C. R. MORSE.

COMPUTING MACHINE.

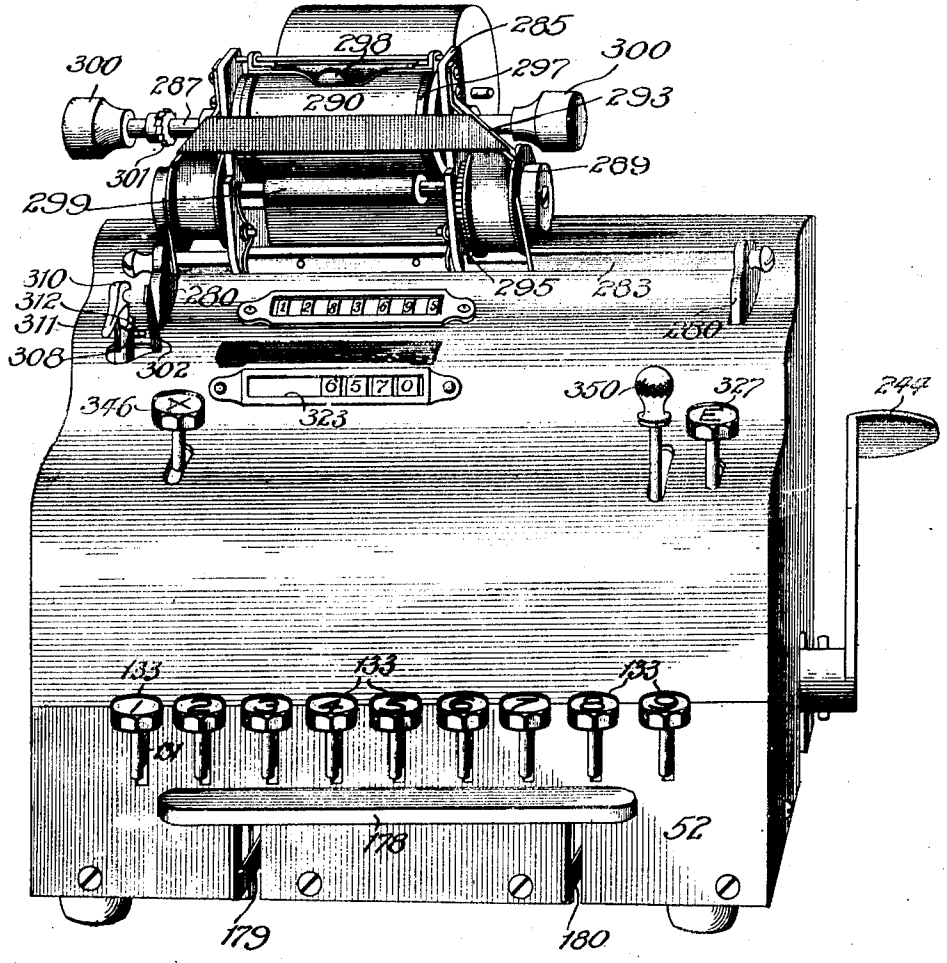
APPLICATION FILED AUG. 27, 1910.

1,098,353.

Patented May 26, 1914.

17 SHEETS—SHEET 1.

Fig. 1.



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Patented May 26, 1914.

17 SHEETS—SHEET 2.

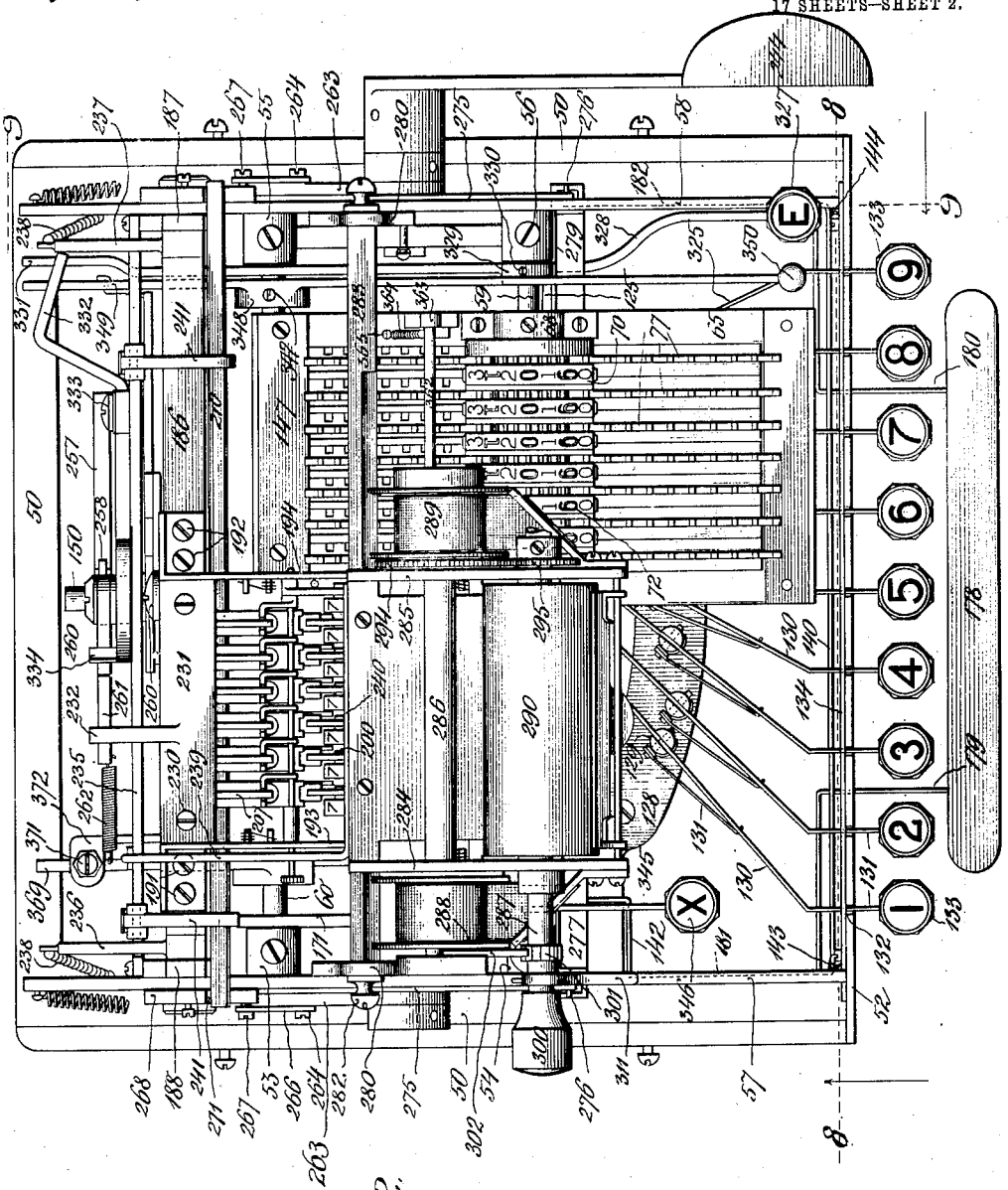


FIG. 2.

Witnesses:
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Inventor:
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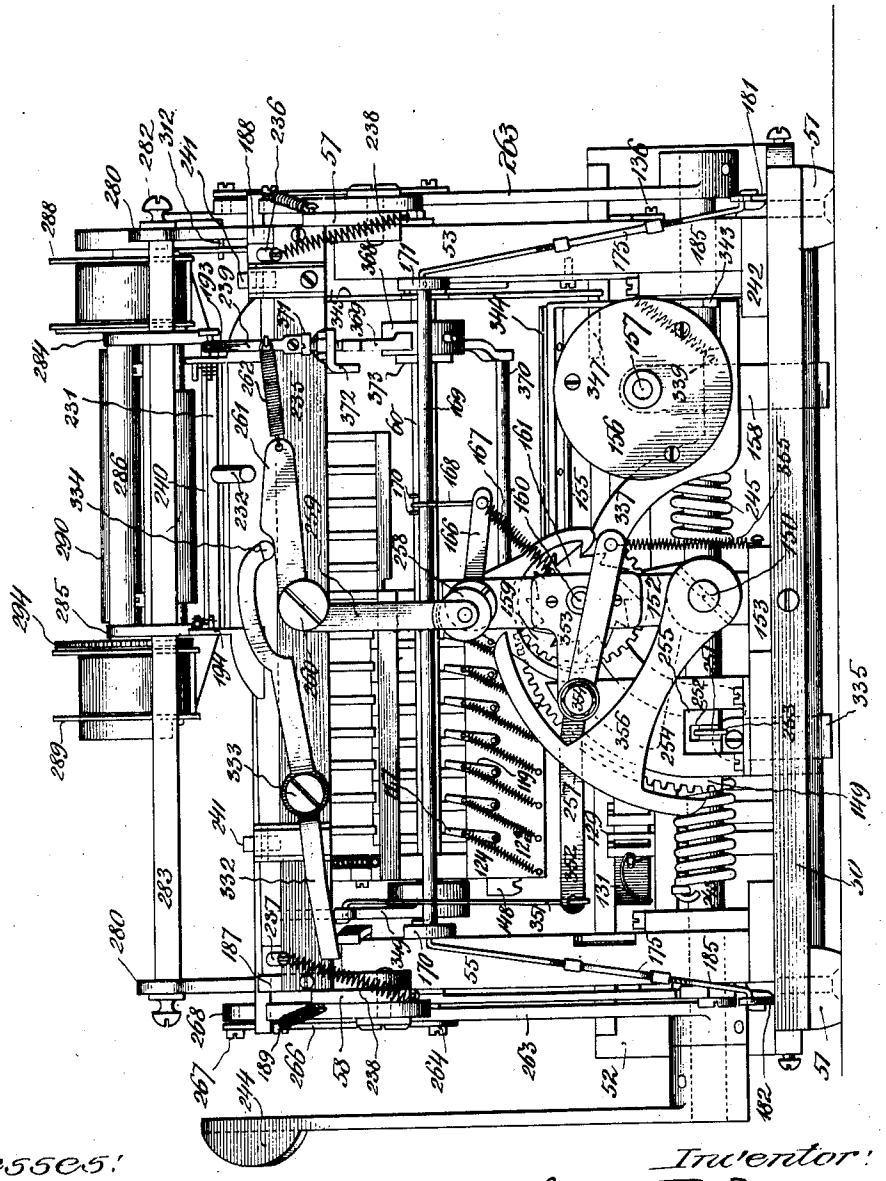
APPLICATION FILED AUG. 27, 1910.

1,098,353.

Patented May 26, 1914.

17 SHEETS—SHEET 3.

Fig. 3.



Witnesses:

Geo. C. Davison

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COMPUTING MACHINE.

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1,098,353.

Patented May 26, 1914.

17 SHEETS—SHEET 4.

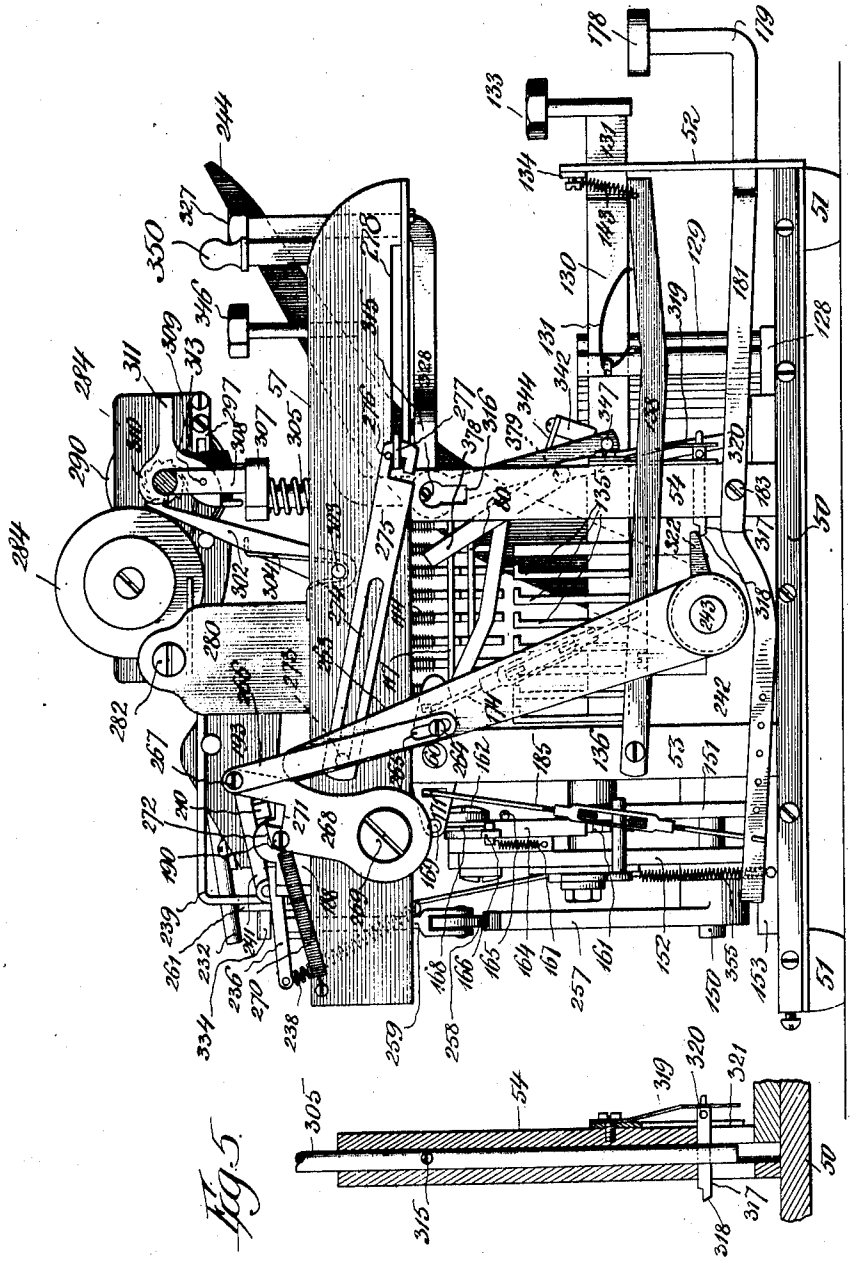


Fig. 4.

Fig. 5.

Witnesses:
Geo. Gibson.
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Inventor:
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COMPUTING MACHINE.

