rack bars 52 are returned to normal position, and the crank arm 83 additionally serves for communicating motion to the control shaft 85, shown in detail in Fig. 7, which extends transversely through the main frame near its rear end.

In the particular form of construction illustrated in this application, the control shaft 85 has an oscillating movement similar to that of the main shaft 82. The control shaft 85 is provided with a crank disk 86 at one end, and a yielding link 87 (Figs. 1 and 18) connects this disk with the crank arm 83 and is made yielding to impart flexibility to the operation of the machine. As shown, this link comprises a pair of overlapping sections 88, 89, and a pair of side plates 90, 91. The two side plates 90 and 91 are connected by springs 92. These side plates are also provided with oppositely facing studs 93, 94, the two studs being located at the opposite ends of the plates. Each stud projects through slotted openings 95, 96, provided in the two link sections 88, 89, in their overlapping portions, and through a slotted opening 97 or 98 in the opposite side plate 90 or 91. The result of this construction is that the springs 92 normally hold the link 87 to a fixed length, and a relative longitudinal sliding movement of the two link sections 88 and 89 in either direction results in an extension of the springs. The link 87 may accordingly be elastically extended or elastically contracted from its normal length.

The main spring 81 is connected with the section 88 of the link 87 near its point of attachment to the crank arm 83. To insure that only complete strokes of the actuating handle 80 may be made, in each direction, a double acting pawl 99 coöperates with ratchet teeth 100 formed on the rim of the crank disk 86. The range of movement of the crank disk 86 is determined by a stop block 101, and by a fixed stud 103 which is carried by the stop block and projects outwardly therefrom. The stop block 101 is secured against the main side plate 39 and is engaged at one side by an inturned arm 102 on the crank disk 86, to arrest the movement of the machine as each operation is completed. The stud 103 is engaged by an edge of the crank disk 86 to limit the forward movement of the disk. The transverse rod 104 is slidingly supported in slotted openings 105 in the main side plates 39 and 40. It also extends through a slotted opening 106 (Fig. 3) in each of the rack bars 52. The two ends of the rod 104 are engaged with the notched lower ends of two depending oscillating plates 107, one at each side of the machine. Each of the plates 107 is

swung, during a part of the oscillation of the main shaft 82 in each direction, by a cam roller 109, carried by the adjacent crank arm 83 or 84, which enters a flaring cam slot 108 in the corresponding plate.

It is of importance that the power required to operate the machine be substantially uniform, whatever the number of keys in use. To this end a variable friction drag is provided by the following means:—A pair of washers 110 are mounted upon the shaft 104 to bear against opposite sides of each rack bar. Springs 111, coiled about the shaft, react between the washers of adjacent bars, thus developing friction between the washers and such of the bars as are inactive. As the active bars travel with the rod 104 they move without friction. It follows, therefore, that the load and the friction drag vary inversely with variations in the number of rack bars in action. So, too, the effort required in tensioning the springs is rendered approximately uniform, for while the resistance to the return of the handle varies with the number of bars in action, there is a corresponding variation, inversely, of the friction drag.

As is customary, the indicator wheels 51 of the accumulator 25 are normally engaged with the rack bars 52 only during the return movement of the latter. Furthermore, when a total is taken the indicator wheels 51 are engaged with the rack bars 52 only during the outward movement of the rack bars. In the taking of a sub-total, the indicator wheels 51 are engaged with the rack bars 52 during both their outward and return movements. The engagement and disengagement of the indicator wheels 51 and rack bars 52 is accomplished by vertical movement of the spindle 112 on which the indicator wheels are mounted. This spindle is guided by having its ends seated in vertical extended notches 113 (Fig. 2) in the ends of the accumulator bracket 26. The spindle 112 is supported in the ends of a bail-like frame 114, hereinafter termed the accumulator frame, which swings upon a transverse tie-rod 115. This tie-rod in turn has a swinging movement and is part of a rocking frame which also comprises the bell-crank levers 116, one at each side of the machine. The bell-crank levers 116 each have one arm pivotally secured against the accumulator bracket 26, as at 117. A spring 118 acts between the other arm of one of the bell-crank levers 116 and a fixed stud 119, to normally hold the spindle 112 in elevated position.

When an oscillating control shaft, as 85, is employed, vertical movement of the indicator wheels 51 is most conveniently accomplished by the turning of an oscillating plate 120. As shown, this plate is pivotally secured against one of the side plates, as 40, of the main frame adjacent its forward end, as by a stud 121. Under these circumstances a short link 122 connects the plate 120 with one of the arms of the adjacent bell-crank lever 116. While the spring 118 normally serves to hold the spindle 112 in elevated position, a second spring 123, acting between the link 122 and the plate 120, serves to hold the spindle 112 in depressed position when the point of connection of the link 122 with the plate 120 has passed below the level of the stud 121. By the use of the spring 123 the need of extreme accuracy in fitting the parts is obviated.

In the form of construction which is more particularly illustrated in Figs. 2, 7 and 9, a flanged disk 124 having three studs 125, 126 and 127, is mounted upon one end of the control shaft 85, and two links 128, 129, are provided for communicating motion from these studs to the plate 120. The link 128 is effective for turning the plate 120 in both directions during the normal operation of the machine. On the other hand, the link 129 is effective for turning the plate 120 in both directions during the taking of a total. In taking a sub-total, the link 129 is effective to turn the plate 120 in one direction, and the link 128 is effective to turn the plate 120 in the opposite direction. When a non-add key, as 130, is used, neither of the links 128 or 129 is effective.

The links 128 and 129 are pivotally connected with the plate 120 at opposite sides of its center, as at 131 and 132. The link 128 is formed with a hooked end 133. In the normal operation of the machine, the hooked end 133 of the link 128 is engaged upon one side by the stud 126 as the control shaft 85 approaches the limit of its forward movement, and upon the other side by the stud 125 as the control shaft approaches the limit of its return movement. The link 129 is formed with oppositely facing shoulders 134 and 135. When this link is effective the shoulder 134 is engaged by the stud 127 at the beginning of the forward movement of the control shaft 85. Near the end of the forward movement of the control shaft 85 the stud 125 passes under the rear end of the link 129, for engagement with the shoulder 135 at the beginning of the return movement of the control shaft 85. When a sub-total is taken the stud 127 is engaged with the shoulder 134 at the beginning of the forward movement of the control shaft 85, but the link 129 is moved to an inoperative position at the end of the forward movement of the control shaft. The indicator wheels 51 are accordingly not lifted out of engagement with the rack bars 52 until the stud 125 becomes engaged with the hooked end 133 of the link 128.

The link 129 is normally supported in elevated position out of the path of the studs 125 and 127. For this purpose it rests

in the notched arm 136 of a vertically movable bracket 137, to which the stem 138 of the total key 139 is connected. This method of supporting the link 129 permits of the lifting of the link for the engagement of the stud 125 with the shoulder 135 by the cam engagement of the stud with the rear end of the link. As shown, the bracket 137 is formed with a vertical slot 141, and is slidingly held against the side plate 40 by a stud 142 which runs in this slot. A spring 140 serves for elevating the bracket 137 and total key 139. To prevent movement of the total key 139, except when the machine is at rest or the control shaft 85 has reached the limit of its forward movement, the flange of the disk 124 extends into the path of an outstanding arm 143 carried by the bracket 137, but the said flange has notches 144 and 145 which respectively register with the arm 143 when the machine is at rest and when the control shaft 85 has completed its forward movement.

The movement of the link 128 to inoperative position may be accomplished by downward movement of a sliding plate 146, to which the stem 147 of the non-add key 130 is connected. As shown, the link 128 is formed with a longitudinally extended notch 148, and a stud 149, carried by the plate 146, runs in this notch. The plate 146 is slidingly held against the side plate 40 by a stud 151 which passes through a vertical slot 150 in the plate. A spring 152 serves to normally hold the non-add key 130 in elevated position. As it is desirable that depression and release of the non-add key 139 should only be permitted when the machine is at rest, the plate 146 is formed with a lug 153 which extends over the flange of the disk 124. When the machine is at rest, the lug 153 registers with the notch 145 in the said flange. Since the movement of the control shaft 85 is not sufficient to bring the opening 144 into register with the lug 153 at any time, the non-add key 130 is not released, after depression, until the machine again comes to rest.

In the form of construction illustrated in Fig. 19, all of the movements of the oscillating plate 120 are accomplished through a single actuating link 154, and the flanged disk 124 is supplied with only two studs 155 and 156. This form of construction does not so readily lend itself to the use of a non-add key, and none is shown. The link 154 is formed with two sets of oppositely facing shoulders 157, 158, and 159, 160, the two intermediate shoulders 158 and 159 being the opposite edges of a depending finger 161 of substantial length. In this instance the elevation of the link is controlled by the position of the total key 139. For this purpose the link 154 rests in the notched arm 136 of the sliding bracket 137. In the normal or elevated position of the link 154, the stud 155 engages the shoulder 159 for advancing the link 154 as the control shaft 85 approaches the limit of its forward movement. The stud 156 engages the shoulder 158 to return the link 154 as the control shaft 85 approaches the limit of its return movement. When the total key 139 is depressed, the stud 156 engages the shoulder 157 for advancing the link 154 at the beginning of the forward movement of the control shaft 85, and the stud 155 engages the shoulder 160 to return the link 154 when the control shaft 85 begins its return movement. Engagement of the stud 155 with the shoulder 160 is permitted by a lifting of the link 154 through a cam engagement of the stud 155 with the rear end of the link. In event the total key 139 is released when the control shaft 85 has reached the limit of its forward movement, the link 154 is not returned until the stud 156 engages the shoulder 158 and a sub-total is taken.

Depression of the total key serves both to release all of the rack bars 52 and to clear the keyboard 45, as usual. In the construction shown this is accomplished by a swinging of the key lock and rack lock plates 64, 65 (Fig. 4). For this purpose a comb 161 (Fig. 5) extends transversely through the machine immediately in rear of the main frame. The teeth 162 of this comb serve as wedges for separating the plates 64, 65, of each set. To provide a support for the comb 161 its two ends, 163 and 164, are turned forwardly and pivotally secured against the side plates 39 and 40, respectively, as at 165 (Fig. 1) and 166 (Fig. 2). One of these comb ends, as 164, extends beyond the corresponding pivot 166 into the path of a stud 167, carried by the sliding plate 137, which is depressed by the total key 139.

The comb 161 also serves for clearing the keyboard 45 as the control shaft 85 approaches its position of rest after each operation. As shown, a pawl plate 168 (Fig. 1) is pivotally secured against the comb end 163. The lower end of this pawl plate extends into the path of a stud 169 which is secured against the crank disk 86 upon the inside of the same. During the forward movement of the control shaft 85 the stud 169 lifts the pawl plate 168 without lifting the comb 161. On the other hand, swinging of the pawl plate 168 in the other direction, independently of the comb 161, is prevented by providing the pawl plate with a projection 170 which extends over the pivot 165. As the crank disk 86 approaches the limit of its return movement, the stud 169 accordingly serves to engage the lower end of the pawl plate 168 and lifts the comb 161 to clear the keyboard 45.

When the repeat key, as 171, is used, the

pawl plate 168 is lifted out of the path of the stud 169. For this purpose a lever 172 (Figs. 1 and 14) is pivotally secured against the corresponding side plate, as 39, at 173, and one end of this lever is connected with the stem 174 of the repeat key 171. The other end of the lever 172 extends under a shoulder 175, formed on the pawl plate 168.