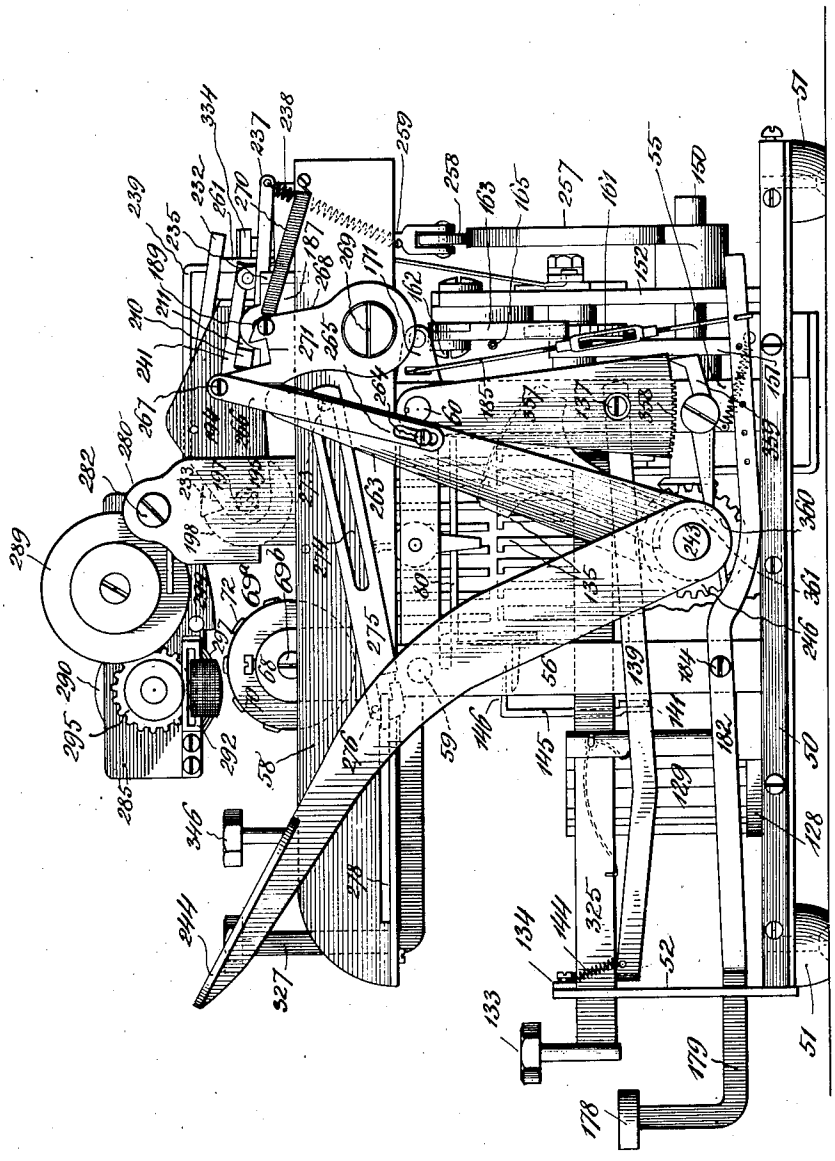
APPLICATION FILED AUG. 27, 1910.

1,098,353.

Patented May 26, 1914.

17 SHEETS—SHEET 5.

Fig. 6



Witnesses:

Fred C. Kerion

Clare L. Possum

Inventor:

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COMPUTING MACHINE.

APPLICATION FILED AUG. 27, 1910.

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17 SHEETS—SHEET 6.

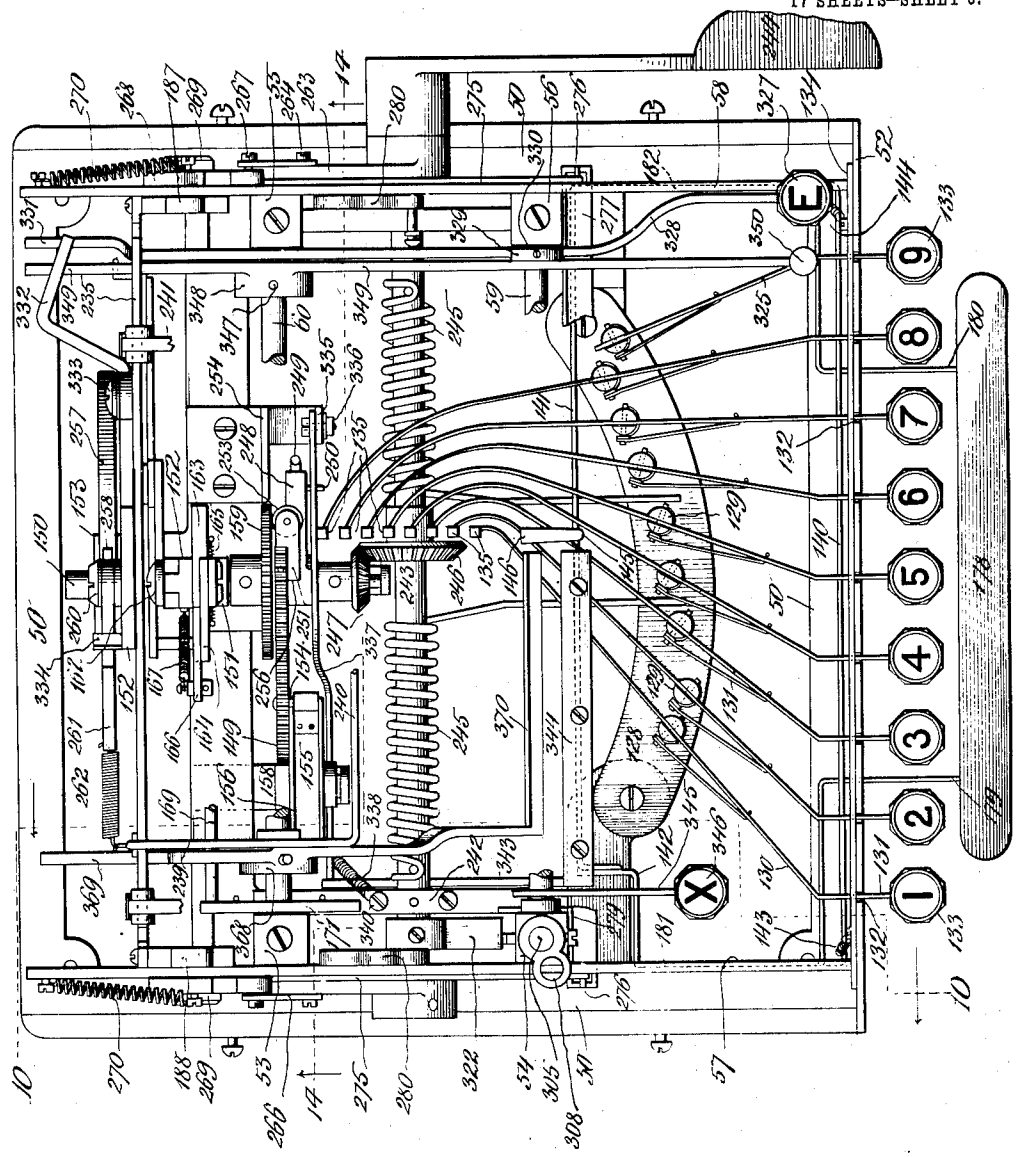


Fig 7

Witnesses:
Fes. Davison
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COMPUTING MACHINE.

APPLICATION FILED AUG. 27, 1910.

1,098,353.

Patented May 26, 1914.

17 SHEETS—SHEET 7.

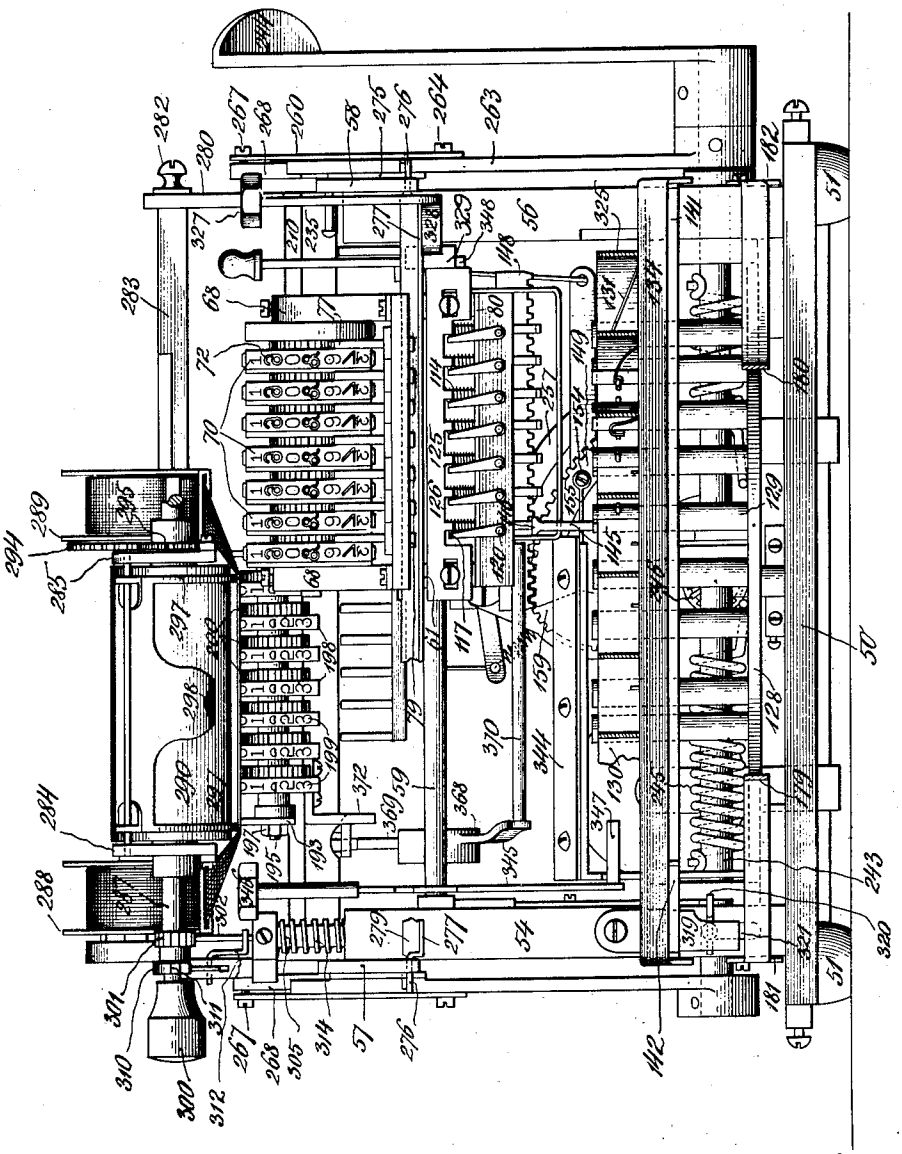


Fig 6.

Witnesses:
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Inventor:
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COMPUTING MACHINE.

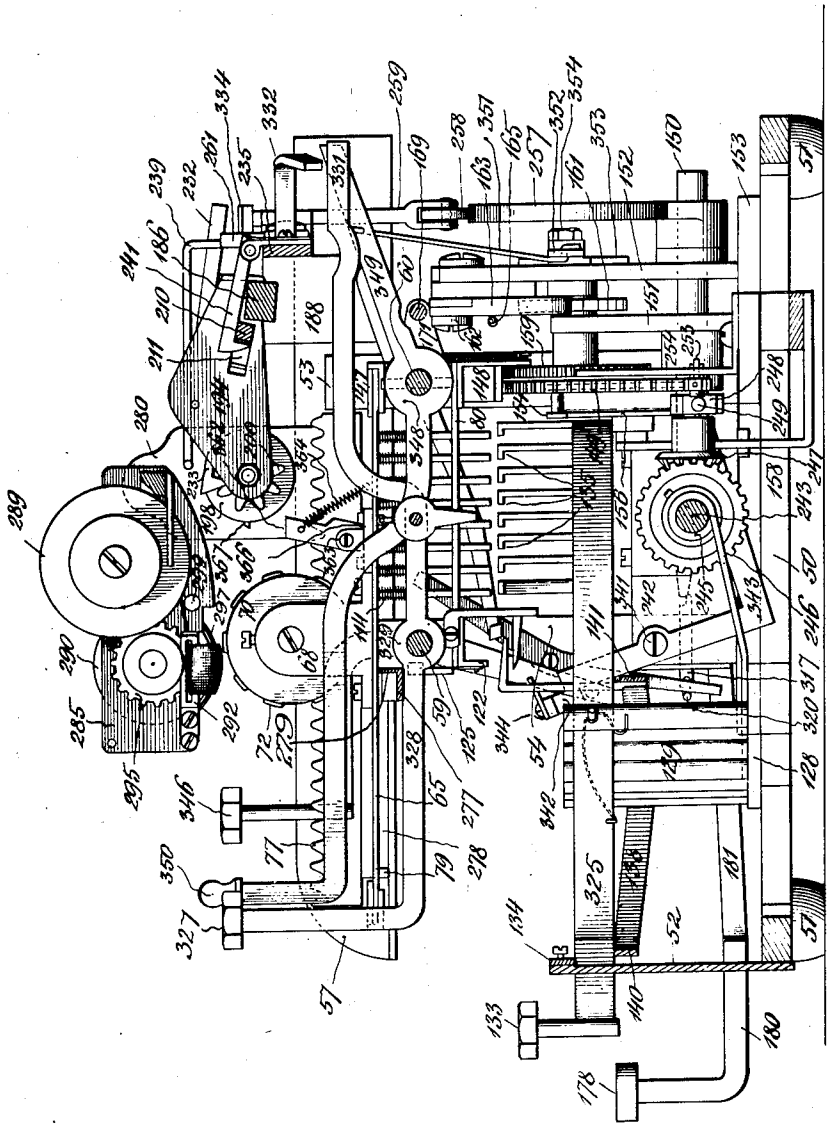
APPLICATION FILED AUG. 27, 1910.

1,098,353.

Patented May 26, 1914.

17 SHEETS—SHEET 8.

Fig 9.



Witnesses:

Fred C. Davison

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COMPUTING MACHINE.

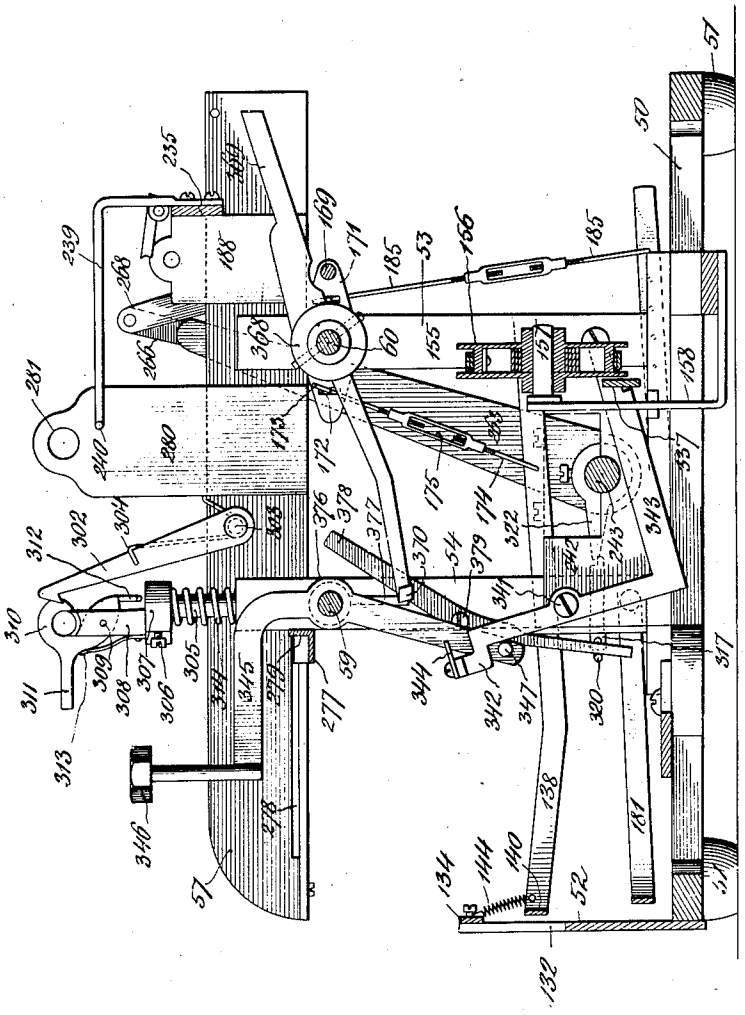
APPLICATION FILED AUG. 27, 1910.

1,098,353.

Patented May 26, 1914.

17 SHEETS—SHEET 9.

Fig. 10.



Witnesses:
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COMPUTING MACHINE.

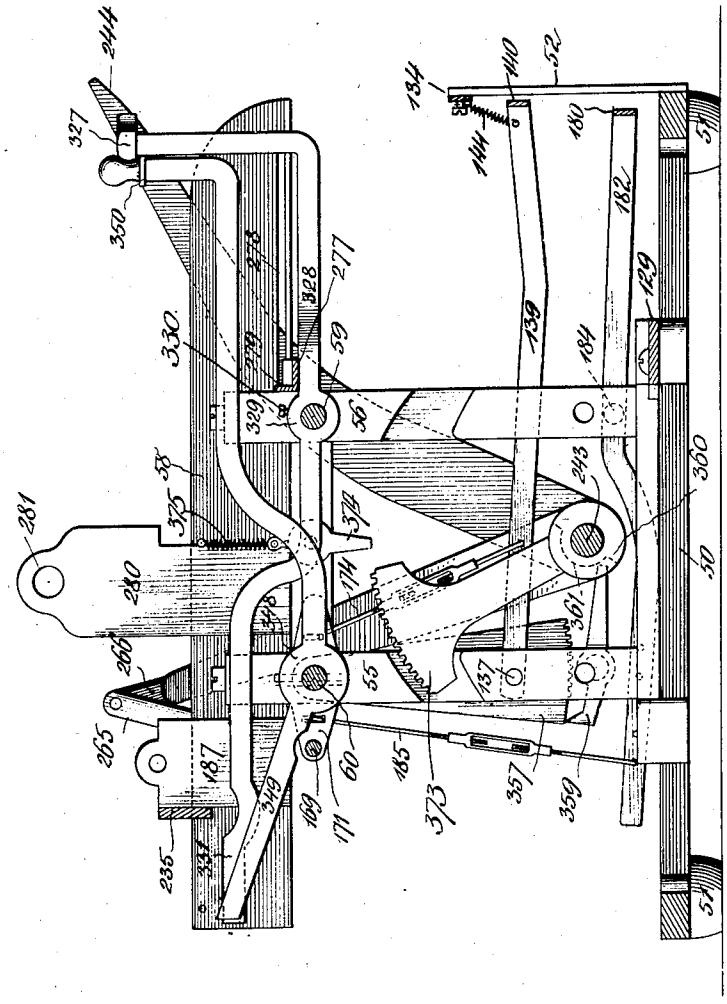
APPLICATION FILED AUG. 27, 1910.

1,098,353.

Patented May 26, 1914.

17 SHEETS—SHEET 10.

Fig. 11.



Witnesses:

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Inventor:

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Attys

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COMPUTING MACHINE.

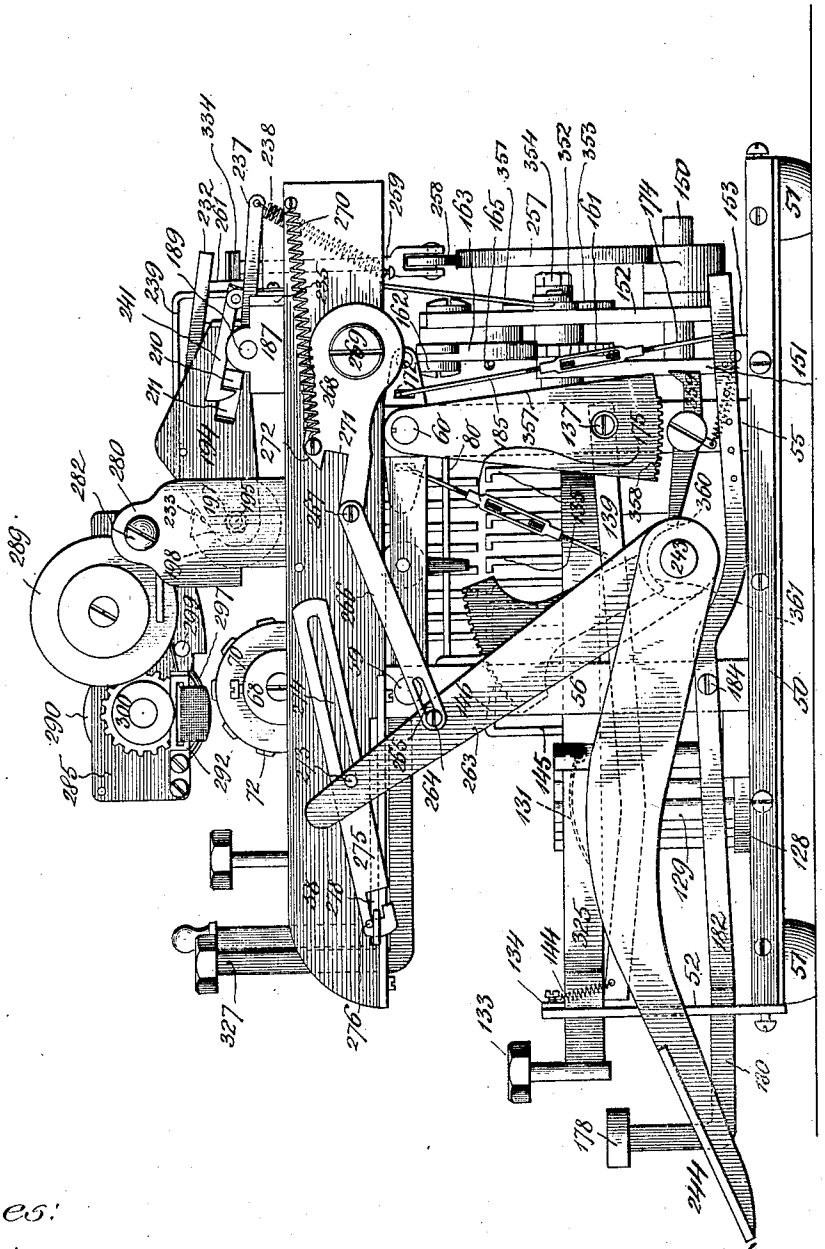
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1,098,353.

Patented May 26, 1914.

17 SHEETS—SHEET 11.

Fig. 12.



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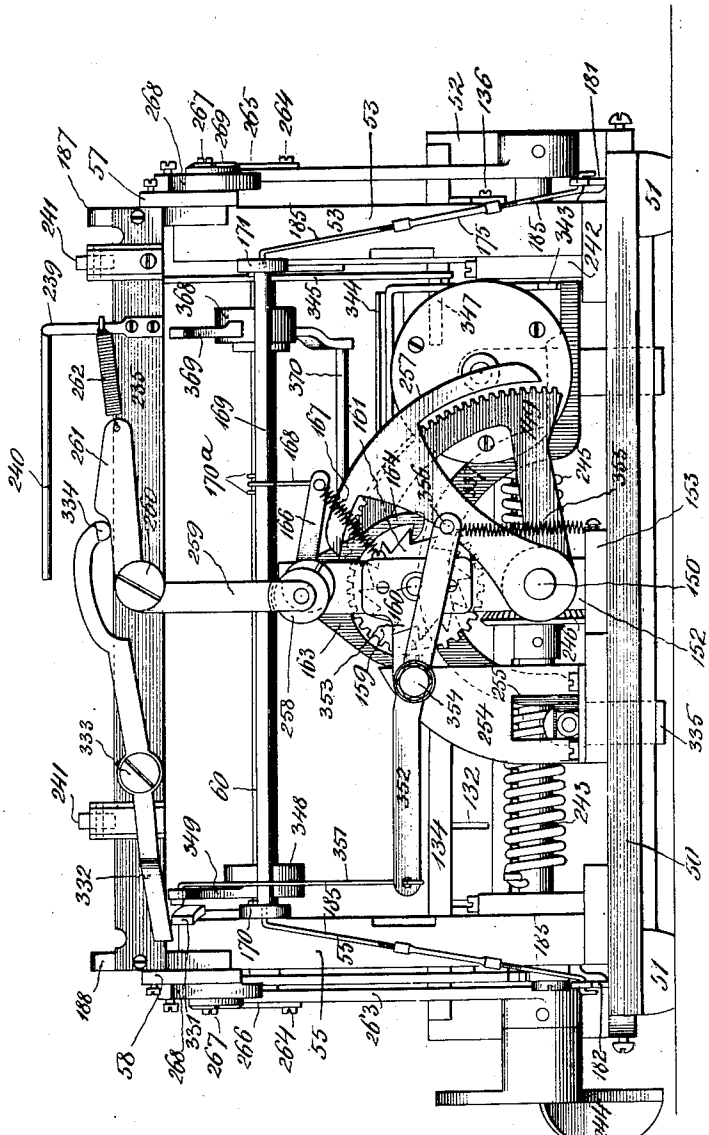
APPLICATION FILED AUG. 27, 1910.

1,098,353.

Patented May 26, 1914.

17 SHEETS—SHEET 12.

Fig. 13.



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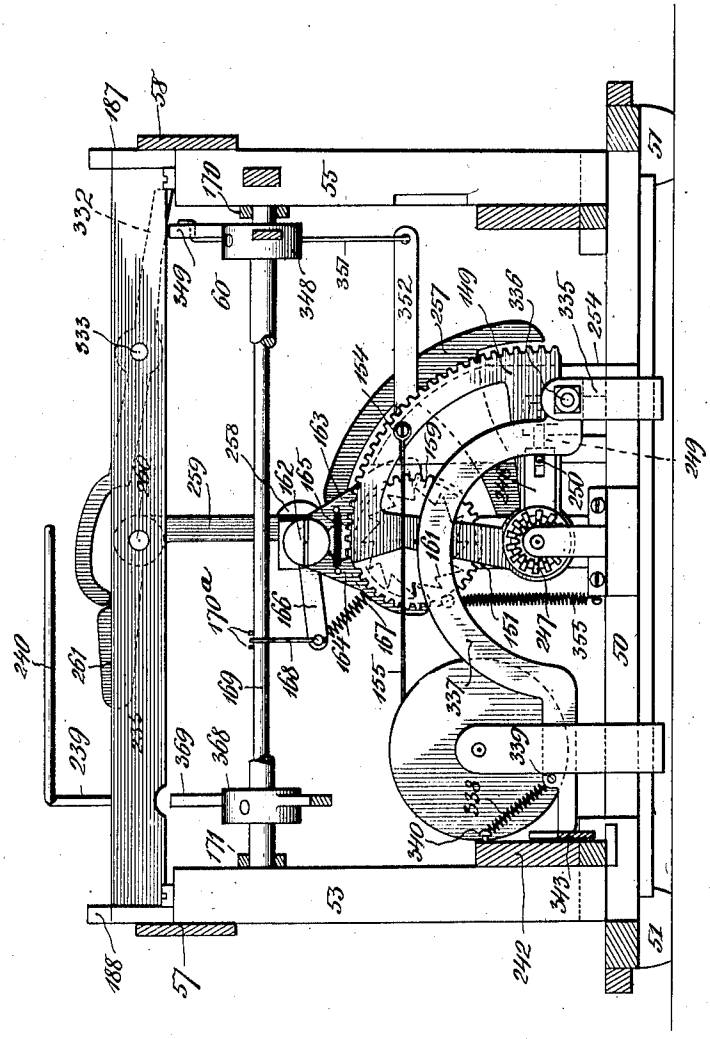
APPLICATION FILED AUG. 27, 1910.

1,098,353.

Patented May 26, 1914.

17 SHEETS—SHEET 13.

Fig. 14.



Witnesses:

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COMPUTING MACHINE.

APPLICATION FILED AUG. 27, 1910.

1,098,353.

Patented May 26, 1914.

17 SHEETS—SHEET 14.

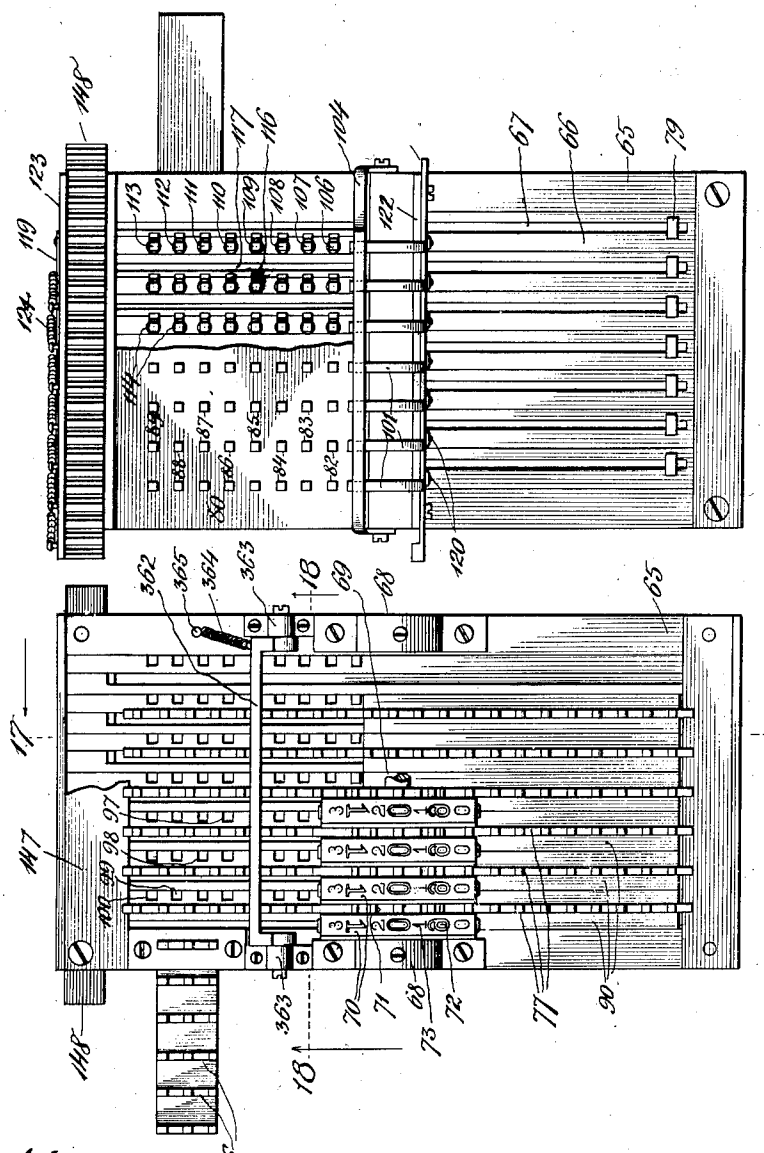


Fig. 16

Fig. 15.