To prevent depression of any of the keys 60 during the operation of the machine, the keyboard lock 75 is desirably raised to effective position immediately at the beginning of each forward movement of the actuating handle 80. The raising of the keyboard lock 75 is accomplished by a spring 176 (Fig. 1), but the keyboard lock is held in depressed position when the machine is at rest. As most clearly shown in Fig. 15, one of the ends 78 of the keyboard lock 75 is extended rearwardly and downwardly beyond its pivot, and the inwardly facing stud 93 of the link 87 (Fig. 18) projects a sufficient distance beyond the link part 91 for engagement with this member. While the key lock end 78 must be released by the stud 93 immediately at the beginning of each operation of the machine, it is necessary that the key lock 75 be depressed a sufficient time before the completion of each operation of the machine for the clearing of the keyboard 45 by the comb 161. To this end a pawl plate 177, controlled by a spring 179, is mounted on the key lock end 78 and extends into the path of the stud 93. During the upward and forward movement of the link 87, the pawl plate 177 yields to the stud 93 and the lifting of the key lock 75 by its spring 176 is permitted as soon as the stud 93 becomes disengaged from the downwardly extended portion of the key lock end 78. Upon the return of the link 87 the yielding of the pawl plate 177 is limited by the engagement of this pawl plate with the pin, as 178, through which one end of the spring 179 is connected to the key lock end 78. The engagement of the stud 93 with the front edge of the pawl plate 177 accordingly serves to unlock the keyboard 45 before the comb 161 is raised by the engagement of the stud 169 with the front edge of the pawl plate 168.

A set of swinging hammers 180 (Fig. 13), one for each type bar 31 to 38, inclusive, serve for forcing the type bars against the platen 28 to accomplish the printing operations. These hammers are loosely pivoted upon a transverse shaft 181. This shaft is journaled in the side plates 47 and 48, and at one end it projects through the corresponding side plate, as 47. Rotation of the shaft 181 in one direction serves for restoring the hammers 180 after their operation. For this purpose a pair of cranks 183 are fixed upon the shaft 181, at opposite ends of the row of hammers, and a restoring rod 184 extends between the cranks 183 in front of the hammers.

Each hammer 180 is actuated by a separate spring 185 (Fig. 13). Each of these springs extends from the corresponding hammer to a fixed transverse frame member 186, which also serves to guide the type bars 31 to 38 inclusive at their upper ends. Each hammer 180 acts upon the corresponding type bar 31 to 38, through a lever 187. These levers are pivotally supported upon a fixed transverse rod 188, one of the levers being alined with each of the type bars and with a stud 189 carried by the corresponding hammer 180. At their upper ends the levers 187 extend above the pivot rod 188 for engagement with the type bars in substantial alinement with the platen 28.

The printing hammers 180 are normally held against movement by a set of hammer locks 190 or 191. The hammer lock 190 controls the hammer 180, which actuates the type bar 31 for printing the clear signal. The remaining hammer locks 191 control the hammers 180 which actuate the figure type bars 32 to 38 inclusive. The hammer locks 190, 191, are pivotally mounted upon a transverse rod 192, carried by a swinging frame 193, and hereinafter referred to as the rectifying frame. The rectifying frame 193 is in turn carried by a transverse shaft 194. This shaft is also journaled in the side plates 47, 48, and projects through the corresponding side plate, as 47, at one end. In their advanced positions (Fig. 3) the hammer locks 190, 191, are held against the front of the cross-piece 195 of the rectifying frame 193. For this purpose a separate spring 196 extends from the lower end of each hammer lock 190 and 191 to a lower cross-piece 197 of the rectifying frame 193.

The rear edge of the cross-piece 195 of the rectifying frame 193 serves to aline the type for printing by entering one of a series of notches 198 provided at the front end of the arm 57 of each bell-crank lever 55 (Fig. 13). As shown, the rectifying frame 193 is swung rearwardly immediately prior to the printing operation, as by the engagement of a crank pin 206 (Fig. 7), mounted in a crank arm 199 on the control shaft 85, with a crank arm 200 (Fig. 6) carried by the projecting end of the shaft 194. Preferably the crank pin 206 also serves for moving the restoring rod 184 (Fig. 13) out of the path of the hammers 180 immediately prior to the release of the hammers by the hammer locks 190, 191. For this purpose one arm of a bell-crank lever 182, fixed upon the projecting end of the hammer shaft 181, is formed with a notch 201, and a second bell-crank lever 202, pivotally secured against the side plate 47 upon the outside of the same, as at 203

(Fig. 6), carries a cam roller 204 at one end for entering the said notch 201. The other end of the bell-crank lever 202 is formed with a notch 205 for receiving the crank pin 206 when the control shaft 85 approaches the limit of its forward movement. A spring 207 acts between the bell-crank levers 182 and 202, and serves to insure a smoother operation while the parts are being restored to their normal positions by the engagement of the crank pin 206 with that part of the bell-crank lever 202 which is below the notch 205 during the return movement of the control shaft 85. If the spring 207 is of sufficient strength to overcome the resistance of all of the hammer-actuating springs 185, the main spring 81 is largely relieved of the work of restoring the hammers 180.

As the type bar 31 is supplied with only a single type character, no vertical movement of it is required. This type bar accordingly has a fixed pivot, as upon a transverse rock shaft 208 (Fig. 13). A spring 209 (Fig. 5), coiled about this shaft adjacent one end of the same, serves for swinging the type bar 31 away from the platen 28. The type bars 32 to 38 inclusive are normally held out of contact with the platen 28 by helical springs 210 (Fig. 13), one of which acts between the lower end of each type bar 32 to 38 and the corresponding bell-crank lever 55.

Withdrawal of the hammer locks 191 only when characters are to be printed from the corresponding type bars 32 to 38, is conveniently accomplished by providing each of the said hammer locks with a forwardly projecting stop shoulder 211 (Fig. 13). It follows from this construction that rearward movement of the rectifying frame 193, when any one of the bell-crank levers 55 is in the normal position illustrated in Fig. 3, serves only to swing the lower end of the corresponding hammer lock 191 rearwardly without withdrawing the upper end of the hammer lock from the corresponding hammer 180. On the other hand, when any one of the bell-crank levers 55 has been raised by a forward movement of the corresponding rack bar 52, as in Fig. 13, rearward movement of the rectifying frame 193 causes the stop shoulder 211 of the corresponding hammer lock 191 to fulcrum against the forward end of the bell-crank lever 55 and swings the upper end of the hammer lock forwardly to release the corresponding hammer 180.

A convenient arrangement for printing the significant zeros is illustrated in Fig. 10. As shown, each hammer lock 191, except the one at the extreme right-hand end of the series, is provided near its upper end with a lateral projection 212, which extends in front of the upper end of the next adjacent hammer lock 191 to the left. As both units and tens will always be printed, the hammer lock 191 at the extreme right-hand end of the series is not provided with a lateral projection, but this hammer lock has a fixed connection 213 with the next adjacent hammer lock 191 to the left.

While the printing of a signal with the first item is desired, as usual, the invention contemplates that this shall be accomplished by permitting the actuation of the type bar 31 with the corresponding printing hammer 180 only when the accumulator 25 is clear. For this purpose each of the indicator wheels 51 of the accumulator is formed with a notch 214 (Figs. 3 and 13). A comb 215 (Fig. 11) extends under the indicator wheels 51, and the notches 214 of all of the indicator wheels register with the teeth of the comb 215 only when the accumulator 25 is clear. When this condition exists the comb 215 may be raised to enter its teeth in the notches 214. At other times the raising of the comb 215 is limited by the engagement of one or more of its teeth with the rims of the corresponding indicator wheels. Furthermore, as the accumulator 25 is clear when a total or sub-total is being printed, provision is desirably also made to prevent the raising of the comb 215 at this time, viz:—when the accumulator frame 114 has been lowered during the outward movement of the rack bars 52.

As shown, the comb 215 is carried between a pair of crank arms, as 216 (Fig. 13), one at each end of the comb. These crank arms are fixed upon a rock shaft 217, and this rock shaft extends between and is journaled at its opposite ends in the two ends of the accumulator frame 114. The rock shaft 217 accordingly rises and falls with the accumulator frame 114. Movement of the comb 215 is confined to a vertical plane by providing it at each end with a slotted arm 218, which engages the spindle 112 upon which the indicator wheels 51 are mounted. The rock shaft 217 is also provided with a crank arm 219 intermediate its ends. This last-mentioned crank arm carries a crank pin 220. The function of these parts is to provide for the withdrawal of the hammer lock 190 when the raising of the comb 215 is permitted. To this end a link 222, having a notched forward end for receiving the pin 220, extends rearwardly from this pin over the transverse frame member 41, and over the control shaft 85. At its rear end the link 222 is turned upwardly and has a pin and slot connection 223 with the hammer lock 190. This pin and slot connection permits rearward movement of the rectifying frame 193 without dislodging the hammer lock 190 from the corresponding hammer 180.

It will be understood that raising of the

comb 215 and withdrawal of the hammer lock 190, as in Fig. 13, are accomplished by forward movement of the link 222. To prevent raising of the comb 215 when a total or sub-total is to be printed, the link 222 is equipped with a pivoted latch member 224. When the accumulator frame 114 has been lowered in advance of outward movement of the rack bars 52, as in taking a total or sub-total, the link 222 is lowered at its forward end and the latch becomes engaged with the transverse frame member 41, as in Fig. 12. This prevents forward movement of the link 222, notwithstanding the fact that when the printing operation is to be accomplished the notches 214 of all of the indicator wheels 51 will have been brought into register with the teeth of the comb 215. On the other hand, when a "first item" is to be printed the link 222 is moved forwardly in advance of the depression of the accumulator frame 114. Under these circumstances the forward end of the latch 224 rides upon the top of the transverse frame member 41, as in Fig. 13.

When forward movement of the link 222 is permitted this is accomplished as the actuating handle 80 approaches the end of its forward stroke. For this purpose the crank arm 199 on the control shaft 85 is formed with a contact shoulder 221. In order that the operation of the machine may not be interfered with when the link 222 is held against forward movement, a yielding stud 225 is carried by the link for coöperation with the contact shoulder 221. As shown, the stud 225 is mounted at the lower end of a crank-arm 226, which has pivotal connection with the link 222, and a stout spring 227 acts between the stud 225 and the link for causing the link to move with the stud except when such movement is prevented.

The shifting of the ribbon guides 29, 30 (Fig. 5), for differentiating items, totals and non-add items by printing the same from different parts of a multi-colored ribbon, is conveniently accomplished in the manner now to be described. The ribbon guides 29, 30, are respectively located at the upper ends of the two sides 228 and 229 of an upright sliding frame. This frame also includes a transverse front plate 232, connecting the side members 228 and 229 intermediate their ends. Movement of the frame is guided by forming each side member 228, 229, with a vertical slot 230 (Fig. 2), which receives an instanding stud 231 carried by the corresponding side plate 47 or 48. At their lower ends the frame members 228 and 229 are pivotally connected with crank arms 233 carried by the rock shaft 208 (Fig. 3).

Movement of the rock shaft 208 is varied in accordance with the part of the ribbon to be used for printing. As shown, the rock shaft 208 is provided at one end with a crank arm 234. A link 235 (Fig. 2) connects the crank arm 234 with a crank arm 236, which is mounted upon the inner end of another transverse rock shaft 237. The rock shaft 237 extends outwardly from one side of the recording mechanism 27 to the plane of the adjacent side of the machine. As shown, it is journaled at one end in the adjacent side plate 48 of the recording mechanism. The other end is journaled in a bracket plate 238, carried by the main side plate 40 (Fig. 5). The rock shaft 237 is also supplied with a crank arm 239 near its outer end. This crank arm is connected with a link 240, which extends forwardly therefrom alongside of the main frame. A spring 241, acting between the link 240 and the bracket plate 238, serves to normally support the link for holding the ribbon guides 29 and 30 in their lowest position.

At its forward end the link 240 has a pin and slot connection 242, 243, with the adjacent plate 107, the slot 243 being of different lengths at different levels, and the upper and shortest part of the slot being only equal to the width of the pin 242. It follows from this construction that if the link 240 is depressed to bring the shortest part of the slot 243 into alinement with the pin 242, the link 240 will be moved with the plate 107 throughout the full range of movement of the latter and the ribbon guides 29, 30, are completely elevated. On the other hand, as the link 240 is normally held in elevated position by the spring 241, the longest part of the slot 243 is normally alined with the pin 242, and this pin is idle during its travel throughout the full length of the slot. If the link 240 is partly depressed, the pin 242 will be effective to raise the ribbon guides 29, 30, a sufficient distance to present the intermediate part of the ribbon for printing. In event only a two-colored ribbon is used, the printing of the upper and lower parts of the several characters will then be accomplished with differently colored parts of the ribbon.