Witnesses:

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APPLICATION FILED AUG. 27, 1910.

1,098,353.

Patented May 26, 1914.

17 SHEETS—SHEET 15.

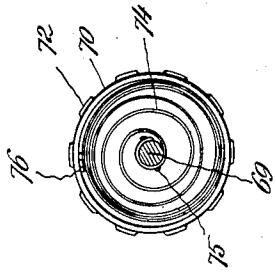


Fig. 19.

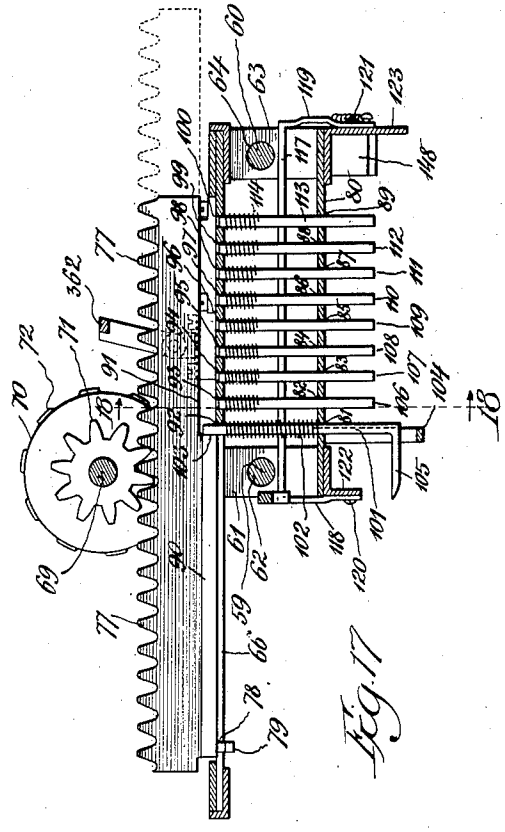


Fig. 17.

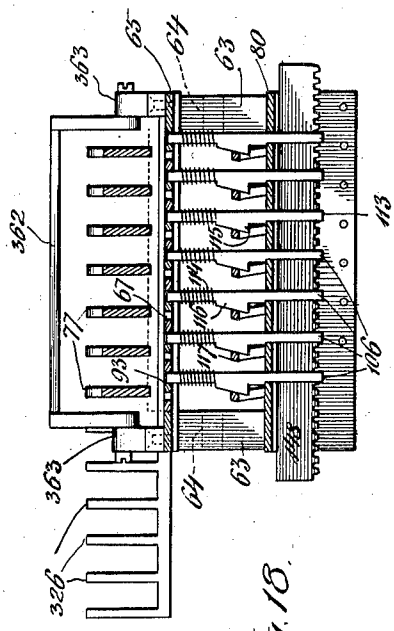


Fig. 18.

Witnesses:
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Clara L. Rosenau

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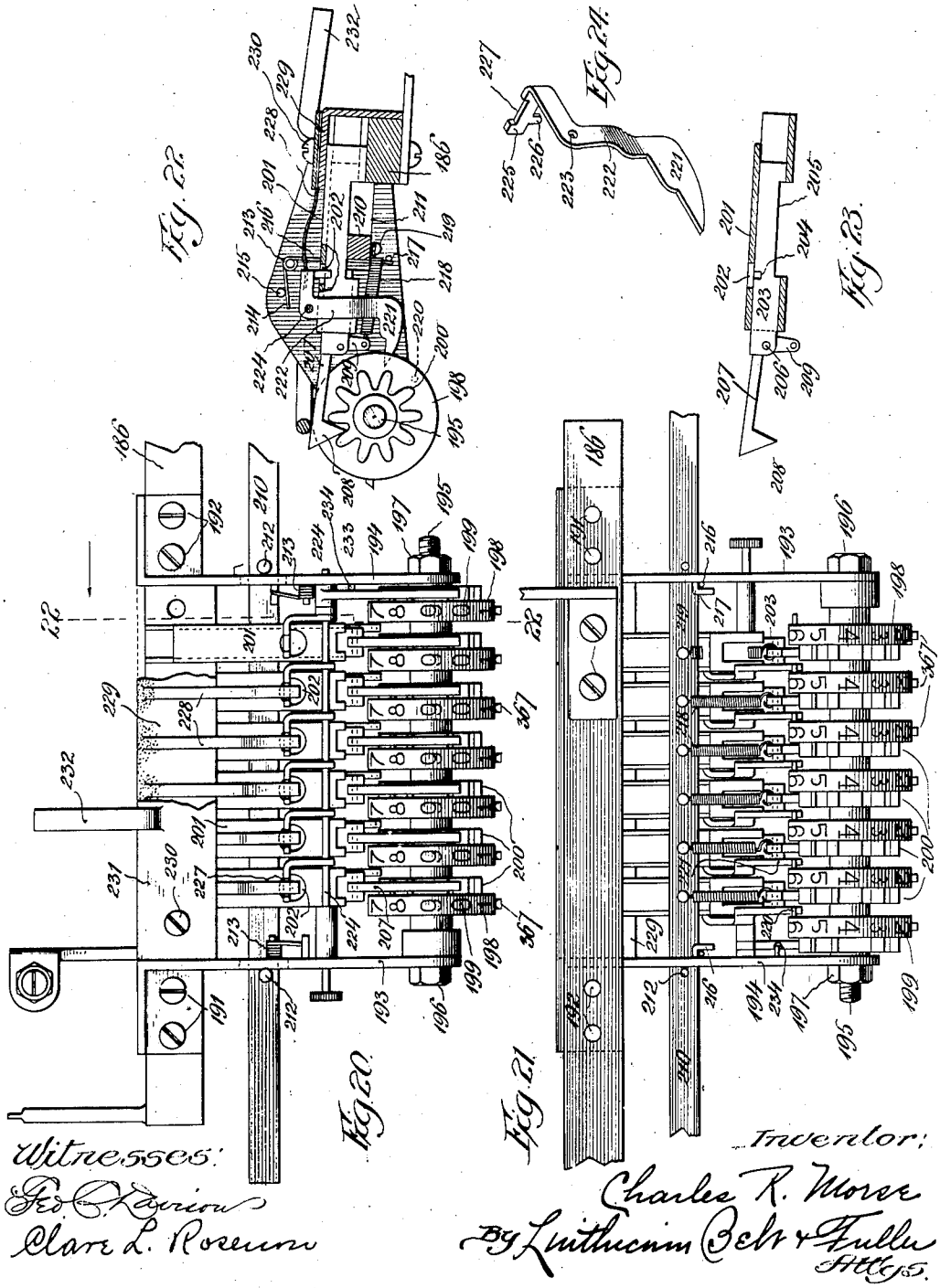
COMPUTING MACHINE.

APPLICATION FILED AUG. 27, 1910.

1,098,353.

Patented May 26, 1914.

17 SHEETS—SHEET 16.



Witnesses:
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COMPUTING MACHINE.
APPLICATION FILED AUG. 27, 1910.

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Patented May 26, 1914.

17 SHEETS—SHEET 17.

Fig. 25.

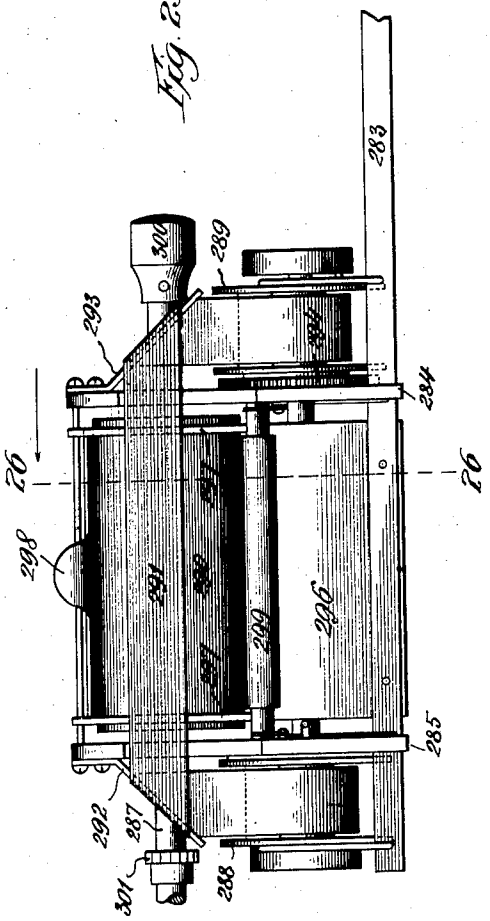
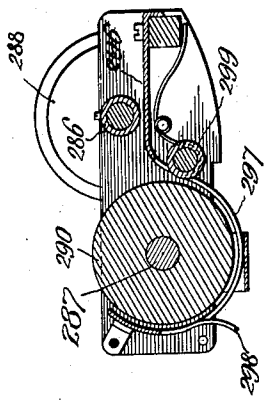


Fig. 26.



Witnesses:
Fred. C. Davison
Clara L. Rosenau

Inventor:
Charles R. Morse
By Smith, Brown, Gelt & Fuller
Attys.

UNITED STATES PATENT OFFICE.

CHARLES R. MORSE, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE MORSE ADDING MACHINE COMPANY, A CORPORATION OF SOUTH DAKOTA.

COMPUTING-MACHINE.

1,098,353. Specification of Letters Patent. Patented May 26, 1914.

Application filed August 27, 1910. Serial No. 579,209.

To all whom it may concern:

Be it known that I, CHARLES R. MORSE, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Computing-Machines, of which the following is a specification.

My invention relates to computing or adding machines, and pertains more especially, though not exclusively, to machines of this character having but ten value-keys, as distinguished from those machines supplied with a set of keys for each column of figures.

One object of the invention is the provision of an accumulating machine in which several of the various parts shall be formed and constructed as readily-detachable or quickly-removable units, which obviously facilitates the construction of the machine and the repair of the same.

Another feature of adding machines incorporating the advantages of this invention resides in the fact that in a mechanism of this character the item or amount set up on the number-wheels is visible to the operator before such amount is printed as an item on the paper slip, and before such amount is transferred to the accumulator wheels. In addition, I supply the machine with an error-key which permits the quick elimination of an error in setting up a given amount before such amount is printed or accumulated.

Another feature of this type of machine is the indication of the various figures of an item all in one line in a conspicuous place directly in front of the operator.

Another salient object of the invention is the positive actuation of the accumulator wheels from the number-wheels by means of racks and co-acting pinions.

Another aim and purpose of the invention is the provision of a machine in which if two value-keys are pressed down or manipulated at the same time the value of only one of such keys is listed, and this is indicated to the operator before the printing and accumulating. Furthermore, if two keys are depressed at the same time there is no binding or interfering action between such keys.

As will be readily understood from a consideration of the preferred and desirable embodiment of the invention hereinafter described in detail and illustrated in the accompanying drawings, a machine embodying this invention is composed of comparatively few and simple parts and is economical to manufacture.

This improved machine also provides for the clearing of the accumulator and number-wheels in a simple and efficient manner, including the printing of the total, which is transferred from the accumulator wheels to the number wheels before the latter are restored to initial 0 position. To effect this clearing of the machine the operator needs to actuate but a single key and the operating handle.

Furthermore, another feature of novelty and improvement resides in having the number wheels provided not only with type numerals capable of performing the printing operation, but also with independent indicator numerals directly in front of the operator, which, of course, facilitates the detection of any error in an item before it is listed. In addition, the mechanism is provided with a device permitting the machine to multiply numbers, that is, perform a succession or series of additions. This is brought about by simply depressing a key provided for that purpose during a portion of the actuations of the operating lever.

These with many other new features of benefit and advantage will be readily understood by those skilled in the art from a consideration of the following detailed description.

Referring to the drawings—Figure 1 is a perspective view of the complete machine inclosed in a suitable housing or casing; Fig. 2 is a plan view of the machine with the casing and paper roll holder removed; Fig. 3 is a rear elevation of the appliance; Fig. 4 is an end elevation of the machine; Fig. 5 is a vertical section through a portion of the mechanism performing the printing operation; Fig. 6 is an elevation of the other end of the machine; Fig. 7 is a top plan view with many parts omitted and broken away; Fig. 8 is a vertical section on line 8—8 of Fig. 2; Fig. 9 is a vertical section on line 9—9 of Fig. 2; Fig. 10 is a vertical section on line 10, 10 of Fig. 7; Fig. 11 is a vertical cross-section on line 11, 11 of Fig. 7; Fig. 12 is an end elevation of the machine showing the operating handle down and the other parts in corresponding position, the view being similar to that of Fig.

6; Fig. 13 is a rear view of a portion of the machine showing the parts in positions different from those which they occupied in Fig. 3; Fig. 14 is a vertical section on line 14, 14 of Fig. 7; Fig. 15 is a plan view of the number-wheel carriage with parts broken away to more clearly illustrate the construction; Fig. 16 is a bottom plan view of the parts shown in Fig. 15, certain of the elements being broken away for clearness of illustration; Fig. 17 is a section on line 17, 17 of Fig. 15; Fig. 18 is a section on line 18, 18 of Fig. 15; Fig. 19 is a detail section of one of the number-wheels; Fig. 20 is a plan view of the accumulator mechanism with parts broken away; Fig. 21 is a bottom plan view of the construction shown in Fig. 20; Fig. 22 is a section on line 22, 22 of Fig. 20; Fig. 23 is a detail view of one of the accumulator pawls and its sliding support; Fig. 24 is a perspective view of one of the carrying levers of the accumulator mechanism; Fig. 25 is a bottom plan of the platen and ribbon unit of the construction; and Fig. 26 is a section on line 26, 26 of Fig. 25.

Referring to the drawings, it will be apparent that the frame of the machine comprises an open rectangular base portion 50 mounted on a plurality of rubber or other suitable feet 51. Upstanding from the front edge of such base and forming a part of the frame of the machine is a vertically-disposed plate 52 (Figs. 2—4—6—7—9). Arising from the base 50 there are also provided four vertical posts 53, 54, 55, and 56 (Figs. 2—3—4—6—7—8). Mounted at the tops of posts 53 and 54 is a plate member 57 (Figs. 2—4—7) and at the tops of posts 55 and 56 is a similar member 58 (Figs. 2—3—6—7).

The above-described elements constitute the main but not all of the portions of the supporting-framework of the machine, the other parts being referred to hereinafter.