Depression of the link 240 to cause a complete elevation of the ribbon guides 29, 30, is preferably accomplished when the total key 139 is used. This is most readily brought about by making the stud 167, which is effective for clearing the keyboard, long enough to also extend over the link 240 (Fig. 2). The totals and sub-totals are accordingly printed from a different part of the ribbon than is used during the normal operation of the machine. On the other hand, a partial depression of the link 240 is desired when the non-add key 130 is used. For this purpose a separate key 244 is mounted in the keyboard 45 adjacent the non-add key 130. As shown, the stem 245 of the

key 244 is pivotally connected with a swinging plate 246. This plate is pivotally secured against the main side plate 40 at 247, and carries a stud 248 for engagement with the upper edge of the link 240. A spring 249 acts between the swinging plate 246 and a fixed support for raising the key 244 and the plate.

Preferably provision is made for preventing use of the non-add key 130 except when the key 244 has been depressed. As shown, the sliding plate 146, which is effective for depressing the link 128, is formed with a projection 250 which normally overlies an extended part 251 of the swinging plate 246. When this construction is employed, depression of the key 244 to move the extended part 251 of the swinging plate 246 out from under the projection 250 is required to permit the use of the non-add key 130. Furthermore, when the non-add key 130 has been depressed, the projection 250 lies in rear of the extended part 251 of the swinging plate 246 (Fig. 8) to prevent the return of the key 244 until the non-add key 130 has been released. Printing of the non-add items from an intermediate part of the ribbon is thereby insured.

While the construction shown permits of the operation of the type bar 31 to print a signal with a non-add item, in event such an item is printed when the accumulator 25 is clear, the printing will, nevertheless, be distinguished from a "first item" by the use of an intermediate part of the type ribbon. Furthermore, as the printing of non-add items does not affect the accumulator, the operation of the type bar 31 to print signals with the non-add items when the accumulator is clear, does not in any way interfere with the subsequent operation of the type bar 31 to print a signal with the next added item. In other words, the type bar 31 always operates to print a signal when the accumulator 25 is clear, except during the printing of a total or sub-total. The present construction is accordingly distinguished from those in which the printing of a signal is determined by a previous setting of parts which would be disturbed by the printing of a non-add item. Although the invention contemplates that both totals and sub-totals may be printed from the same part of the type ribbon and will therefore be shown in the same color, the totals and sub-totals will be readily distinguished by the fact that the next item, whether a non-add or an added item, following a total, will be accompanied by the signal printed from the type bar 31, whereas this type bar will not be operated during the printing of the next item following a sub-total. It will be understood that if a plurality of non-add items are printed, next following the taking of a total, the signal printed by the type bar 31 will be repeated with each of these non-add items and will also be shown with the first succeeding added item.

The machine may be largely constructed from stamped metal parts without machine finishing, if the parts are so shaped as to avoid the use of cut edges as bearing surfaces for moving members. To this end the rack bars 52 are each formed with horizontal flanges 252 (Fig. 4) and 253 (Fig. 5). These flanges slide through openings 254 in the transverse frame member 41 or 42, and each opening 254 has enlarged ends 255 to prevent contact of the margins of the opening with the corresponding rack bar, either at the angle between the rack bar and its said flange 252 or 253, or at the free edge of the flange. Furthermore, smooth supporting bearings for each rack bar 52 are provided by securing a separate plate 256 against the transverse frame members 41 and 42 below the openings 254. The plates 256 are each formed with a series of inturned lugs, as 257 (Fig. 3). These lugs extend through the openings 254 under the flange 252 or 253 of the corresponding rack bar 52. Preferably the width and spacing of the lugs 257 is such that the free edge of each flange 252 or 253 extends beyond the adjacent edge of the corresponding lug 257. There is accordingly no requirement for imparting a smooth finish to the free edges of the flanges 252 and 253.

An arrangement whereby a relatively small number of inexpensively formed and readily assembled parts may be used for supporting and guiding the key stems 61 is more particularly illustrated in Figs. 1, 3, 16 and 17. As shown, a separate plate 258, having a series of inturned lugs 259 at different levels (Figs. 16 and 17), is secured against each of the main side plates 39, 40, upon the outside of the same, the lugs 259 projecting through the corresponding side plate. The lugs 259 serve as brackets for supporting a series of shelves 260. The shelves 260 have slots 261 for receiving the key stems 61, and they are held to their seats upon the bracket lugs 259 by downward pressure of the key springs 262. Each shelf 260 has a ribbed reinforcing plate 263, secured thereto along its upper surface, the forward edge of the reinforcing plate being formed with notches to clear the key springs 262.

At its rear edge each shelf 260 extends under the bracket lugs 259 of the next higher set. Each shelf 260 is also formed with a pair of depressed lugs 265, 266, at each end, for engaging the front and rear edges, respectively, of the bracket lugs 259 upon which the shelf is supported. In assembling the parts each shelf 260 is first applied in a position sufficiently in rear of that

which it finally assumes to permit the hooked lower ends 267 of the key stems 61 to pass the rear edge of the next lower shelf or the rear edge of the inturned flange 268 of the front end plate 43. At this time the rear edge of the newly applied shelf is located a substantial distance under the bracket lugs 259 of the next higher set, and the front edge of the shelf is supported in elevated position through the fact that the depressed lugs 265 are resting upon the top of the bracket lugs 259 upon which the shelf is finally to be supported. The corresponding key stems 61 having been introduced and held in depressed position, the shelf 260 is moved forwardly until the hooked lower ends 267 of the key stems 61 become engaged with the rear edge of the next lower shelf, or with the rear edge of the flange 268 and the depressed lugs 265 have passed the front edges of the corresponding bracket lugs 259. The key springs now serve to depress the shelf and to firmly hold it in position with the depressed lugs 265 and 266 engaged with the front and rear edges of the bracket lugs 259.

In some instances it may be desirable to avoid the necessity of holding the total key 139 down until after the operating handle 80 has begun its return movement to insure the clearing of the machine. This may be accomplished by the use of the construction illustrated in Figs. 20 and 21. In this arrangement the key 139 serves for taking both a total and a sub-total, the clearing of the machine after taking a sub-total being prevented by lifting the total key at the end of the forward stroke of the operating handle. As shown, two vertical sliding plates 269, 270, are employed for controlling the link 154. The spring 140 is connected with the plate 270, while the stem 138 of the total key 139 is connected with the plate 269. The plates 269 and 270 each have slots 271, 272, for receiving guide pins 273 and 274 carried by the main side plate 40, and the end of the key stem 138 coöperates with a shoulder 275 on the plate 270 to cause downward movement thereof when the total key is depressed and restoration of the total key by the spring 140, but permitting a manual restoration of the total key without lifting the plate 270.

The plate 270 is formed with the same arm 136, having a notch 276 (Fig. 22) for receiving the link 154 that is provided on the bracket plate 137 (Figs. 9 and 19) for receiving the corresponding link 129 or 154. The plate 270 also carries the stud 167 which engages the forwardly extended end 164 of the comb 161, to clear the keyboard when the total key is depressed. In this instance, however, the flanges of the disk 124, while arranged to permit the depression of both of the plates 269 and 270 prior to the beginning of a forward stroke of the operating handle, permits only the plate 269 to be lifted at the end of the forward stroke of the handle. As the plate 269 carries a stud 277 which extends under the link 154, the lifting of the plate 269 serves to raise the link 154 in the manner required when a sub-total is taken, but the lifting of the plate 270 being prevented, the spring 140 cannot act to lift the total key and this must be manually accomplished. This construction also has the advantage of preventing the depression of the total key at the end of the forward stroke of the operating handle.

In the arrangement shown in Figs. 20 and 21, the plates 269 and 270 have each an outturned stud 278, 279, and both of the studs register with the notch 144 of the flanged disk 124 when the machine is at rest, but only the stud 278 of the plate 269 registers with the notch 145 of the flanged disk 124 when the control shaft 85 is at the limit of its forward movement. It follows that in event the plate 270 has been depressed prior to the beginning of a forward stroke of the operating handle 80, it cannot be raised until both the forward and return strokes of the handle have been completed. On the other hand, the stud 278 of the plate 269 may pass through the notch 145 of the flanged disk 124 to permit a manual restoration of the total key at the end of the forward stroke of the handle.

The form of construction illustrated in Figs. 20 and 21 also has provision for preventing the depression of the total key 139, following the printing of an item, until after a pause in the operation of the machine sufficient to insure that all of the transfer devices of the accumulator shall have completed their movement. When the machine is equipped with recording devices there is no occasion for the operator to read the total upon the register wheels after printing the last item. The operator may therefore undertake to clear the machine immediately upon the completion of the return movement of the handle 80. For this purpose he will depress the total key 139 and pull the handle forwardly again.

In the particular form of accumulator illustrated in the drawings, the operation of the transfer devices is not interrupted until the indicator wheels 51 are depressed for reëngagement with the rack bars 52. During the normal operation of the machine the reëngagement of the indicator wheels 51 with the rack bars 52 does not occur until the handle 80 has reached the limit of its forward movement. The operation of the transfer devices may therefore be continued during the forward movement of the handle 80, and a completion of the movement of the transfer devices is insured. On the other hand, depression of the total key 139 brings

about a reëngagement of the indicator wheels 51 with the rack bars 52 immediately at the beginning of the forward movement of the operating handle 80. It follows that the total key 139 and operating handle 80 should, therefore, not be used, after printing an item, until a sufficient interval has been allowed for the transfer devices to complete their movement. If desired, this may be accomplished by the use of a freely swinging pendulum 280 (Figs. 21 and 22). As shown, this pendulum is pivotally secured against the main side plate 40, adjacent its upper edge, and hangs in front of the flanged disk 124. Its lower end is struck by the stud 156 as this stud approaches its position of rest.

When the lower end of the pendulum 280 is struck by the stud 156, the pendulum swings rearwardly by its momentum and a brief interval is required for it to return to its normal position. During this interval the transfer devices of the accumulator may complete their movement. Depression of the total key 139 before the transfer devices of the accumulator have completed their movement is accordingly prevented if provision is made to hold the total key 139 against movement except when the pendulum 280 hangs in its normal vertical position. For this purpose the pendulum 280, is formed with a slot 281 widened at its upper end, and the sliding plate 269, which is rigidly connected with the stem 138 of the total key, is provided with a stud 282 which projects outwardly into this slot. When the total key 139 is elevated, the swinging of the pendulum 280 is permitted by the fact that the stud 282 registers with the widened upper end portion of the slot 281. On the other hand, the stud 282 can pass through the contracted throat of the slot 281 only when the pendulum 280 hangs in its vertical position. After contact of the stud 156 with the lower end of the pendulum 280, as the stud 156 approaches its position of rest, the total key 139 cannot be depressed until the pendulum has returned to its vertical position.

Should it be desired to equip the machine with a governing cylinder 283, this may be readily accomplished in the manner more particularly illustrated in Figs. 2 and 5. As shown, the cylinder 283 is carried by a swinging yoke 284, and this yoke is pivotally supported between the bracket plate 238 and the adjacent side plate 48 of the recording mechanism. A link 285 connects one arm of the yoke 284 with the crank arm 84 on the main shaft 82. The piston rod 286 of the governing cylinder 283 is suspended from a transverse rod 287 which extends in fixed position between the upper end of the bracket plate 238 and the adjacent side plate 48. Ordinarily, however, the governing cylinder may be dispensed with, as the conjoint action of the rack bar springs and rack bar friction drag, as described, will insure a smooth action of the machine.