The two posts 54 and 56 have mounted in their top ends and extended longitudinally of the machine a rock-shaft or rod 59 (Figs. 2—7—9—10—11), the other posts 53 and 55 having mounted therein, and at substantially the same height, a similar rock-shaft 60 (Figs. 2—6—7—9—10—11). The sliding carriage for the number-wheels reciprocates upon these two rods 59 and 60 and comprises the two blocks 61 (Fig. 17) apertured in alinement at 62 for the accommodation of the front rod 59, on which they slide. The carrier comprises also two back blocks 63 (Figs. 17—18) apertured in alinement at 64 for the accommodation of the back rod 60. Mounted on the tops of these four blocks I provide a rectangular frame 65 (Figs. 2—9—15—16) accommodating a plurality of narrow plates 66 each longitudinally slotted at 67. Two bearings 68 are secured to the tops of the side longitudinal members of the frame 65, and on a shaft 69 rotatably adjustable in such bearings I loosely mount a plurality of number-wheels 70 (Figs. 2—6—8—9—12) corresponding in number to the columns which the machine is capable of adding. Each of such number-wheels has secured to one side a pinion 71 (Figs. 15—17), and has on its outer periphery not only type or printing numerals 0 to 9, inclusive, characterized 72 in the drawing, but also indicator numerals facing in the opposite direction and characterized 73 (Fig. 15), such latter numerals being disposed between the type numerals. Each of these number-wheels 70 is of hollow formation, as shown in Fig. 19, and houses a flat spiral spring 74, one end of each of which is secured at 75 to the common shaft 69, the other end being fastened at 76 to the wheel itself, the action of the spring being such as to tend to rotate the number-wheel in a counter-clockwise direction as the wheel is viewed in Fig. 17. The tension of all of these number-wheel springs may be simultaneously adjusted, either decreased or increased, by loosening the set-screws 69^a, turning the shaft 69 by means of its slotted end 69^b, and then again setting up the screws to hold the shaft in adjusted position. In the particular machine under consideration I have shown seven of these number-wheels, so that this especial machine is capable of adding the figures of seven columns. The teeth of each gear 71 mesh with those of a sliding rack 77 (Figs. 2—15—17—18), several of such racks being used and each having a downward projection 78 accommodated in one of the slots 67 and having an enlarged head 79 below the slots, these projections or lugs 78 acting to maintain the forward ends of the racks in proper position and permit their ready reciprocation. The more rearward portions of the racks are held in position by being accommodated between adjacent number-wheels 70. A horizontal plate 80 (Figs. 17 and 18) is mounted on the lower ends of the blocks 61 and 63, such plate having nine square holes 81 to 89, inclusive, in register with the path of travel of the enlarged foot or base piece 90 of each sliding rack 77, each of such racks being cut away at its under side along its rear portion at 91. Each of the narrow plates 66 (Fig. 17) is provided with nine square holes 92 to 100, inclusive, in vertical alinement with the holes of plate 80. In order to hold the racks 77 in their normal forward position against the action of the springs 74 of the number-wheels, I provide seven right-angled catches 101 (Fig. 17) extended through the front rows of holes 81 and 92, each of such catches being surrounded by a coil expansion spring 102 which projects its top end above the aper-

ture 92 sufficiently to form a catch for the shoulder 103 of the base of the corresponding rack. The descent of these catches is limited and restricted by a suitably-supported, depending, substantially-U-shaped strap 104. As is clearly indicated in the various figures, the feet or lower portions 105 of the catches 101 project forwardly in a row for a purpose hereinafter indicated. All of the other holes of the plates 66 and 80 are provided with sliding stops or pins, each rack having eight of such stops 106 to 113, inclusive, each stop having a coil spring 114 normally pulling the member downwardly so that it does not project above its plate 66, as is clearly indicated in Figs. 17 and 18. Each of said sliding stops has a shoulder 115 (Fig. 18) leading to which is an upper beveled or inclined surface 116. Each row of the sliding members 101 and 106 to 113, inclusive, is supplied with a rocking-bar 117 having its ends 118 and 119 downturned and pivoted at 120 and 121 on angles 122 and 123 forming parts of the sliding number-wheel carriage. At the back of the machine each of the arms 119 has connected thereto a coil contractile spring 124 (Figs. 3—16—17), the lower end of which is fastened to the angle 123, and which tends to rock the bars 117 into contact with the row of sliding stops, as is clearly shown in Fig. 18, the contact of such arms 117 with the stops being above the shoulders 115 in the normal inoperative position of the parts. It should be apparent, therefore, that if one of the stop pins, 110 for example, is elevated sufficiently its top end will be projected into the path of travel of a corresponding rack, and the arm 117 will swing inwardly below the shoulder 115 of the pin, thereby locking the latter in rack-stopping or limiting position. If now the corresponding catch 101 is depressed against the action of its spring 102 the rack is released and travels rearwardly, due to the action of the number-wheel spring 74, until its shoulder 103 strikes the top protruding end of the pin 110, it being understood that the corresponding number-wheel is rotated at the same time and that the proper display and type numerals will be brought to indicating and operative or printing position when the rack is arrested in its movement by the pin.

Slidingly mounted on the front of the carriage, as shown in Fig. 8, is a release bar 125 notched at 126 for the accommodation of the front end portions of the various rocking catches 117, such sliding release, by striking a hub 329 of an error lever 328 fixed on rod or shaft 59, being adapted to rock all of the arms 117 and release all of the upwardly-projected pins previously employed for limiting the movements of the various racks. Referring now to the operating mechanism for this carriage and its various elements, it will be noticed that upstanding from a curved bar 128 (Figs. 2—4—6—7—8—9) forming a portion of the base or frame of the machine, I provide nine posts 129, in the slotted head ends of which are fulcrumed a plurality of bent key levers 130, each under the influence of a spring 131 tending to raise the front or key-equipped portion of the same. The forward ends 131 of these bent levers project through slots 132 in the vertical plate 52 and are supplied with the various numeral keys 1 to 9, inclusive, characterized 133, the upward movement of such forward portions of the levers being limited and restricted by a bar 134 fastened to the plate 52 along its top edge. The rear upturned ends 135 (Figs. 4—6—7) of the bars 130 supplied with the numeral or value-keys 1 to 8, inclusive, are arranged in alinement, as shown in Fig. 7, and are disposed substantially directly beneath the lower ends of the first forward and back row of stop-pins 106 to 113, inclusive, when the carriage is at its limit of travel to the right as the machine is viewed from the front or top. If, therefore, the operator depresses any of the numeral-keys 1 to 8, inclusive, for example key #5, its rear upstanding end 135 will elevate stop-pin 110 against the action of its depressing spring 114 so as to project the upper end of the stop-pin into the path of travel of the shoulder 103 of the rack farthest to the left on the carriage, and this stop-pin will be retained in such elevated position by the rocking-bar 117 swinging beneath its retaining shoulder 115.

Pivoted to the outer faces of the two rear posts 53 and 55 of the machine frame at 136 and 137 (Figs. 4 and 6) are the two rearwardly-extended arms or bars 138 and 139 of a frame having in addition to the parts 138 and 139 the two longitudinal bars 140 and 141 (Fig. 7), the former being disposed directly beneath the front portions of the key levers 130 and the latter having one end off-set at 142. This frame is spring-pulled upwardly by a pair of coil contractile springs 143 and 144 (Fig. 7) which are connected to the front of the frame and to the bar 134. The longitudinal bar 141 carries in alinement with the lever ends 135 an upstanding catch release 145 (Fig. 6) with a rearwardly-extended finger 146 (Figs. 6 and 7) disposed above the forwardly-projecting foot 105 of the sliding catch 101 of the rack 77 at the left of the sliding numeral wheel carriage. It will be apparent, therefore, that whenever any of the numeral or value-keys 133 are depressed, the frame referred to including the bars 140 and 141 are also depressed, owing to the contact of the keys 130 with the bar 140. The downward movement of the bar 141 oc-

casions a corresponding movement of the finger 146, which in turn, by coöperation with the foot 105, pulls down the catch 101 away from the shoulder 103 after the stop-pin 110 has been projected upwardly by the part 135. This removal of the catch 101 from the shoulder 103 releases the rack and number-wheel, and the former travels rearwardly until the shoulder 103 strikes the pin 110, which arrests and prevents further sliding of the rack and further turning of the number-wheel. Such movement of the rack, however, has turned the wheel sufficiently to bring the numeral 5 to the top portion of the wheel and to bring the index numeral 5 to the front thereof for visual inspection. It might be remarked in passing that no sliding stop-pin on the carriage is required to set up the numeral 9 on any number-wheel, because the rear cross-bar 147 (Figs. 9 and 15) on the carriage is so spaced as to act as a common stop for all of the racks when any 9's are set up, the rack in such cases traveling their full limit of movement.

Referring now to the portion of the mechanism for bringing about the travel of the carriage at the same time the various numbers are set up on the number-wheels, I call attention to the fact that across its rear end the number-wheel carriage is provided with a toothed-rack 148 (Figs. 9—15—16) having its teeth projecting downwardly. Meshing with such rack I provide a gear-sector 149 (Figs. 3—7—8—9) freely rotatable on the shaft 150 revoluble in bearings in a pair of vertical members 151 and 152 (Fig. 7) arising from a base 153 secured in any approved manner to the base of the machine. This sector has attached thereto by a screw 154 one end of a metal band 155 adapted to be wound upon and unwound from a rotatable, spring-actuated drum 156, (Figs. 3—7—10) mounted at 157 at the upper end of an arm 158 secured to the base of the machine and arising therefrom. The spring in such drum tends to wind the steel band thereupon and through the sector and rack connection tends to pull the carriage toward the left as the computing machine is viewed from the front. Also meshing with the teeth of rack 148 is a pinion 159 (Figs. 7—8—9—14) fixed on an escapement shaft 160 rotatable in bearings in the upper portions of the standards 151 and 152, and having fixed to itself between such bearings a ratchet-wheel 161 forming a part of the escapement mechanism. Above this ratchet wheel 161 on a screw 162 mounted on the upper part of post 152, I pivot a pair of escapement pawls 163 and 164 (Fig. 13) pulled toward one another by a coil spring 165 (Fig. 12) connecting the two pawls or dogs. The pawl 163 has an extension arm 166 pulled downwardly by a spring 167, one end of which is fastened to the arm 166, the other end being secured to a stationary part of the frame, such spring acting to normally retract the hook end of the pawl 163 away from the ratchet wheel, while the other spring 165 normally keeps the companion pawl 164 in engagement with the ratchet wheel. As is shown in Fig. 13 the free end of the pawl arm 166 is connected by a wire hook or link 168 with a rod 169, the hook portion of the link fitting over the rod and being held in place between two pins 170^a. This rod 169 connects together the rearwardly-extended portions of two levers 170 and 171 freely rotatable on the rod or shaft 60 just inside of the two rear posts 53 and 55. In front of such shaft 60 the rock lever 171 is apertured at 172 for the accommodation of a bent end 173 of an adjustable link 174 having an adjusting turnbuckle 175 (Fig. 10), the lower end of such link being pivotally attached to the arm 138 of the forwardly-extending rocking-frame heretofore referred to, and pivoted on the back posts at 136 and 137. It should, therefore, be apparent that whenever any one of the number keys is depressed, with a resultant downward swinging of arm 138 on its pivot 136, the longitudinal rod 169 is raised, which movement occasions the rise of arm 166, the inward travel of pawl 163 into the path of movement of the ratchet teeth, and the outward swinging of pawl 164 away from the ratchet teeth, due to coöperating shoulders 176 and 177 on the two dogs or pawls. Such actuation of the escapement mechanism permits the steel band drum, through the coöperating gear sector and rack, to move the number-wheel carriage to the left an amount equal to the distance between adjacent number-wheels.

The machine is also equipped with an elongated 0 or space-bar 178 (Figs. 2—4—6—7—9) mounted on the bent forwardly-projecting ends 179 and 180 of a pair of lever bars 181 and 182 fulcrumed on the two front posts 54 and 56 at 183 and 184, respectively. The rear end of each of these levers 181 and 182 (Figs. 4 and 6) is connected by an adjustable link 185 to the rearwardly-projecting portions of the levers 170 and 171. It should be apparent, therefore, that every time the 0 or space-bar 178 is depressed the escapement mechanism is operated as indicated above through the elevation of the bar 169 so as to permit the carriage, under the action of the spring drum and connecting steel band, to travel to the left the same amount as would have occurred if a numeral-key had been actuated.

From an understanding of the mechanism so far as described above, it should be plain that the sliding-carriage on which the number-wheels are mounted travels to the left a number of steps or spaces corresponding to

the number of times the numeral-keys and 0 bar have been actuated.

A description of the accumulator mechanism will now be given.

A shaft 186 (Figs. 2—9—20—21—22) rectangular in cross-section is detachably and rockingly secured in a pair of bearings 187 and 188 suitably mounted on members 57 and 58 of the main frame by means of a pair of removable screws 189 and 190. Secured to such shaft 186 by screws 191 and 192 I provide a pair of forwardly-extending plate members or brackets 193 and 194. Fastened on the front ends of such brackets I employ a bolt or shaft 195 having at one end a head 196 and at the other end a nut 197. Freely rotatable on this bolt, and spaced apart a distance equal to the distance between the centers of the number-wheels on the number carriage, are seven accumulator wheels 198 provided on their cylindrical peripheries with indicating numerals 199 0 to 9, inclusive. Each accumulator wheel has fixed to one side thereof a pinion 200, it being understood that these seven pinions are spaced apart from one another the same distance that the racks 77 of the number-wheel carriage are separated from one another. The carrying and locking mechanisms for these accumulator wheels comprise the following elements, (Figs. 20 to 24 inclusive): Suitably supported on the rocking-bar 186 I provide seven forwardly-extending casings 201 spaced apart the same distance as the accumulator-wheel pinions 200, each casing having a cylindrical aperture 202 extended through its top wall. Each of these casings accommodates a sliding bar 203 recessed on its top surface at 204 and cut away on its under surface at 205 so as to provide an elongated notch or recess on the bottom face of each slide. At its forward protruding end I pivot at 206 a pawl 207 having a V-shaped tooth 208 and a depending arm 209, the pawl, as will be observed, being in the form of a bell-crank. Beneath this series of slides and accommodated in the various recesses 205 is a pawl-advancing bar 210 of considerable length, and which extends through alined supporting slots 211 in the brackets or plates 193 and 194, the longitudinal shifting of such bar 210 being prevented by the pair of upstanding pins 212 disposed just outside of the pair of brackets 193 and 194. On the inside of each bracket I place on a suitable pin a coil-spring 213, one end of which 214 strikes a stop-pin 215, while the other depending end 216 of the spring lies in front of the path of lateral bodily movement of the bar 210 and slightly rearwardly of the front end of slot 211, the rearward movement of such end 216 of the spring being limited by a suitable stop 217. It will, therefore, be apparent that when the bar or rod 210 is shifted bodily laterally toward the front of the machine along the slots 211, it will engage the two depending ends 216 of the springs and be subjected to their retracting pressure. Each arm 209 of the six dogs or pawls is connected by means of a coil spring 218 to a pin or screw 219 on the bottom of bar 210. Projecting from the left-hand side of each accumulator wheel is a pin 220 adapted to co-act with the forwardly-projecting portion or foot 221 of a carrier-lever 222, six of which are fulcrumed at 223 on a small rod or shaft 224 supported in the brackets or plates 193 and 194. Each of these carrier levers has at its rear end a laterally-extended part 225 equipped on its under side with a downwardly-extended lug 226, and being notched on its top surface at 227 for the accommodation of the front end of a leaf-spring 228, six of which are employed, one for each carrier-lever. These springs are secured at their rear ends to a bar 229 fastened to the rocking-bar 186 by means of screws 230 beneath a top plate 231 having a rearwardly-extended arm or pin 232. The pinion of the accumulator wheel farthest to the right as the machine is viewed from the front is supplied with a pawl 233 pivoted on a pin 224 and pulled downwardly by a spring 234. Secured to the bearings 187 and 188 (Fig. 2) and extended parallel to the rock-bar or shaft 186 I provide a stationary bar 235, which among other functions acts as a limiting stop for the descent of a pair of rearwardly-extended arms 236 and 237 secured to the rock-bar 186 and pulled downwardly by a pair of springs 238, the lower ends of which are fastened to the frame. These springs act to normally keep the accumulator in elevated position, the extent of such elevation being determined by the bar 235. Also secured to this bar 235 is a bent rod 239 having a front portion 240 disposed directly above the various pawls or dogs 207. Also mounted on the bar 235 I employ a pair of spring-actuated catches 241 which cooperate with the transversely-slidable bar 210 to hold the same in retracted back position.