Instead of the type bars 31 to 38 upon which the type characters are directly formed, there may be used type carriers 288 within which are transversely mounted a plurality of spring-retracted type carrying plungers, as 289. When this form of construction is followed the type carriers 288 have a vertical movement only, and to this end are provided with a pair of longitudinal slots 290, 291, for receiving a pair of cross-rods 292, 293, mounted in the side plates 47 and 48 of the recording mechanism. The type carriers are raised and lowered by the bell-cranks 55, each of which is provided with a stud 294 fitting within a lateral slot 295 in the corresponding carrier. The hammers, 296, in this instance, make contact directly with the heads of the type plungers, and each is thrown forward by means of a spring 297 when released by withdrawal of the locking latch 298. The hammers are withdrawn by mechanism corresponding with that already described, suitably modified, the rod 184 engaging the hammers between their heads and the shaft 181 upon which they are pivoted, instead of at the opposite side of this pivot. A crank arm 299 takes the place of the bell-crank 202 of Fig. 6, and is connected by means of a link 300 with a crank-arm 301 on the shaft 181. In connection with this modified form of construction the same rectifying mechanism is employed as with the type bars of Fig. 5, the two forms of type mounting being equivalents in the broader aspects of the invention. It will be understood, therefore, that for the purposes of this specification the term "type bar" as employed in the claims includes either a bar upon which the type characters are directly fixed, or a bar carrying movable type characters.

While the various parts of the machine are shown in operative and preferred forms, various changes of detail may be made without departing from the scope of the invention in its broader aspects.

Features shown but not claimed herein are made the subject of divisional applications, including my application for patent on rack bar and bearing for calculating machines and the like, Serial No. 307,941, filed July 1, 1919, and my application for patent on clear signal printing mechanism for listing machines and the like, Serial No. 340,581 filed November 25, 1919.

I claim as my invention—

1. In a listing machine or the like, in combination, a type bar, means for moving the bar to a plurality of different adjusted positions, a rectifying member operable upon the type bar in its various adjusted posi-

tions, a printing hammer, a hammer lock, and operative connection between the hammer lock and the rectifying member, whereby movement of the rectifying device imparts movement to the hammer lock.

2. In a listing machine or the like, in combination, a movable member provided with a plurality of type characters, means for moving the member to bring the type characters to printing position, a rectifier for accurately positioning the type characters for printing, a spring-actuated hammer for applying printing pressure to the type characters, a lock carried by the rectifier for holding the hammer in retracted position, and being releasable by the movement of the rectifier.

3. In a listing machine or the like, in combination, a longitudinally movable type bar, a series of studs having inclined side margins associated with the type bar, a rectifier comprising a plate movable into the spaces between the studs, a printing hammer, and a lock for the hammer, such lock comprising a lever pivotally mounted on the rectifier and being releasable by the movement thereof.

4. In a listing machine or the like, in combination, a longitudinally movable type bar, a series of studs having inclined side margins associated with the type bar, a rectifier comprising a plate movable into the spaces between the studs, a printing hammer, and a lock for the hammer, such lock comprising a spring-advanced lever pivotally mounted on the rectifier and being adapted to fulcrum on an appurtenance of the type bar as the rectifier is advanced.

5. In a listing machine or the like, in combination, a longitudinally movable type bar, a series of studs having inclined side margins associated with the type bar, a rectifier comprising a plate movable into the spaces between the studs, a printing hammer, and a lock for the hammer, such lock comprising a spring-advanced lever pivotally mounted on the rectifier and having a lug adapted to fulcrum on one of the named studs as the rectifier is advanced.

6. In a listing machine or the like, in combination, a plurality of characters movable to printing position, a rectifier for accurately positioning the type characters, a hammer coöperating with the type characters for effecting the printing impression, and a hammer lock mounted on and released by the movement of the rectifier.

7. In a listing machine or the like, in combination, a vertically reciprocable type-bar, a bell crank lever, one arm thereof being pivotally attached to the type-bar, a notched segment carried by the said arm of the bell-crank lever, a horizontally reciprocable rack bar, means connecting the other arm of the bell-crank lever with the rack bar, and a rectifying plate engageable with the notches of the said segment.

8. In a listing machine or the like, in combination, a type bar, means for moving the bar to a plurality of different positions for printing each of the figures zero to nine inclusive, a rectifying member operable upon the type bar in any of its adjusted positions, a printing hammer, a hammer lock, and means operable by each movement of the rectifying member to release the hammer lock from the hammer except when the type bar is in zero position.

9. In a listing machine or the like, in combination, a type bar movable to different positions for printing each of the figures zero to nine inclusive, a series of studs with intervening notches movable with the rack bar, a rectifying member movable into the notches between different studs of the series in accordance with the position of the type bar, a printing hammer, a hammer lock pivotally connected with the movable rectifying member, and an abutment carried by the hammer lock for engagement with one of the said studs to effect the release of the hammer lock from the hammer as the rectifying member enters the corresponding notch when the type bar is positioned to print any one of the figures one to nine inclusive, the abutment being located beyond the end of the series of studs when the type bar is positioned to print zero.

10. In a listing machine or the like, in combination, a type bar pivotally supported at one end and longitudinally adjustable across the printing line, a lever pivotally supported in rear of the type bar and making contact therewith at one end in substantial alinement with the printing line in any adjusted position of the type bar, and a swinging hammer engageable with the other end of the lever.

11. In a listing machine, or the like, in combination, a type bar adjustable across the printing line, a lever pivotally supported in rear of the type bar and making contact therewith at one end in substantial alinement with the printing line in any adjusted position of the type bar, and a swinging hammer engageable with the other end of the lever.

12. In a listing machine or the like, in combination, a type bar adjustable across the printing line, a lever having two arms of unequal length pivotally supported in rear of the type bar, its shorter arm in contact with the type bar at one end in substantial alinement with the printing line in any adjusted position of the type bar, and a swinging hammer having wiping engagement with the longer arm of the lever.

13. In a listing machine or the like, in combination, a type bar carrying a set of figure printing types arranged longitudi-

nally along the same near one end, a bell-crank lever to one arm of which the other end of the type bar is pivotally connected, the same arm of the bell-crank lever being formed with a series of notches equaling in number the number of types carried by the type bar, a rectifying member movable into the different notches in accordance with the position of the bell-crank lever and type bar, a printing hammer, a hammer lock, connection between the hammer lock and the movable rectifying member, a sliding rack bar, a link connecting the sliding rack bar with the other arm of the bell crank lever, and a set of keys controlling the movements of the sliding rack bar.

14. The combination with the key stems of a row of keys of a calculating machine, of a pair of spring-pressed swinging plates between which the key stems slide, coöperating cam lugs and shoulders on the plates and key stems, a spring-advanced sliding rack bar, a rack bar stop carried by one of the plates, a wedge movable between the plates for separating them to release the key stems and the rack bar, a total key, and connection between the total key and the wedge.

15. The combination with the key stems of a row of keys of a calculating machine, of a pair of spring-pressed swinging plates between which the key stems slide, coöperating cam lugs and shoulders on the plates and key stems, a spring-advanced sliding rack bar, a rack bar stop carried by one of the plates, a wedge movable between the plates for separating them to release the key stems and the rack bar, and means for advancing the wedge.

16. The combination with the key stems of a row of keys of a calculating machine, of a pair of spring-pressed swinging plates between which the key stems slide, coöperating cam lugs and shoulders on the plates and key stems, a spring-advanced sliding rack bar, a rack bar stop carried by one of the plates, a wedge movable between the plates for separating them to release the key stems and the rack bar, and actuating means for returning the rack bar and advancing the wedge as the rack bar approaches the limit of its return movement.

17. The combination with the key stems of a row of keys of a calculating machine and calculating mechanism controlled by the key stems including a sliding rack bar, of a pair of spring-pressed swinging plates between which the key stems slide, coöperating cam lugs and shoulders on the plates and key stems, a rack bar stop carried by one of the plates, a wedge movable between the plates for separating them to release the key stems and the rack bar, a spring-advanced keyboard lock entering the path of movement of one of the plates to prevent separation of the plates when the said keyboard lock is released, and actuating means for the said calculating mechanism normally operable to release the said keyboard lock at the beginning of the advance movement of the sliding rack bar to withdraw the keyboard lock as the rack bar approaches the limit of its return movement and to thereafter advance the said wedge.

18. The combination with the key stems of a row of keys of a calculating machine and calculating mechanism controlled by the key stems, of a pair of spring-pressed swinging plates between which the key stems slide, coöperating cam lugs and shoulders on the plates and key stems, a wedge movable between the plates for separating them to release the key stems, actuating means for the calculating mechanism, and a pawl connected with the wedge and extending into the path of a movable part of the said actuating means.

19. The combination with the key stems of a row of keys of a calculating machine and calculating mechanism controlled by the key stems, of a pair of spring-pressed swinging plates between which the key stems slide, coöperating cam lugs and shoulders on the plates and key stems, a wedge movable between the plates for separating them to release the key stems, oscillating actuating means for the calculating mechanism, and a pawl acting in one direction only connected with the wedge and extending into the path of a movable part of the said actuating means.

20. The combination with the key stems of a row of keys of a calculating machine and calculating mechanism controlled by the key stems, of a pair of spring-pressed swinging plates between which the key stems slide, coöperating cam lugs and shoulders on the plates and key stems, a wedge movable between the plates for separating them to release the key stems, actuating means for the calculating mechanism, a shiftable pawl connected with the wedge and normally extending into the path of a movable part of the said actuating means, a repeat key, and connection between the repeat key and the pawl.

21. The combination with the key stems of a row of keys of a calculating machine and calculating mechanism controlled by the key stems, of a pair of spring-pressed swinging plates between which the key stems slide, coöperating cam lugs and shoulders on the plates and key stems, a wedge movable between the plates for separating them to release the key stems, oscillating actuating means for the calculating mechanism, a shiftable pawl acting in one direc-

tion only connected with the wedge and extending into the path of a movable part of the said actuating means, a repeat key adapted to move the pawl out of such path.

22. The combination with the key stems of a row of keys of a calculating machine and calculating mechanism controlled by the key stems, of a pair of spring-pressed swinging plates between which the key stems slide, coöperating cam lugs and shoulders on the plates and key stems, a wedge movable between the plates for separating them to release the key stems, means for advancing the wedge, and a repeat key for rendering such advancing means inoperative.

23. In a machine of the kind described, in combination, a plurality of locked, spring advanced rack bars, means associated with each rack bar adapted to release said bar and determine the range of its movement, an actuating member for returning the rack bars after their advance movement, and a friction drag between the actuating member and the rack bars.

24. In a machine of the kind described, in combination, a plurality of normally locked spring-advanced rack bars, a plurality of keys associated with each rack bar, each key being adapted to release such bar and determine the range of its advance movement, an actuating member for returning the rack bars after their advance, and a friction drag between the actuating member and the rack bars.

25. In a calculating machine, in combination, a reciprocable rack bar, a spring acting on the rack bar to move it in one direction, a reciprocable actuating member having a limited sliding engagement with the rack bar, means for controlling the movement of the rack bar, and a friction device resisting relative movement between the rack bar and the said actuating member.

26. In a calculating machine, in combination, a plurality of parallel reciprocable rack bars, a separate spring acting on each rack bar to move it in one direction, the spring-actuated movements of all of the rack bars being in the same direction, a reciprocable actuating member common to all of the rack bars and having a movement equal to that of the maximum range of movement of the rack bars, stops limiting relative movement between the rack bars and the said actuating member in the direction in which the rack bars are moved by their springs, and a friction device resisting relative movement between each rack bar and the said actuating member in both directions.

27. In a calculating machine, in combination, a plurality of parallel reciprocable rack bars, a separate spring acting on each rack bar to move it in one direction, the spring-actuated movements of all of the rack bars being in the same direction, independent means for varying the distance through which each rack bar may be moved by its spring, a reciprocable actuating member common to all of the rack bars and havng a fixed range of movement equal to the greatest movement of the rack bars, stops limiting relative movement between the rack bars and the said actuating member in the direction in which the rack bars are moved by their spring, and a friction device resisting relative movement between each rack bar and the said actuating member.

28. In a calculating machine, in combination, a plurality of parallel reciprocable rack bars, a separate spring acting on each rack bar to move it in one direction, the spring-actuated movements of all of the rack bars being in the same direction, independent means for varying the distance through which each rack bar may be moved by its spring, a reciprocable actuating member common to all of the rack bars and having a fixed range of movement equal to the greatest movement of the rack bars, stops limiting relative movement between the rack bars and the said actuating member in the direction in which the rack bars are moved by their springs, a friction device resisting relative movement between each rack bar and the said actuating member, a driving member operable upon the said actuating member to move it in the direction in which the rack bars are moved by their springs, and a main spring operable upon the driving member to move it in the opposite direction.

29. In a calculating machine, in combination, a plurality of parallel reciprocable rack bars, a separate spring acting on each rack bar to move it in one direction, the spring-actuated movements of all of the rack bars being in the same direction, a reciprocable actuating member common to all of the rack bars and having a movement equal to that of the rack bars, stops limiting relative movement between the rack bars and the said actuating member in the direction in which the rack bars are moved by their springs, an independent lock controlling each rack bar, a friction device resisting relative movement between each rack bar and the said actuating member in both directions, a driving member operable upon the said actuating member, and a main spring operable upon the driving member to move it in the opposite direction.

30. In a calculating machine, in combination, a reciprocable rack bar, a spring acting on the rack bar to move it in one direction, a reciprocable actuating member having a limited sliding engagement with the rack bar, means controlling the movement of the rack bar, a friction device resisting relative movement between the rack bar and the said actuating member, a driving member oper-

able upon the said actuating member, and a main spring for returning the said driving member.

31. In a calculating machine, in combination, a reciprocable rack bar, a spring acting on the rack bar to move it in one direction, a reciprocable actuating member having a limited sliding engagement with the rack bar, means controlling the movement of the rack bar, a friction device resisting relative movement between the rack bar and the said actuating member, a manually operated driving member operable upon the said actuating member to move it in one direction, and a main spring for returning the said actuating member.

32. In a calculating machine, in combination, a plurality of parallel reciprocable rack bars, each movable automatically in one direction when released, the said automatic movements of all of the rack bars being in the same direction, independent means controlling the automatic movement of each rack bar, a reciprocable actuating member common to all of the rack bars, stops limiting relative movement between the rack bars and the said actuating member in one direction in which rack bars are automatically moved, a friction device resisting relative movement between each rack bar and the actuating member in both directions, a manually operated driving member operable upon the said actuating member to move it in one direction, and a main spring for returning the actuating member.

33. In a listing machine or the like, in combination, an accumulator, printing mechanism including type bars and a movable ribbon guide, a ribbon shift key controlling the movement of the ribbon guide, rack bars controlling the type bars and normally coöperating with the accumulator, a non-add key operable upon depression to interrupt the coöperation of the rack bars with the accumulator, and a latch controlled by the ribbon shift key normally preventing depression of the said non-add key.

34. In a listing machine or the like, in combination, an accumulator, printing mechanism including type bars and a movable ribbon guide, rack bars controlling the type bars and normally coöperating with the accumulator, a non-add key operable upon depression to interrupt the coöperation of the rack bars with the accumulator, and a separate ribbon shift key normally preventing depression of the non-add key and effective on depression to release the non-add key and change the operative position of the ribbon guide.

35. In a listing machine or the like, in combination, item and total printing elements including a set of movable type bars and a movable ribbon guide having a normal position, a vertically movable accumulator frame, a set of indicator wheels mounted in the accumulator frame, a set of inwardly and outwardly movable rack bars connected with the movable type bars and coöperating with the indicator wheels when the accumulator frame is depressed, driving means normally operable to depress the accumulator frame only during inward movement of the rack bars, a total key effective upon depression to cause the driving means to depress the accumulator frame during outward movement of the rack bars and to shift the ribbon guide to different position, a non-add key effective upon depression to prevent depression of the accumulator frame, and a ribbon shift key effective upon depression to render the ribbon guide operable in a third position.

36. In a listing machine or the like, in combination, item, total and non-add printing elements including a set of movable type bars and a movable ribbon guide operable in three positions, a set of movable rack bars coöperating with said type bars, driving means normally coacting with said type bars and said ribbon guide in one position to print items, a total key effective on depression to cause said ribbon guide to assume a second position and to cause said type bars to print a total, and a non-add key effective upon depression to cause said type bars to print non-accumulated items with said ribbon guide in a third position.

37. In a listing machine or the like, in combination, item and total printing elements including a set of movable type bars and a movable ribbon guide normally operable in one position, a vertically movable accumulator frame, a set of indicator wheels mounted in the accumulator frame, a set of inwardly and outwardly movable rack bars connected with the movable type bars and coöperating with the indicator wheels when the accumulator frame is depressed, driving means normally operable to depress the accumulator frame only during inward movement of the rack bars, a total key effective upon depression to cause the driving means to depress the accumulator frame during outward movement of the rack bars and to render the ribbon guide operable in a different position, a non-add key effective upon depression to prevent depression of the accumulator frame, a lock preventing depression of the non-add key and a ribbon shift key effective upon depression to release the lock and to render the ribbon guide operable in a third position.

38. In a calculating machine, in combination, a movable accumulator, an oscillating crank shaft having two cranks, and an adjustable link connected with the accumulator and having two sets of oppositely facing contact shoulders selectively engagable with the two cranks of the crank shaft

in the different adjusted positions of the link.

39. In a calculating machine, a movable accumulator, an oscillating crank shaft having two cranks, a shiftable link connected with the accumulator and having two sets of oppositely facing contact shoulders selectively engageable with the two cranks of the crank shaft in different positions of the link and a total key for shifting the link.

40. In a calculating machine, in combination, a movable accumulator, an oscillating control shaft, a flanged disk on the control shaft, the flange of the disk being notched, two wrist pins carried by the disk, a shiftable link connected with the accumulator and having two sets of oppositely facing contact shoulders selectively engageable with the two wrist pins in different positions of the link, a sliding plate controlling the shifting of the link, a stud on the plate movable through the notches of the disk flange only when the control shaft is at the limit of its movement in each direction, and a total key connected with the sliding plate.

41. In a calculating machine, in combination, a movable accumulator, an oscillating crank shaft having two cranks, a shiftable link connected with the accumulator and having two sets of oppositely facing contact shoulders selectively engageable with the two cranks of the crank shaft in different positions of the link, and means preventing the shifting of the link except when the crank shaft is at the end of its movement in each direction.

42. In a calculating machine, in combination, a movable accumulator, a control shaft having reverse movements in alternation, a single reciprocable shiftable link permanently connected with the accumulator for moving the same, means rigid with the control shaft for actuating the link in the two directions of its movement in one position of the link as the control shaft approaches the ends of its said reverse movements and in another position of the link as the control shaft begins its said reverse movements, a total key for shifting the link, and means preventing movement of the total key in either direction except when the control shaft is at the end of its movement in each direction, and additional means preventing the depression of the total key when the control shaft is at the end of its movement in one direction.

43. In a calculating machine, in combination, a vertically movable accumulator, an oscillating control shaft, a single shiftable link connected with the accumulator and actuated by the control shaft in its different positions for depressing the accumulator during the opposite movements of the control shaft, a total key for shifting the link, means preventing movement of the total key in either direction except when the control shaft is at the end of its movement in each direction, and additional means preventing depression of the total key when the control shaft is at the end of its movement in one direction.

44. In a calculating machine, in combination, a vertically movable accumulator, an oscillating control shaft, a flanged disk mounted on the control shaft, a shiftable link connected with the accumulator and actuated by the control shaft in its different positions to depress the accumulator during the opposite movements of the control shaft, a vertically movable total key, a pair of vertically sliding plates one being connected with the total key and controlling the link and the other extending under the total key, a spring for elevating the last mentioned plate, and a stud on each plate, the stud of the first separately mentioned plate being movable through a notch of the disk flange when the control shaft is at the end of movement in each direction and the stud of the other plate being movable through a notch of the disk flange only when the control shaft is at the end of its movement in one direction.

45. In a calculating machine, in combination, a movable accumulator, an intermittently operable control shaft, shiftable connection between the control shaft and the accumulator operable in its different positions to move the accumulator during different parts of the movement of the control shaft, means for manually shifting the said connection operable in either direction between the movements of the control shaft and operable in one direction only between the said parts of the movement of the control shaft and automatic means for shifting the said connection in the last mentioned direction operable only between the movements of the control shaft.

46. In a calculating machine, in combination, a movable accumulator, an intermittently operable control shaft, shiftable connection between the control shaft and the accumulator operable in its different positions to move the accumulator during different parts of the movement of the control shaft, a total key controlling the position of the said shiftable connection, means permitting manual restoration of the total key during the movement of the control shaft and automatic means for restoring the total key operable only between the movements of the control shaft.

47. In a calculating machine, in combination, a movable accumulator, an oscillating control shaft, shiftable connection between the control shaft and the accumulator during different parts of the movement of the control shaft, a total key controlling the position of the said shiftable connection, automatic means for restoring the total key op-

erable only when the control shaft is at the end of its movement in one direction and means permitting manual restoration of the total key when the control shaft is at the limit of its movement in the other direction.

48. In a calculating machine, in combination, a movable accumulator, an intermittently operating control shaft, shiftable connection between the control shaft and the accumulator operable in its different positions to move the accumulator during different parts of the movement of the control shaft, a total key controlling the position of the said shiftable connection, means preventing depression of the total key during movement of the control shaft and during a predetermined interval after the control shaft comes to rest.

49. In a calculating machine, in combination, a movable accumulator, an intermittently operating control shaft, shiftable connection between the control shaft and the accumulator operable in its different positions to move the accumulator during different parts of the movement of the control shaft, a total key controlling the position of the said shiftable connection, a pendulum movable under the total key to prevent its depression, and a movable part actuated by the control shaft and arranged to make contact with the pendulum to swing it under the total key as the control shaft comes to rest.

50. In a calculating machine, or the like, in combination, a plurality of rows of key stems, a series of overlapping plates each having notches arranged along that edge which overlies the next adjacent plate for slidingly receiving the key stems of one of the rows, springs surrounding the key stems and bearing on the corresponding plates, and means preventing lateral displacement of each when held to its seat upon the next lower plate by the corresponding springs.

51. In a calculating machine, in combination, a vertically movable accumulator, printing mechanism, a series of rack bars for actuating the accumulator wheels and the printing mechanism, a control shaft, a shiftable link for raising and lowering the accumulator and being actuated from the control shaft, and a non-add key for disconnecting the link from the control shaft.

52. In a calculating machine, comprising an accumulator and printing mechanism and arranged to take items and totals, the combination with such mechanisms, of rack bars for actuating the accumulator and printing mechanisms, a control shaft, a link for engaging the accumulator wheels with the rack bars and being actuated by the control shaft but normally disconnected therefrom, means for connecting such link with the control shaft, a second link normally connected with the control shaft for engaging the accumulator wheels with the rack bars for taking items, and means for disconnecting the second named link from the control shaft.

53. In a calculating machine or the like, in combination, a plurality of rows of key stems, a spring coiled around each stem and bearing upwardly against a shoulder thereon, a seat for the springs of each row of keys comprising a plate slotted to receive the key stems, seats upon which the ends of each plate rest, the several plates being arranged in stepped relation, each plate overlapping the next lower plate.

54. In a calculating machine or the like, in combination, a plurality of rows of key stems, a spring coiled around each stem and bearing upwardly against a shoulder thereon, a seat for the springs of each row of keys comprising a plate slotted to receive the key stems, seats upon which the ends of each plate rest, the ends of the plate having depressed portions for engaging the side margins of the seats, the several plates being arranged in stepped relation, each plate overlapping the next lower plate.