Referring now to the operating mechanism for actuating the accumulator and other parts of the machine, attention is first directed to Fig. 7. In suitable bearings in plates 242, forming a part of the main frame of the machine, I supply a rotatable main shaft 243 having fixedly secured to its right-hand end an operating lever or handle 244. Encircling and secured to this main shaft is a pair of actuating springs 245 which act upon the shaft in such manner as to maintain the handle 244 in elevated position. Also mounted on this shaft is a beveled gear 246 in mesh with a beveled pinion 247 fixed to the short shaft 150 hereinabove referred

to. Fixed and rotatable with such shaft 150 is an arm 248 carrying in its end a beveled spring-actuated catch 249 having a laterally-extended retraction projection 250. Such catch is adapted to coöperate with a block 251 pivoted in a slot 252 in the edge of gear sector 149 (Figs. 7—9—14), such block having mounted in a projecting portion thereof a roller 253 adapted to travel on the front face of a fixed plate 254 which is recessed or apertured at its lower end at 255 (Fig. 3) to permit the block to swing on its pivot when the block and roller come opposite this slot, the roller passing from the face of the plate into the slot. It should be noticed from an examination of Fig. 7 that the shoulder or end 256 of the block 251 is adapted for coöperation with the spring catch 249 explained more fully hereinafter.

Fixed to the rear end of shaft 150 I provide an oscillatory arcuate member 257 (Figs. 3—4—6—7—8) which is adapted to rock the accumulator downwardly by co-action with the roller 258 at the end of a bell-crank lever 259 (Fig. 3) fulcrumed on the bar 235 at 260, one arm 261 of such bell-crank lever being normally pulled into substantially-horizontal position by a coil contractile spring 262. This arm underlies the rearwardly-extended finger 232 rigidly secured to the accumulator rock-shaft 186, as described above. Each end of the main operating shaft 243 has fixed thereto an upstanding arm 263 (Figs. 2—3—4) carrying on its outer face a screw 264 received in a slot 265 of a link 266, the other end of which is pivoted at 267 to a rock-arm 268 fulcrumed on the frame of the machine on a screw 269 and connected to the frame of the machine by a coil retraction spring 270. At its top end each of these arms 268 is notched at 271 for the accommodation and reception of the end portions of the laterally-movable bar 210 described hereinabove, it being obvious from the drawing that a rearwardly-beveled surface 272 leads to each of the notches. Projecting inwardly from each of the arms 263 I use a pin 273 received in a slot 274 of link 275, the two links being fulcrumed in any approved manner about their front ends at 276 to the protruding portions of a laterally-slidable angle-bar 277 movable toward and from the front of the machine in the alined slots 278 of the plate portions 57 and 58 of the frame of the machine, the upstanding flange 279 (Fig. 9) of such angle-bar being adapted, by co-action with the parts 79 of racks 77, to restore such racks to their normal forward positions.

The printing mechanism for this computing machine will now be described.

The opposite ends of the frame are supplied with a pair of standards 280 each having a bearing 281 for a removable journal 282 having threaded engagement with an angular supporting-shaft 283 on and projecting forwardly from which I employ a pair of spaced supporting members 284 and 285 (Figs. 2—3—8—25) which afford bearings for a ribbon shaft 286 and a platen shaft 287, the former having mounted thereon outside of the members 284 and 285 a pair of ribbon-spools 288 and 289, while the latter has secured thereto a ribbon or other suitable platen roller 290. An inked ribbon 291 passes from the spool 288 around a diagonally-diposed bar 292 beneath the lower face of the platen roller around another similar diagonal guiding-bar 293 to the contact spool 289, the proper intermittent feed of such ribbon being brought about through the intermeshing gears 294 and 295 fixed to the ribbon and platen shafts, respectively. As is clearly shown in Fig. 26, a guide 296 provided with straps 297 encircling the roller and equipped with a flaring tongue 298 acts to guide the paper around the platen roller and hold it in proper position, the paper being introduced at the back of the roller; as is customary in typewriters. In Fig. 1 I have shown a supply roll of paper which may be used if desired and supported in any approved manner. This printing mechanism is also supplied with a suitably-journaled spring-pressed contact roller 299 for holding the paper in proper relation to the platen. The ribbon and spools referred to above are provided with an automatic reversing mechanism which constitutes a separate and independent invention and which it is not necessary to refer to further. The platen shaft 287 is supplied at either end with a handle 300, and is also equipped with a ratchet-wheel 301 fixed thereto with which coöperates a pawl 302 (Figs. 2 and 4) pivoted on the frame at 303 and pressed toward the ratchet by a suitable spring 304.

Slidingly mounted so as to reciprocate vertically in the post 54 I use a rod 305, fastened to the top end of which by a screw 306 is a roller 307 having an upstanding bifurcated post 308 between the jaws of which on a pin 309 I pivot a catch or hook 310 supplied with a handle portion 311 and a depending offset foot 312 (Fig. 8), while the post is supplied with a leaf-spring 313 bearing against the catch and tending to force it upwardly into position to engage over the platen shaft 287. Between the collar 307 and the top of the post I interpose a coil expansion spring 314 which maintains the member 305 normally in elevated position, the extent of upward movement of the rod being determined by a lateral screw 315 fastened to the rod, the head of such screw being disposed in an opening 316 in the post. Extended through its lower end the rod 305 has a sliding catch 317 (Figs.

4 and 5) the inner under surface 318 of which is beveled, while the leaf spring 319 secured to the post bears on a cross-rod 320 fastened to the catch. Obviously, in order that the catch may slide in the post the latter is slotted at 321. It should be apparent that the action of spring 319 on the catch acts to thrust the latter rearwardly in a yielding manner, the end of the catch being adapted to co-act with a finger 322 secured to the main shaft 243.

The operation of the mechanism so far as hereinabove described takes place substantially as follows: Assuming, for example, that the operator desires to add the numbers 13,059 and 246,873 and wishes to list these two items and the total, he first depresses key 133 displaying numeral 1, which occasions the elevation of the upstanding end 135 of such lever, which strikes the end of the stop-pin 106 of the row of pins farthest to the left on the number-wheel carriage, raising the top end of such pin into the path of travel of the shoulder 103 of the left-hand rack 77. During such upward movement the bevel surface 116 of the catch 115 swings the arm 117 over slightly, the latter rocking back beneath the shoulder 115 and acting to hold the pin 106 elevated. The depression of the lever 130 bearing the key displaying the numeral 1 causes a descent of the finger 146, which strikes the foot 105 of the spring-actuated catch 101 of the left-hand rack and pushes the same down sufficiently in opposition to the action of its spring 102 so that the left-hand rack 77 is released from such catch subsequent to the elevation of pin 106. Owing to the tendency of the coil spring 74 of the left-hand number-wheel to unwind, such number-wheel and its pinion turn an amount depending upon the travel permitted of the rack 77, which of course is determined by the pin 106. In other words, the rack automatically slides rearwardly until it strikes the pin 106, and under such circumstances the left-hand number-wheel 70 will have turned to bring the type numeral 1 at the uppermost position of the wheel which previously had been occupied by the type numeral 0. The downward turning of the parts 138 and 139 about their fulcrums 136 and 137, brought about by the contact between the lever 130 and the bar 140 secured to such members, causes the forward rocking of both levers 170 and 171 and the consequent elevation of the release rod 169, the movement of the latter being used by means of the link 168 to shift the tooth of the pawl 163 into operative relation with the teeth of ratchet 161. Owing to the coöperation between the shoulders on the two pawls, at the same time that the pawl 163 is moved inwardly toward the ratchet the other pawl 164 is moved out of engagement, the ratchet turning slightly when thus released, being held from further movement by the catch 163. Under these conditions the tooth of the catch or pawl 164 is slightly above the abrupt engaging face of the adjacent ratchet tooth. As soon as the operator removes his finger from key 133, owing to the action of spring 167, the rod 169 descends, catch or pawl 163 moves out of co-acting relation with the ratchet, and, due to the operation of spring 165, the catch or pawl 164 engages the next succeeding tooth, this operation of the escapement having permitted a sufficient degree of rotation of shaft 160 under the action of the spring in drum 156, metal band 155, segment 149, rack 148, and gear 159, whereby the number-wheel carriage is slid to the left on its supporting rods an amount to bring the left-hand rack 77 into register but not into mesh with the gear or pinion 200 of the right-hand accumulator-wheel 198. When the parts are in this position the index numeral 1 on this left-hand number-wheel will be displayed through the window 323 of a casing 324 used to inclose or house a large portion of the mechanism of the machine. The operator, therefore, has before him for his visual inspection an indication of the numeral which he has set up on the number device. The operator now depresses the key 133 displaying the numeral 3 and the operations described above are repeated, with the exception that the part 135 of such lever pushes upwardly the stop-pin 108 of the second row of pins from the left-hand end of the number-wheel carriage, with the resultant setting up of the type-numeral 3 on the second number-wheel at the side of the numeral 1 previously set up on the first number-wheel. As has been explained above, the carriage shifts another amount to the left so as to bring the left-hand rack into register with the gear of the second accumulator wheel from the right-hand end of the accumulator, the second rack of the number-wheel carriage being in register with the gear of the right-hand accumulator wheel, there being at this time displayed at the window opening 323 the numeral 13. To set up the 0 the operator merely depresses the 0 bar 178, which raises the release bar 169 by means of the lever 181 and the link 185 which is connected to the lever 171 rearwardly on its fulcrum. Because this 0 bar is not operatively associated with any of the pins controlling the movements of the racks, no rack is longitudinally shifted under such conditions, the carriage merely moving one point farther to the left. Then the operator depresses the key 133 displaying numeral 5, which elevates pin 110 of the metal rack 77, such actuation of the key bringing about a setting up of the type numeral 5 on the middle number-wheel, a shifting of the carriage one

step farther to the left, and the bringing of the display numeral 5 in front of the window. To set up the numeral 9 the operator depresses key 133 displaying the numeral 9, but inasmuch as such lever, characterized 325 in the drawing, has no extension rearwardly of its fulcrum, none of the stop-pins 106 to 113, inclusive, is operated, but of course the catch 101 of the corresponding rack is depressed and the rack moves rearwardly the full extent of its possible travel, striking against the bar or plate 147, which is so positioned as to take the place of one transverse row of stop-pins and to occasion the setting up of the type numeral 9 on the corresponding number-wheel. As in the previous instances, the carriage moves one step to the left. Now the entire number 13059 is displayed at the window 323, and before this item is printed and set up on the accumulator wheels it is subject to the visual inspection of the operator, who, if he discovers any error in his manipulation of the keys may correct such error by actuation of a part of the mechanism described hereinafter. The five racks 77 at the left-hand portion of the number-wheel carriage are now in register with the gear-wheels of the five accumulator wheels farthest to the right, and in addition the two right-hand short racks of the six racks 326 rigid with the number-wheel carriage and immovable relatively thereto, are in register with the gear-wheels of the two left-hand accumulator wheels, the remaining four relatively stationary racks 326 having passed beyond the accumulator pinions. To print this item 13059, transfer that number to the accumulator, set back all of the number-wheels to 0, and restore the number-wheel carriage to its original right-hand position, it is merely necessary for the operator to depress the handle 244 in opposition to the action of the pair of springs 245 and then let the handle rise again to its ordinary position. This movement of the handle brings about the following operation of the parts: During the first part of the downward swinging of of handle 244 the finger or arm 322 fixedly secured to the main shaft 243 engages the top of pin 317, occasioning the descent of rod 305 against the action of spring 314, and this movement of the rod brings about a downward turning of the entire frame carrying the platen 290, the ribbon, ribbon spools, etc., the shaft 283 rocking on its removable screw journals 282. During this descent of the platen and paper the ribbon and paper are brought into contact with the type-numerals on the tops of those number-wheels only which have been brought into the path of travel of the ribbon and paper by the step by step movement of the carriage. In this way the amount set up on the type-numerals is printed on the paper, and as soon as such printing has occurred the finger 322 passes beyond the pin or catch 317, thereby releasing the printing mechanism and permitting the same to swing upwardly to original position, due to the expansive action of spring 314. This entire printing operation is accomplished while the handle 244 is being swung downwardly through less than one-half of its downward travel. The feeding of the paper ready for the printing of the next item is brought about during the upward swinging of the printing mechanism. During the descent of ratchet-wheel 301 the spring-actuated pawl 302 rides idly over one or more of its teeth, and then during the rise of such ratchet the pawl, by coöperation with one of its teeth, holds the ratchet and brings about a slight rotation of shaft 287 and the platen. This, of course, brings about a feeding of the paper, and, owing to the intermeshing gears 294 and 295, causes a shifting of the ribbon.