55. In a calculating machine or the like, in combination, a plurality of rows of key stems, a spring coiled around each stem and bearing upwardly against a shoulder thereon, a seat for the springs of each row of keys comprising a plate slotted to receive the key stems, seats upon which the ends of each plate rest, the several plates being arranged in stepped relation, each plate overlapping the next lower plate, and a ribbed reinforcing plate fixed to the upper face of each spring supporting plate and having notches in one margin for receiving the lower ends of the key springs.

56. In a machine of the kind described, in combination, a plurality of normally locked spring-advanced rack bars each having a variable range of movement, means associated with each rack bar adapted to release said bar and determine the range of its advance movement, an actuating member having a uniform range of movement for returning the rack bars after their advance, a spring for applying force to said actuating member, means for continuously resisting relative movement of the actuating member with respect to each rack bar in the direction to return the rack bars.

57. In a machine of the kind described, in combination, a plurality of normally locked spring-advanced rack bars, selective means for releasing the rack bars, an actuating member for returning the rack bars after their advance movement, and means offering continuous resistance to relative movement in one direction between the actuating member and each rack bar.

58. In a machine of the kind described, in combination, a plurality of normally locked rack bars, a separate spring for ad-

vancing each rack bar, selective means for releasing the rack bars, an actuating member for returning the rack bars after their advance movement, a main spring operable to drive the actuating member in the direction to return the rack bars, and means offering continuous resistance to relative movement of the actuating member with respect to each rack bar in the direction to return the rack bars for equalizing the load upon the main spring regardless of the number of rack bars which have been advanced.

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LISTING MACHINE.

APPLICATION FILED JAN. 4, 1918.

1,336,840.

Patented Apr. 13, 1920.

10 SHEETS—SHEET 1.

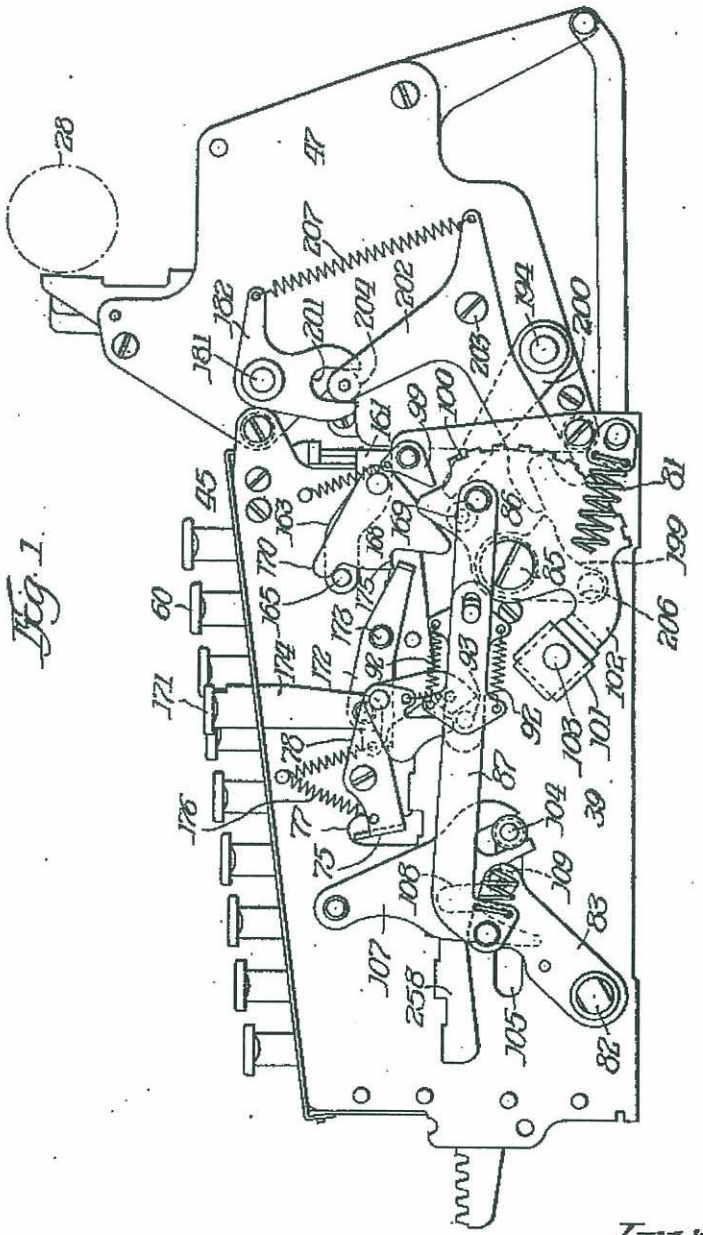

Fig. 1.

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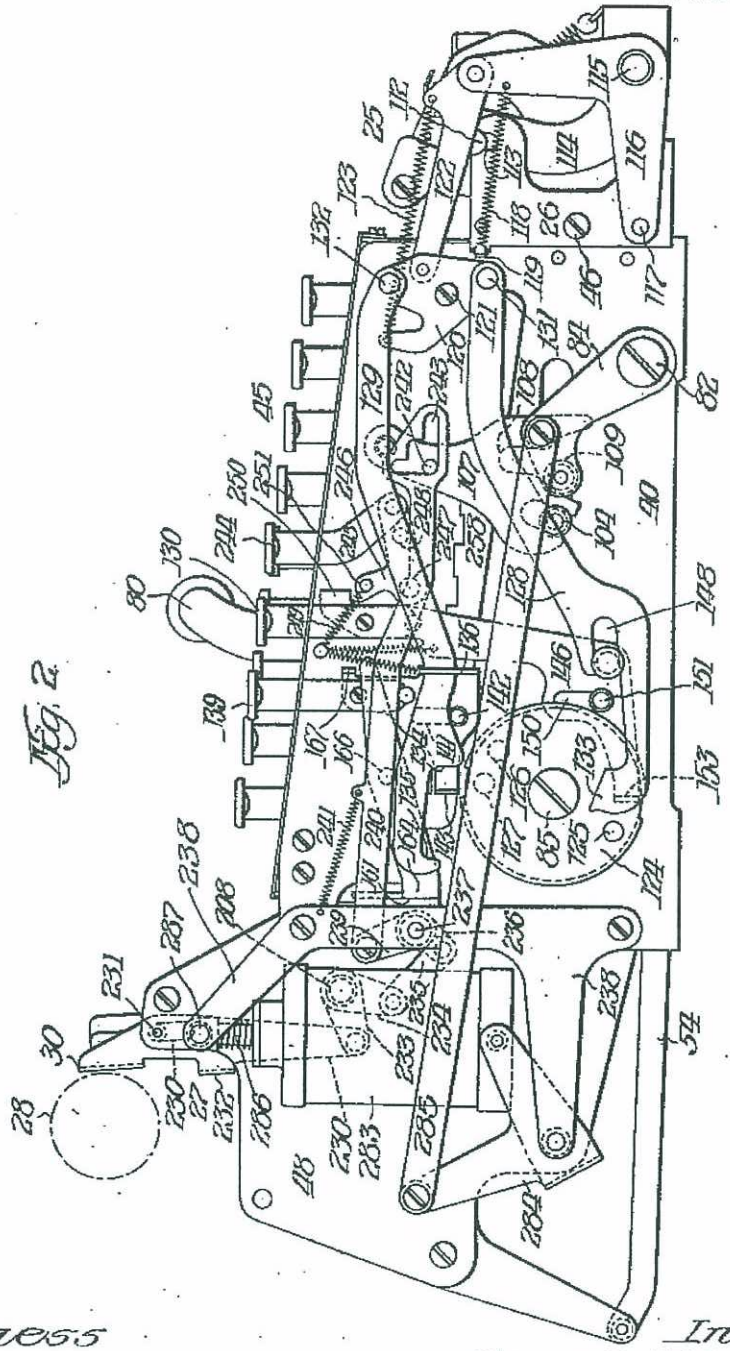

Fig. 2

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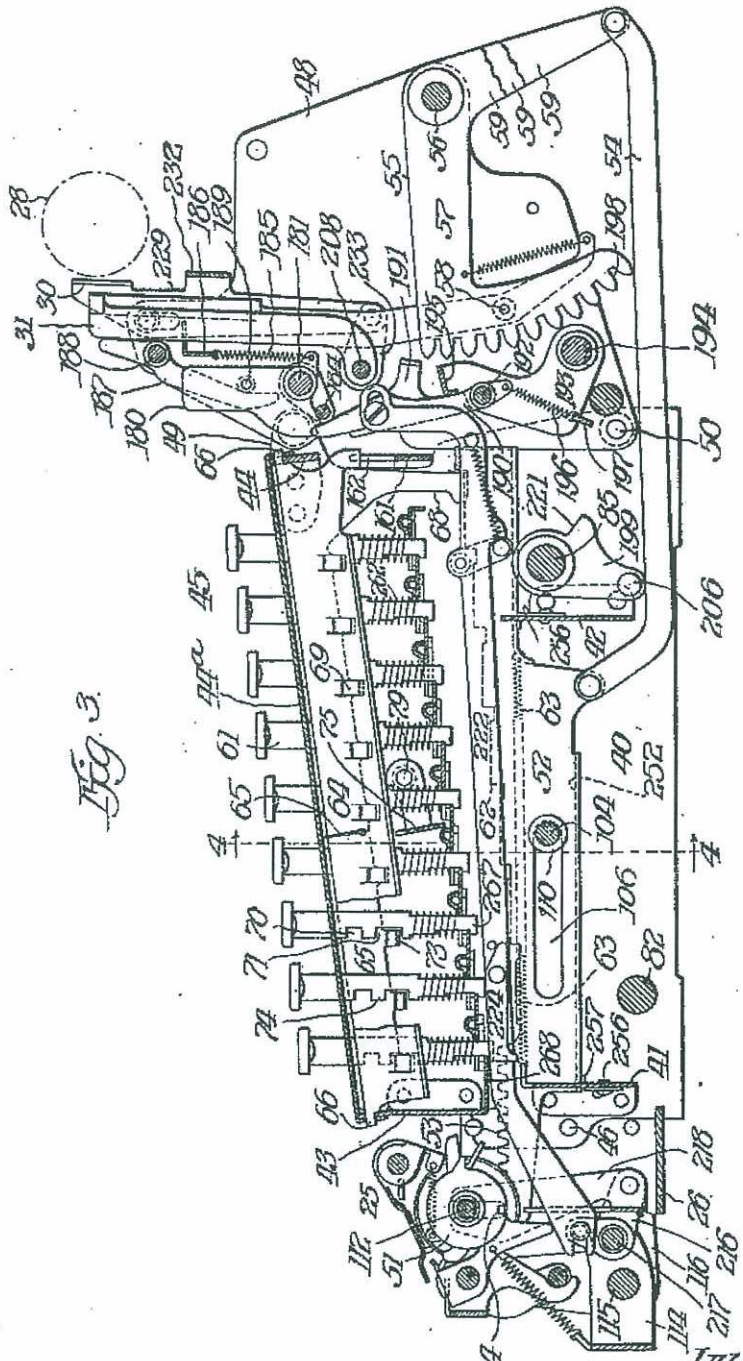

Fig. 3.

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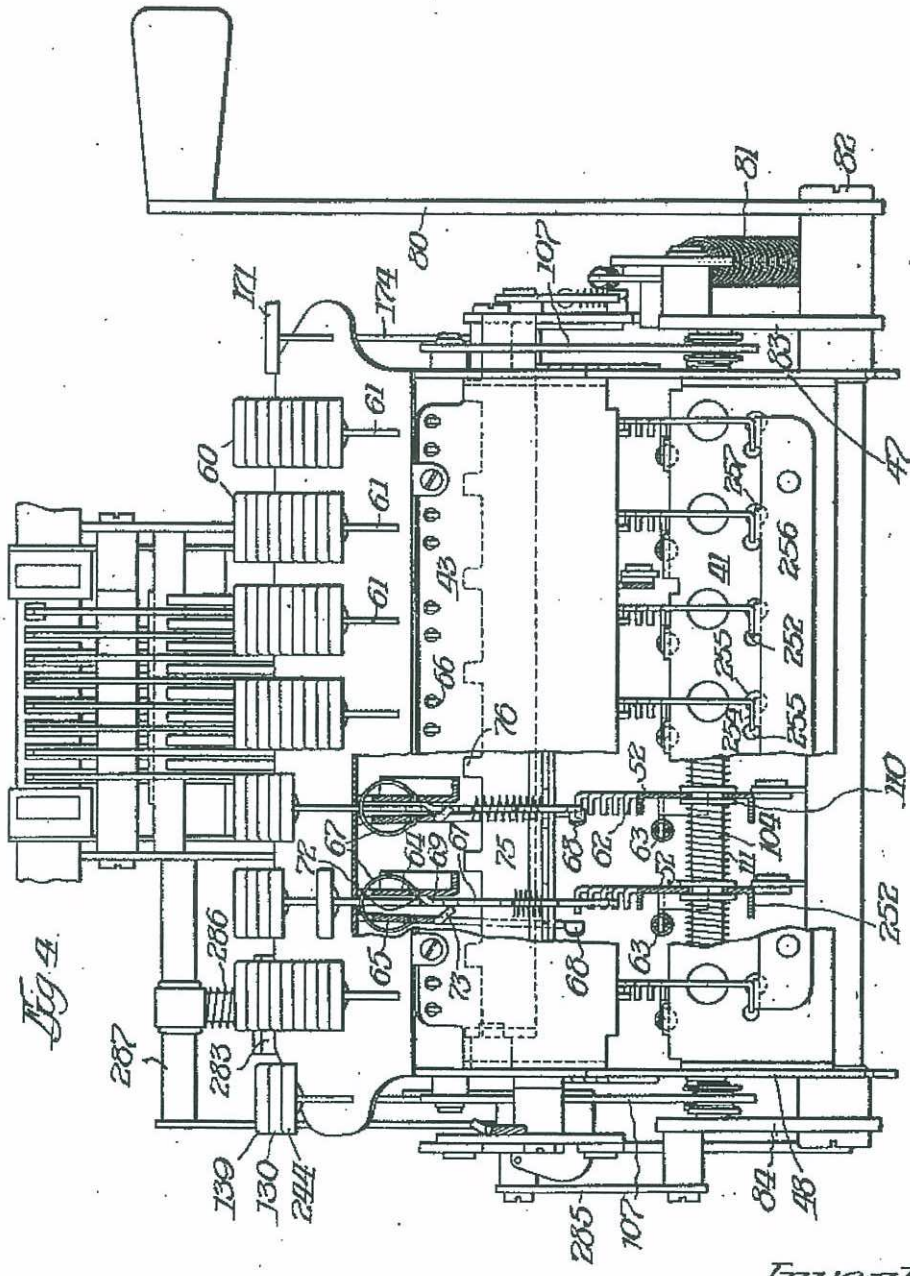

Fig. 4.

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10 SHEETS—SHEET 5.

Fig. 5.

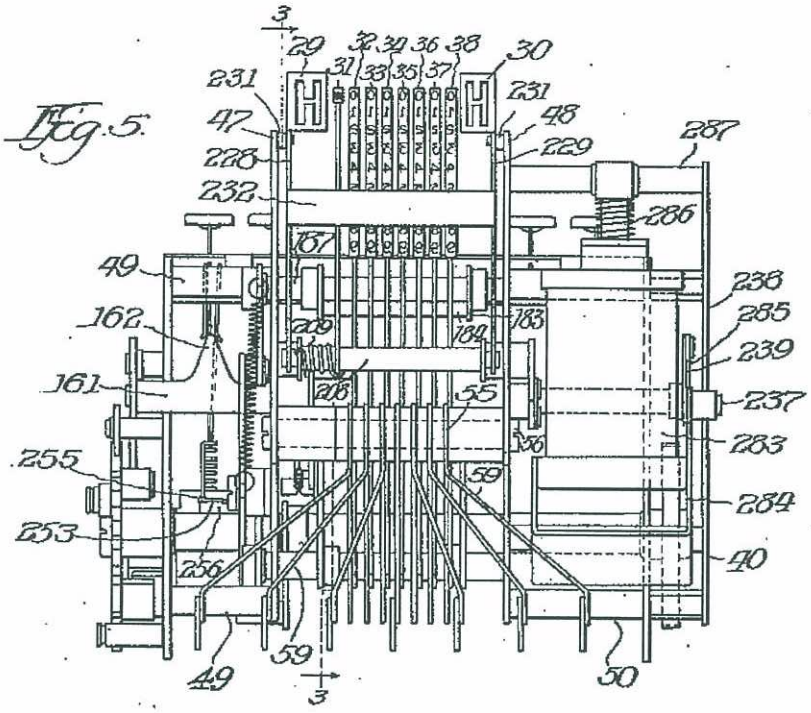
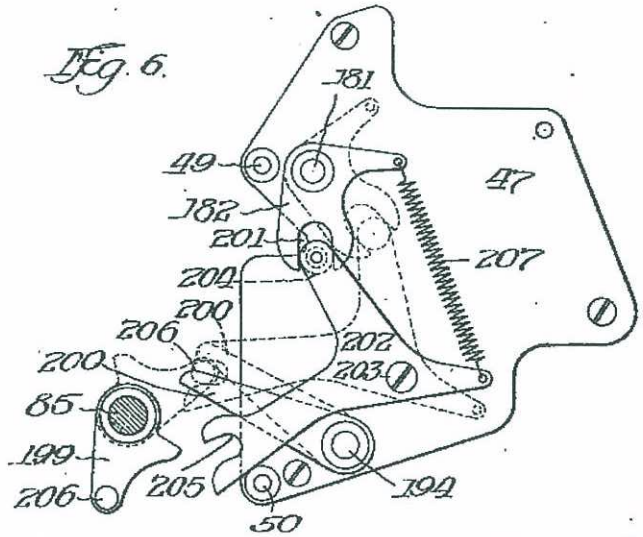


Fig. 6.



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10 SHEETS—SHEET 6.

Fig. 7.

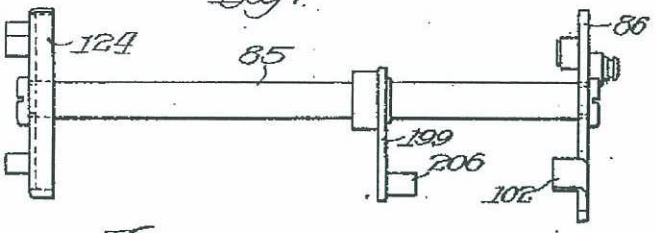


Fig. 8.

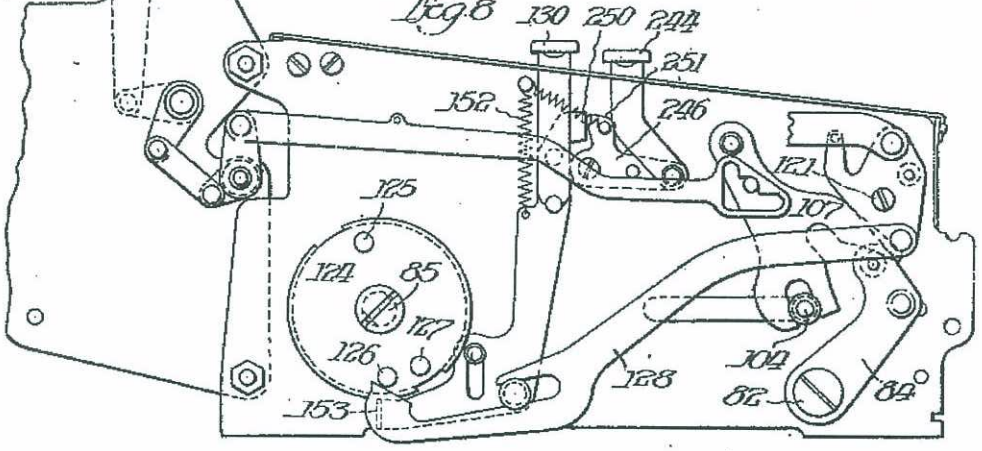
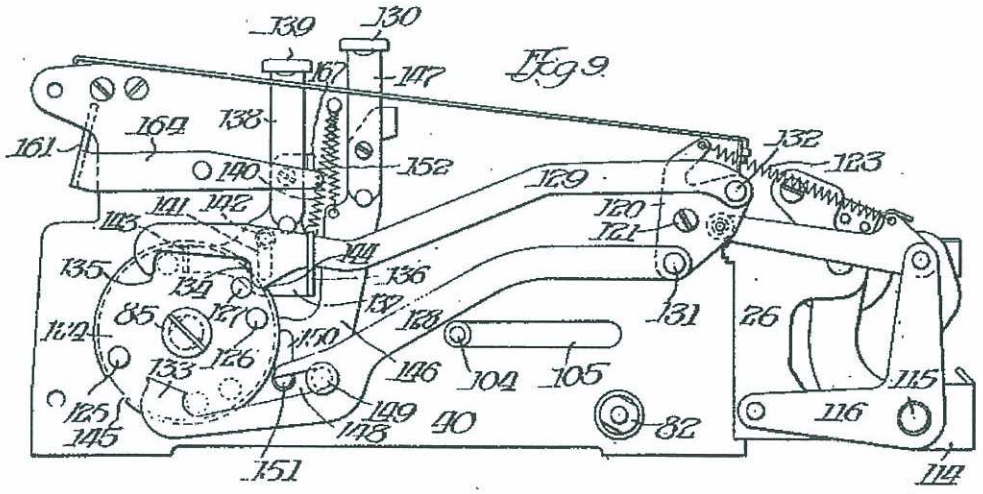


Fig. 9.



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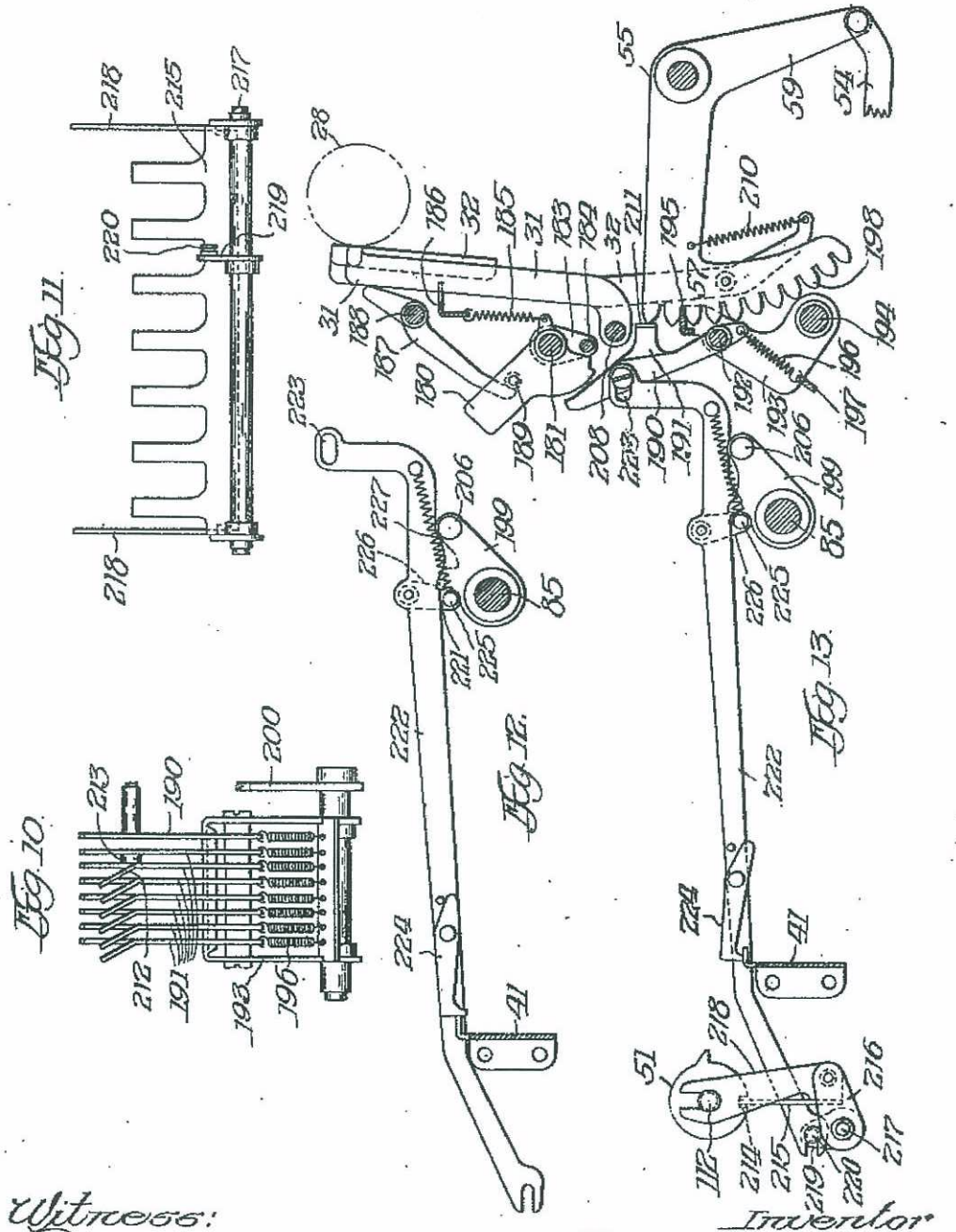

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10 SHEETS—SHEET 8.