As soon as the downward swinging of handle 244 commences, shaft 150 begins to turn in a cross-wise direction as the machine is viewed from the back, and the arcuate member 257 immediately comes in contact with the roller 258 and swings the bell-crank lever 259 in a counter-clockwise direction, its arm 261 striking the projecting finger 232, thereby causing the rocking of shaft 186 in its bearings and the downward swinging of the accumulator mechanism which brings about the meshing of all of the accumulator wheel pinions with the racks, either fixed or slidable, of the number-wheel carriage. It is obvious, therefore, that so long as these racks remain stationary the accumulator wheel pinions can not turn. Practically as soon as the downward turning of the handle begins the two notched arms 268 commence their forward turning and compel the forward shifting of the pawl-resetting bar 210, which is released from the locking action of the two catches 241 as soon as the angular shaft 186 begins to turn, its rear edge, by engagement with the under surfaces of the catches, elevating the same sufficiently to free the bar 210. The notched arms 203 carry the bar 210 forwardly sufficiently to slightly compress the two springs 213, and as soon as this is accomplished the rear walls of the notches 271 pass beneath the end portions of the bar 210, freeing the latter so that it may move bodily slightly rearwardly, due to the action of the two springs 213. This sidewise bodily forward travel of the bar 210 restores to advanced normal position all the pawls 207 previously retracted as explained hereinafter in the carrying operations from one accumulator wheel to the next. As soon as all of these pawls or dogs have been brought to their forward positions, the rack-restoring bar 277 advances, due to the arrival of the pins 273 at the front

ends of the slots 274 of links 275, it being readily understood that the further travel of the arms 263 causes the advance of the bar 277 whose upstanding flange 279 engages the lower heads or enlargements 79 of all of the racks which have previously traveled rearwardly, such flange engaging the part 79 in the various positions of its travel, depending upon the previous amount of movement of the various racks. The teeth of these racks meshing with the pinions of both the number-wheels and the accumulator-wheels, it should be apparent that the restoration of these racks to their normal front position restores all of the number-wheels on the carriage to 0 and advances the wheels of the accumulator varying amounts depending upon the extend of movement of the different racks, which has been previously determined by the actuation of the various number keys and stop-pins, so that we have the number which had been set up on the number-wheels positively transferred to the accumulator wheels, the pawls during such movement of the latter riding idly over the teeth of the gears 200. As soon as this transfer to the accumulator has been brought about, the arcuate member 257 passes sufficiently to the right, as the machine is viewed from the back, so that the roller 258 is free from the same, permitting the rotation of the bell-crank 259, 261 under the action of spring 262 away from the arm or finger 232. As soon as this occurs, the accumulator jumps up to its normal raised position, owing to the contraction of the two springs 238. This rise of the accumulator takes place just about the same time that the operating handle reaches its downward limit of travel. During the downward swinging of the operating handle 244 the pin carrying arm 248 has swung in a counter-clockwise direction as the machine is viewed from the front, its spring catch readily passing by the pivoted dog 251, and during the automatic return of the handle 244 to its customary elevated position the spring-pressed catch 249 engages the end 256 of the dog or block 251, causing the toothed sector 149 to return to ordinary position, such sector bringing about the sliding of the number-wheel carriage to its position farthermost to the right as the machine is viewed from the front. The engagement of the two parts 249 and 256 is maintained so long as the roller 253 travels on the face of the plate 254, and when the roller 253 comes opposite the recess 255 of plate 254 the block 251 swings on its pivot, owing to the pressure of the arm 248, permitting the arm and its catch 249 to pass by the block 251. In this way the number-wheel carriage is slid to the right and restored to its initial position, being retained therein by the escapement hereinabove described. It will, of course, be understood, that while this carriage is moving during this restoration to initial position the escapement ratchet 161 is turning freely beneath pawl or catch 164, the companion pawl 163 being out of engagement with the teeth of the ratchet. When the carriage reaches the limit of its travel to the right the slide 125 strikes the abutment 127 and rocks all of the members 117 to the left, thereby freeing all of the elevated rack-stopping pins and permitting their dropping to inactive position under the influence of their individual coil springs.

After the completion of the various operations heretofore described, the operator then sets up on the number wheels in the manner just described, the number 246,873. In this instance, of course, there will be six number wheels employed instead of five, as in the previous example. These six number wheels, after being operated by the release of the rack bars, will occupy spaces parallel with six of the accumulator wheels just described, the accumulator wheels at this time showing the number 13,059, previously transferred thereto. On the operation of the lever 244, the accumulator pinions will be brought into mesh with the racks and the number 246,873 transferred to said accumulator wheels the series of operations being the same as that heretofore described. The accumulator wheels, after the return of the handle 244 to position, will show the proper total 259,932. Other numbers may be added to this series of numbers by continuing the described operations, the operator having at all times before him the number just set up, and the total of all the numbers. This total of all the numbers may at any time be transferred back to the number wheels and printed on the paper by the operation of the key 350 in the manner heretofore described, after which operation both the number wheels and the accumulator wheels are cleared and set at 0.

Of course, during the transferring of sets of numbers from the number wheels to the accumulators, it will often occur that a number must be carried to a column of higher order, and this carrying operation will now be described.

The carrying on the accumulator is accomplished in the following manner: When any one of the number-wheels 198 of the accumulator is moved sufficiently so that carrying is necessary from such wheel to the next one, the pin 220 of the former wheel will have engaged the foot 221 of lever 222 and swung the latter on its fulcrum in opposition to the action of its leaf-spring 228, thereby removing the projection 226 from the cavity or recess 204 of the slide 203 of the next accumulator member of higher value, and as soon as such release occurs, owing to the action of the spring 218, the re-

leased slide 208 and the catch 207 which it carries move rearwardly, striking against the bar 210. This movement is slight and does not of itself bring about the carrying operation but shifts the slide 203 sufficiently so that the projection 226 can not again enter it. The actual carrying is brought about during the last portion of the upward swinging of the operating handle, at which time the arms 268 in their rearward turning engage the bar 210, carrying it with them. This movement of the bar 210 puts a greater tension upon the springs 218, and all of those catches which have been released for carrying travel back due to the contraction of their individual springs. Such movement of the selected carrying pawls 207 advances all of the accumulator wheels one unit, the pawls 207 being prevented from riding idly over the teeth of the gear wheels 200 by the presence of rod 239 above them, such bar holding them down in proper operative relation with the pinions. The bar 210 is carried rearwardly to its limit of travel and is again caught beneath the two hooks 241. The pawls which have accomplished the carrying operations are not lined up again with the other pawls until the beginning of the next downward movement of the handle 244.

In case an error is made in setting up the numerals on the number-wheels of the sliding carriage, this mistake may be remedied or rectified by clearing the number-wheels; that is, setting them all back to 0 without adding the incorrect number on the accumulator and without printing, and to effect this result I provide the mechanism with an error key 327 (Figs. 2—4—6—7—9) on the forward end of a bent arm 328 (Fig. 11) having a hub 329 through which the rod 59 passes, such hub being fixed to the rod to oscillate therewith by means of a screw 330. The arm 328 extends to the back of the machine and has an off-set portion 331 (Figs. 3 and 11) directly beneath one portion of a lever 332 fulcrumed at 333 and having at its other end a lug or finger 334 directly above the substantially-horizontal arm 261 of a bell-crank fulcrumed at 260. Shaft 59 has fixed to its other end a hub 376 having an arm or finger 377 adapted to co-act with a lever 378 fulcrumed on the post 54 at 379, such lever being in coöperative relation with an offset portion of rod or pin 320, as shown in Fig. 10.

To operate the machine to clear the number-wheels for the elimination of a number set up with an error therein, the operator merely depresses the key 327 which rocks the shaft or rod 59 and elevates the rear end 331, bringing about a descent of the arm 261 of the bell-crank and a swinging of the roller 258 to the left as the machine is viewed from the back (Fig. 3), so that when the operator by his other hand actuates the operating lever 244 the arcuate member 257 will not contact with the roller 258, and consequently there will be no descent to the accumulator, with the result that when the number-wheels are returned to 0 by the forward shifting of their racks there will be no movement of the accumulator wheels. In this way an error in the setting up is readily eliminated, the presence of the error being brought to the operator's attention by the displaying of the set-up number through the window of the casing before the operating handle is actuated. It is to be understood that the manipulation of handle 244 restores the number-wheel carriage to original position. Furthermore, the rocking of shaft or rod 59 causes the retraction of catch 317 out of the path of travel of arm 322, by the movement of lever 378. Consequently, no printing of the incorrect number occurs, as well as no accumulation thereof, and in addition there is no shifting of the paper or feeding of the inked ribbon.

To multiply on this machine or to add to the accumulator the number set up on the number-wheels a definite number of times, it is merely necessary to operate the machine in the manner hereinafter indicated. To accomplish this result I have provided the machine with the following parts: On a suitable support 335 (Figs. 7 and 14) I fulcrum at 336 an arched arm 337 normally pulled outwardly by a coil contractile spring 338 connected to the lever or arm at 339 and to the frame of the machine at 340. The arched portion of this arm when in normal raised position is just slightly out of the path of travel of the lateral arm or finger 250 of the spring-pressed dog 249 housed in a recess of the arm 248. When this curved arm 337, however, is pulled slightly downwardly it acts to maintain the catch 249 out of coöperative relation with the pivoted block 251 of the toothed sector so that the operating handle 244 may be depressed and raised a succession of times without retracting the number-wheel carriage to its initial right-hand position on the machine. In other words, the connection between this handle and the carriage can be maintained inoperative by a slight depression or rocking of the arm 237 on its pivot 236. To bring about this manipulation of the parts I pivot on the frame of the machine at 341 (Fig. 10) a bell-crank lever having an upstanding arm 342 and a substantially-horizontally-disposed arm 343, the latter lying directly above the free end of arm 337. The top end of the arm 342 of the bell-crank lever carries a comparatively long bent holding bar or plate 344 which when swung rearwardly is adapted to overlie the foot portions 105 of the depressed catch pins 101 and to underlie the corresponding foot por-

tions of the pins which have not been depressed, these remarks applying when the carriage has been shifted into register with the accumulator mechanism. Loosely fulcrumed on the rod 59 (Fig. 10) I provide a bent lever 345 carrying at its upper end a key 346 marked "X," the lower end of the lever having a laterally-extended pin 347 disposed just in front of the leg 342 of the bell-crank lever fulcrumed at 341. Assuming that the desired number has been set up on the number-wheels of the sliding carriage and that the latter has shifted as explained above into register with the accumulating mechanism; in order to multiply this number or to add its value a given number of times on the accumulator, the operator depresses the key 346 and maintains the same depressed during a number of actuations of the operating handle 244 one less in number than the multiplier or the number of times it is desired to add the number on the number-wheels to the accumulator, the final actuation of the operating handle taking place after the key 246 has been released. It should be apparent from an understanding of the mechanism that when the key 346 is pressed down it rocks the lever 342, 343 on its fulcruom 341, which brings the bar 344 above the forward projecting parts 105 of the pins 101 which have been actuated, the bar being below the corresponding portions of the unactuated pins. This rocking of the lever on the fulcrum 341 also turns the arched arm 337 on its pivot 336 so that as long as the key 346 is maintained pressed down the manipulation of the operating handle will have no effect on the position of the number-wheel carriage and will not restore it to its original right-hand position because the arched part of the bar 337 keeps the catch 249 out of contact and out of operative relation with the dog 251. With the key 346 depressed, further actuation of the operating handle rocks the accumulating mechanism down into mesh with the racks and all of the racks are restored by the bar 277 to their original forward position. Owing, however, to the fact that the bar 344 prevents all of the operated catch-pins 101 from rising under the influence of their springs, none of such racks are retained in such forward position as is customary in the ordinary operation of the machine, that is, when it is not multiplying. Consequently all of such racks follow the bar 277 back under the action of the springs and the number-wheels and automatically again set up on said number-wheels the number previously set up thereon by the number keys. Consequently, every time the operating handle is actuated this number is added to the accumulator, the number-wheels are all set back to 0, and are immediately and automatically set up again with the same number which they previously had. This operation is repeated as long as the key 346 is kept depressed. It will be understood, of course, that during the repetition of these operations, the spring-pressed stop corresponding to the value set up on the number wheel is held in elevated position by the bar 117 and is not permitted to return until the carriage returns, when the release bar 125, carried by the carriage, will displace the catch 117, permitting the stop to return to unexposed position. When the final addition of the number is made it is of course desired to return the carriage to its original position, and consequently just prior to the final actuation of the operating handle the operator releases key 346, and due to the contraction of spring 338 bar 344 is removed from the pins and the arch bar 337 is moved out of the path of travel of the lateral arm 250 of catch 249, so that when this final movement of the handle occurs the number-wheels are all set back to 0 and the carriage slides back to its ordinary position. If, therefore, it is desired to multiply the number set up on the number-wheel by 7, which is the same as adding this number seven times on the accumulator, the operator depresses the key 346 and holds it depressed during six actuations of the operating handle, the key being released just prior to the seventh operation of the handle.

It is of course at times necessary and desirable to print the total on the accumulator on the strip of paper, and accordingly this embodiment of my invention is equipped with parts for accomplishing such result and for setting back all of the number-wheels and accumulator wheels to 0. In other words, the total is printed and the entire machine cleared.

To shaft 60 I fasten, by means of a set-screw 347 (Fig. 2), the hub 348 of an arm or bar 349 carrying at its front end an upstanding knob 350 and extending rearwardly of the machine directly beneath an end of lever 332. Such rear end of the bar is connected by a wire link 351 (Fig. 13) with one end of a lever 352 fulcrumed on a bracket 353 at 354, such lever being normally pulled downwardly by a spring 355 and having at one end a pin 356 adapted when such end is raised to release the ratchet dog 164 and permit the escapement ratchet 161 and its shaft to turn, thereby also permitting the unrestricted travel of the number-wheel carriage to the left to the limit of its movement. Shaft 60 also has fixed to one end thereof a notched sector 357 (Fig. 6) coöperating with the teeth 358 of which is a spring-pressed dog 359, one end of which is adapted to co-act with a shoulder 360 of a collar 361 on the main power shaft 243.

By reference now to the number-wheel carriage it will be noted that an inverted U-

shaped clearing-bar 362 (Figs. 2—9—15—17—18) is mounted so as to be capable of rocking in a pair of bearings 363 on the carriage, the bar being rocked rearwardly by a coil spring 364 secured thereto and to the carriage at 365, the rearward turning of the bar being limited by a shoulder 366 (Fig. 9) of one of its legs engaging the top surface of the carriage. This clearing bar is adapted to co-act with the plurality of protruding pins 367 with which each of the accumulator wheels 198 is supplied with one. When one of these pins 367 strikes the bar 362 the display numeral 0 of such accumulator wheel will be opposite the accumulator display opening or window of the casing of the machine, as shown in Fig. 1.

As the machine is viewed from the top or front, the left-hand portion of shaft 60 has fixed thereto the hub 368 (Fig. 7) of an arm having a rearwardly-extended portion 369 and a forward portion 370 bent laterally with respect to the main body of the arm. This rear part 369 co-acts with an adjustable screw 371 (Fig. 3) threaded through the end of an arm 372 rigidly fastened to the bottom surface of the accumulator rock-shaft 186.