Fig. 14.

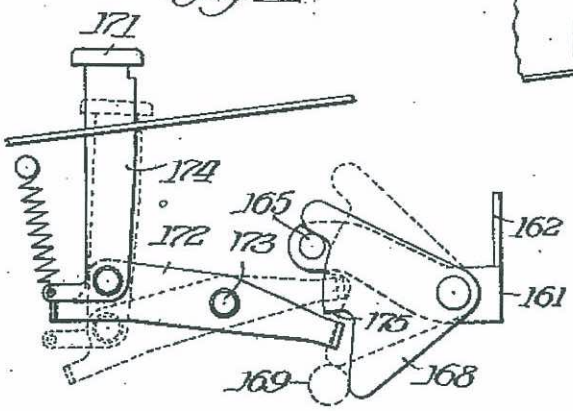


Fig. 15.

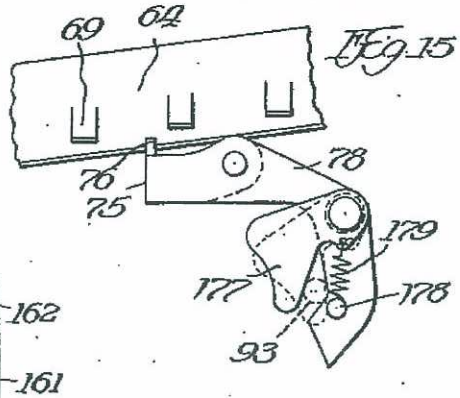
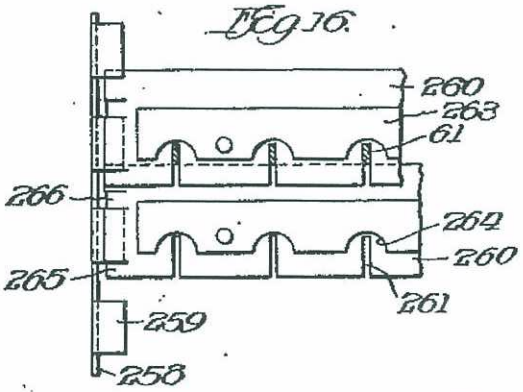


Fig. 16.



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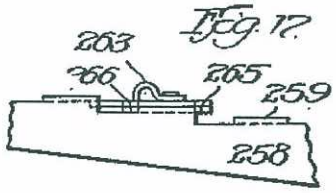
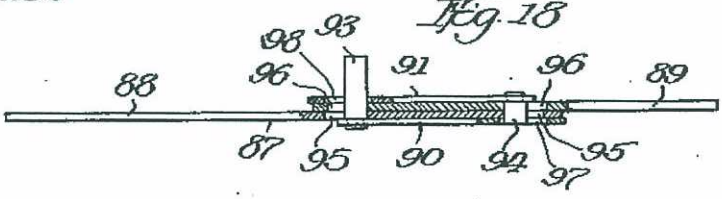


Fig. 18.



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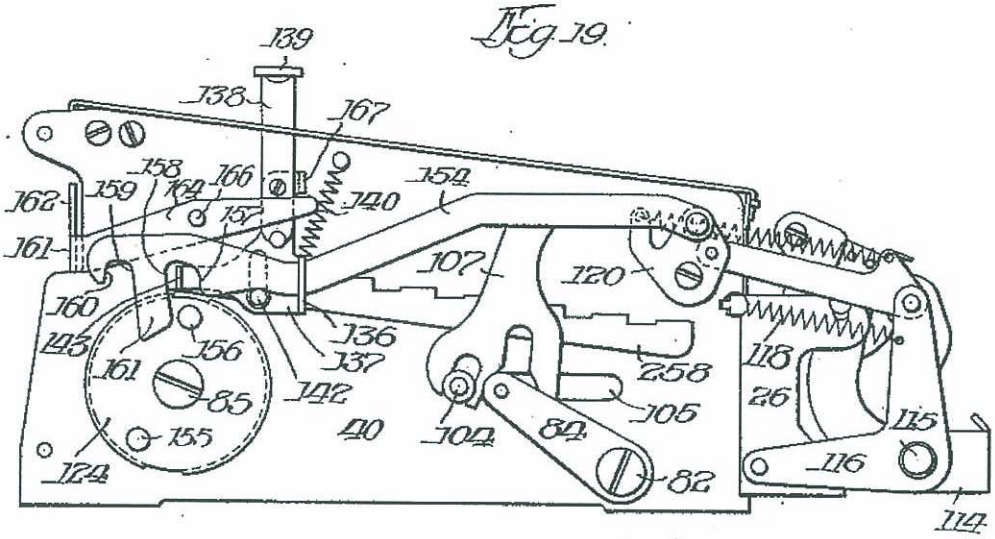
10 SHEETS—SHEET 9.

Fig. 19.



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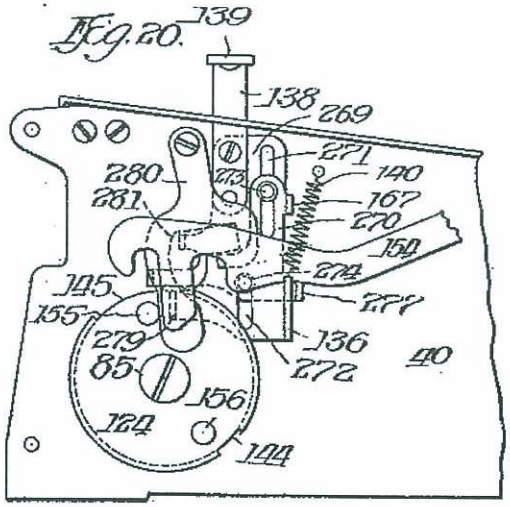


Fig. 21.

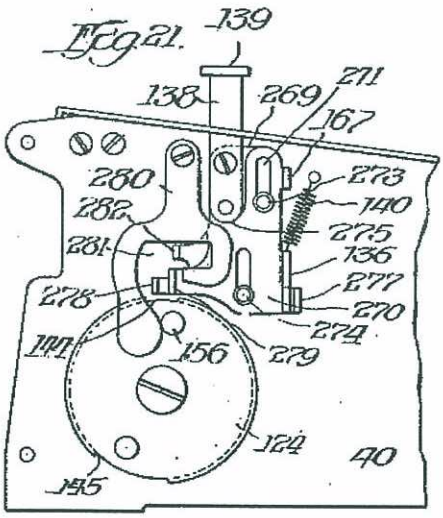
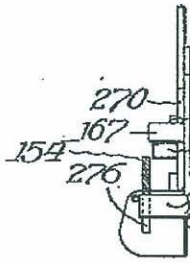


Fig. 22.



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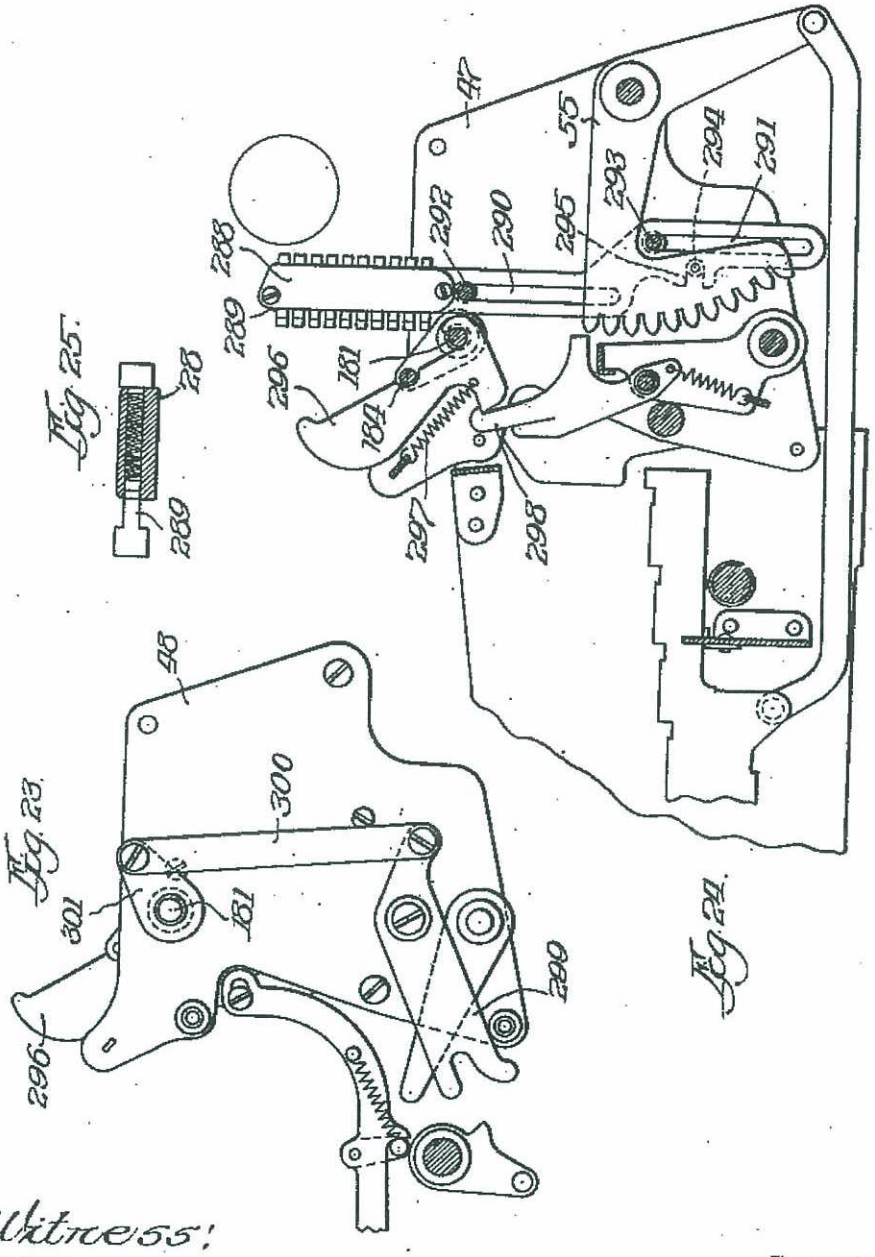

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