To transfer the total from the accumulator wheels, displayed at the accumulator window in the casing, to the number-wheels, print such total on the strip of paper, and clear all of the numeral wheels both of the number device and of the accumulator, the operator grasps the handle 350 and raises the same a small amount, which releases the escapement, owing to the upward travel of pin 356 and the coöperation of the latter with one of the dogs of the escapement. The spring drum 156 immediately pulls the carriage to the left to its full limit of travel, which is determined by a collar 373 on the shaft 60 at one side of the hub 368 and against which the end of the carriage is adapted to strike. This positions such carriage with all of its racks in register with the pinions of the accumulator wheels, and with the bar 370 above all of the foot pieces or forward extensions 105 of the catch-pins 101. The operator now depresses the handle 350, which causes a slight rocking of the shaft 60 and an upward movement of the arm 369, which by contact and coöperation with the arm 372 rocks the accumulator mechanism downwardly so that the accumulator pinions are all in mesh with the movable racks, and under such circumstances the bar 210 is maintained in its rearward position by the rock arms 268 which have not yet traveled. The rocking of shaft 60 also causes a descent of the release member 370 which pulls down all of the catch-pins 101, thereby releasing all of the racks. Shaft 60 is automatically held in this position so as to hold the accumulator in co-active relation with the racks and the catch-pins retracted by means of the catch 359 engaging one of the teeth 358. As soon as the racks are released by the withdrawal of the pins 101, which does not take place however until the accumulator has been rocked down, the springs 74 of the number-wheels rotate all of such wheels and push the racks back varying amounts depending upon the amount previously set up on the accumulator, the wheels of the latter turning in a counter-clockwise direction as the machine is viewed from the left-hand end until all of the pins or projections 367 strike the top of the rock bar 362, and under such circumstances all of the accumulator wheels will stand at 0 and the total which was previously thereon will have been transferred by the movement of the racks to the number-wheels 70. The operating handle 244 is now pressed down, the printing of the total from the number-wheels is effected on the paper strip in the usual manner, then the shoulder 361 releases the catch 359, the accumulator thus freed swings upwardly automatically away from the racks, and then the rack-restoring bar 277 moves forwardly carrying with it all the racks to their forward position, such movement of the racks turning all of the number-wheels 70 around to 0, there being no turning of the accumulator wheels because their pinions are out of mesh with the rack, such accumulator wheels having previously all been turned to 0. The racks are automatically locked in this retracted position, the bar 370 having released all of the catch-pins 101 as soon as the sector 357 was freed by the catch 359, spring 355 operating through the various parts of the connecting mechanism to lift the bar 370, as will be readily understood. During the upward travel of the operating handle 344 the carriage is restored to its right-hand position in the usual manner.

I wish to direct attention to the fact that this machine is composed of a number of readily detachable or removable units; for example, the printing platen, ribbon, ribbon feeding device, etc., can be removed from the machine as a unit by merely taking out the pair of screw journals 282, so that if at any time repairs or changes are necessary this part of the mechanism can be readily taken away from the rest and a new or repaired one easily substituted. By unhooking the top ends of the springs 238 from the arms or fingers 236, 237, and taking out the end screws 189, 190 of the accumulator rock-shaft 186, the entire accumulator mechanism can be removed with facility and despatch. It will also be apparent that the key-levers 130 and keys 133 being all mounted on posts 129 on a single removable curved plate 128, this part of the machine also constitutes an independent and detachable u..it. The sliding number-wheel car-

riage and the numerous parts mounted thereon also constitute an additional removable unit which can be taken out without material interference with any other part of the mechanism. This is true also of the escapement mechanism and associated parts, all of which are mounted and supported on a base-plate 153 readily detachable from the frame of the machine. The mechanism, therefore, constitutes at least five distinct and separate units, namely, key-board, number-carriage, accumulator, escapement and return mechanism, and the platen and ribbon mechanism.

In a device of this style and character it is desirable to provide some means to compel a complete actuation or manipulation of the operating-handle, and I have accordingly equipped this device with parts to effect this result. By reference to Fig. 11 it will be apparent that the main operating-shaft 243 has fixed thereto a sector 373, and the frame of the machine has pivoted thereon a pawl 374 spring-actuated by a spring 375. As the handle 244 is depressed the pawl strikes the teeth of the sector 373 and prevents a return of the handle to raised position until the entire segment 373 has passed by the tooth or pawl, such complete passage of the sector permitting the pawl to be inclined in the opposite direction and permitting the operating handle to be raised automatically to initial position.

I wish to have it understood that this invention is not limited and restricted to the precise and exact features of construction herein described and set forth, because the details of the mechanism may be varied within wide limits without departure from the substance of the invention and without the sacrifice of any substantial benefits and advantages.

I claim:

1. In a computing machine, the combination of a movable carriage, a plurality of number-wheels on said carriage, means to turn said wheels, a series of stop-pins for each number-wheel adapted to arrest the turning of the wheel at different points corresponding to different values or numbers, a set of value-keys adapted to coöperate with the groups of stop-pins of the various number-wheels in succession, and means upon actuation of a stop-pin of any number-wheel by operation of one of said value-keys to advance the carriage and bring the stop-pins of the next number-wheel into operative relation with said value-keys, substantially as described.

2. In a computing machine, the combination of a movable carriage, a plurality of revoluble number-wheels on said carriage, a pinion rotatable with each of said number-wheels, a sliding rack in mesh with the teeth of each of said number-wheel pinions, means to turn said number-wheels, a series of rack-arresting members for each rack adapted to stop the latter and its number-wheel at different points corresponding to different numbers or values, a set of value-keys adapted to coöperate with the groups of rack-arresting members of the various racks in succession, and means upon actuation of a rack-arresting member of any number-wheel by operation of one of said value-keys to advance the carriage and bring the rack-arresting members of the next number-wheel and rack into operative relation with said value-keys, substantially as described.

3. In a computing machine, the combination of a movable carriage, a plurality of number-wheels on said carriage, spring means to turn said number-wheels, a pinion rotatable with each number-wheel, a sliding rack in mesh with the teeth of each of said number-wheel pinions, a series of rack-arresting members for each of said racks and number-wheels adapted to arrest the movement of the rack and corresponding number-wheel at different points corresponding to different numbers or values, a set of value-keys adapted to coöperate with the groups of rack-arresting members of the various racks and number-wheels in succession, a catch for each of said racks adapted to hold its number-wheel in 0 position, means to release the catch of a rack after its rack-arresting member has been projected into arresting position, and means upon actuation of a rack-arresting member of any number-wheel and rack by operation of one of said value-keys to advance the carriage and bring the rack-arresting members of the next rack and number-wheel into operative relation with said value-keys, substantially as described.

4. In a computing machine, the combination of a movable carriage, a plurality of revoluble number-wheels on said carriage spring means to turn said number-wheels, a pinion revoluble with each of said number-wheels, a sliding rack in mesh with each of said pinions, a series of stop-pins for each of said racks adapted to arrest the turning of the number-wheel at different points corresponding to different numbers or values, a set of value-keys adapted to coöperate with the groups of stop-pins of the various number-wheels in succession, means acting to automatically maintain the actuated stop-pins in rack-arresting position, and means upon actuation of a stop-pin of any number-wheel by the operation of one of said value-keys to advance the carriage and bring the stop-pins of the next wheel and rack into operative relation with said value-keys, substantially as described.

5. In a computing machine, the combination, of a movable carriage, a plurality of revoluble number wheels on said carriage,

spring means to turn said number wheels, a pinion revoluble with each of said number wheels, a sliding rack in mesh with each of said pinions, a catch for each of said racks adapted to hold its number wheel in 0 position, a series of stop-pins adapted to arrest the turning of the number wheels at different points corresponding to different numbers, keys adapted to coöperate with said stop-pins, means adapted to automatically maintain the said stop-pins in rack arresting position, and means upon actuation of a stop-pin of any number wheel by the operation of one of said keys, to advance the carriage and bring the stop-pins of the next wheel and rack into operative relation with said keys, substantially as described.

6. In a computing machine, the combination of a frame, horizontal supports on said frame, a carriage mounted for reciprocation on said supports, an escapement mechanism operatively connected to said carriage, a frame forming part of said carriage and provided with slots, racks mounted for reciprocation in said slots, number wheels in engagement with said racks, said number wheels having spring means to cause their independent rotation, an accumulator mechanism mounted on the frame of the machine and adapted for oscillation, means for setting up values on said number wheels, and means for oscillating said accumulator mechanism into engagement with said racks, whereby values set up on said number wheels are transferred to said accumulator mechanism, substantially as described.

7. In a computing machine, the combination of a carriage arranged for step-by-step movement, a plurality of number wheels arranged on said carriage, spring means to turn said wheels, a pinion revoluble with each of said number-wheels, a sliding rack in mesh with each of said number-wheel pinions, a plurality of rack-arresting means coöperating with each of said racks and adapted to stop the movement thereof and of the corresponding number-wheel at different points corresponding to different values or numbers, a set of value-keys adapted to actuate said rack-arresting means, catches to hold said racks and number-wheels in initial position, means to release said catches, a plurality of accumulator-wheels, a pinion for each of said accumulator-wheels, means to shift said accumulator-pinions into mesh with the actuated racks, means to restore said racks and number-wheels to initial position, the values set up on said number-wheels being transmitted to the accumulator through the racks and pinions during such restoration, substantially as described.

8. In a computing machine, the combination of a carriage having a step-by-step motion, a plurality of revoluble number wheels mounted on said carriage, a shiftable element positively connected to each of said number-wheels, a series of stops for each of said elements and number-wheels adapted to arrest their movement at different points corresponding to different numbers or values, a set of value-keys adapted to cooperate with the groups of said stops, means to turn said number-wheels and shift said elements, an accumulator mechanism adapted to be actuated by said elements, and means to restore said elements and number-wheels to initial 0 position, substantially as described.

9. In a computing machine, the combination of an accumulator mechanism, a movable carriage, number-wheels on said carriage, means to turn said number-wheels to set up values thereon, means to move said carriage to bring the number-wheels on which the amount has been set up into register with the accumulator mechanism, means to transfer the amount on said number-wheels to the accumulator mechanism, and means on said carriage adapted to prevent operation of that portion of the accumulator mechanism out of register with the actuated number-wheels, substantially as described.

10. In a computing machine, the combination of a plurality of revoluble number-wheels, a pinion rotatable with each of said number-wheels, a movable rack in mesh with each of said number-wheel pinions, a plurality of stops to arrest the movement of said racks and pinions at different points corresponding to different values, means to turn said number-wheels and move said racks, catches to hold said number-wheels and racks in initial position, value-keys adapted to set up amounts on said number-wheels by operating the proper stops and releasing the corresponding catches, an accumulator mechanism adapted to mesh with said racks, means to restore said racks and number-wheels to initial position and add to the accumulator mechanism the amount set up on the number-wheels, and means to render said catches temporarily inoperative whereby multiplication may be effected by a succession of actuations of the rack-restoring means, substantially as described.

11. In a computing machine, the combination of a movable carriage, a plurality of revoluble number-wheels on said carriage, a pinion rotatable with each of said number-wheels, a movable rack in mesh with each of said number-wheel pinions, a plurality of stops to arrest the movement of said racks and pinions at different points corresponding to different values, means to automatically hold the actuated stops in operative position, means to turn said number-wheels and move said racks, catches to hold said number-wheels and racks in initial position, value-keys adapted to set up amounts on

said number-wheels by operating the proper stops and releasing the corresponding catches, an accumulator mechanism adapted to mesh with said racks, means to advance said carriage step by step as the individual numbers are set up on the number-wheels, whereby to shift the racks of said wheels into register with the accumulator mechanism, means to restore said racks and number-wheels to initial position and transfer to the accumulator mechanism the amount set up on the number-wheels, means to restore said carriage to original position, and means to render said catches and said carriage-restoring means temporarily inoperative, whereby multiplication may be effected by a succession of actuations of the rack-restoring means, substantially as described.

12. In a computing machine, the combination of a slidable carriage, a plurality of number-wheels mounted on said carriage, means to set up amounts thereon, an accumulator mechanism, positive connections between said number-wheels and accumulator mechanism, means to restore said number-wheels to 0 position and transfer the amount set up thereon to the accumulator mechanism through said positive connection, means to hold said number-wheels in initial 0 position, and means to render said latter means temporarily inoperative, whereby multiplication or successive additions may be secured, substantially as described.

13. In a computing machine, the combination of a reciprocatory carriage, a plurality of number wheels mounted on said carriage, each number wheel being provided with means for independent rotation under self-contained energy, rotation-controlling racks also mounted on said carriage and in mesh with said wheels, an accumulator mechanism normally out of engagement with said racks but adapted to be engaged thereby, means for shifting said carriage whereby to bring said racks first into register and then into engagement with said accumulator mechanism, then releasing the energy stored in said number wheels and causing a movement of the racks and accumulator mechanism whereby amounts set up on said accumulator mechanism are transferred to said number wheels, substantially as described.

14. In a computing machine, the combination of a reciprocatory carriage, a plurality of number wheels mounted on said carriage, means to actuate said number wheels to set up values thereon, said means including racks, an accumulator mechanism normally out of engagement and register with said racks, means for moving said carriage to bring all the accumulator wheels and said racks into register, means for bringing said mechanism and racks into engagement, and means for releasing the said number wheels and sliding said racks whereby the amounts set up on said accumulator mechanism are transferred to said number wheels, substantially as described.

15. In a computing machine, the combination of a reciprocatory carriage, a plurality of number wheels mounted on said carriage, means to set up amounts on said number-wheels including spring means to turn said number-wheels, a plurality of accumulator wheels, connections between said number-wheels and accumulator wheels, means to stop said accumulator wheels at 0 position, stops to hold said connections with the number-wheels in 0 position, means to release said number-wheel stops whereby to transfer the amount on said accumulator wheels to said number-wheels and set back said accumulator wheels to 0 position by the action of said spring means, and means to restore said number-wheels to 0 position, substantially as described.

16. In a computing machine, the combination of a reciprocatory carriage, a plurality of revoluble number-wheels mounted on said carriage, a spring for each of said number-wheels adapted to turn the same, a pinion secured to each of said number-wheels, a rack in mesh with each of said number-wheel pinions, a plurality of accumulator wheels, a pinion secured to each of said accumulator wheels, said accumulator wheel pinions adapted to be thrown into mesh with said rack, catches to hold said racks with said number-wheels at 0 position, means to release said rack catches to transfer the amount on said accumulator wheels to said number-wheels through said racks by the action of the number-wheel springs and to return said accumulator wheels to 0 position, and means to return said number-wheels to 0 position, substantially as described.

17. In a computing machine, the combination of a movable carriage, a plurality of number-wheels on said carriage, means to turn said number-wheels to set up values thereon including spring means to revolve said number-wheels, accumulator wheels, means to move said carriage to bring the number-wheels on which the amount has been set up into register with the accumulator wheels, an escapement to govern such movement of the carriage, connections between said number-wheels and accumulator wheels, means to stop said accumulator wheels at 0 position, stops to hold said connections with the number-wheels at 0 position, means to release said stops to transfer the amount on said accumulator wheels to said number-wheels and return said accumulator wheels to 0 position, restoring means to return said number-wheels to 0 position, means to restore said carriage to original position, means to release said escapement to permit the quick travel of the carriage to the limit of its movement, and a common

handle to actuate both of said releasing means, substantially as described.

18. In a computing machine, the combination of a movable carriage, a plurality of printing number-wheels on said carriage, means to turn said number-wheels to set up values thereon including spring means to revolve said number-wheels, accumulator wheels, a printing platen, means to move said carriage to bring the number-wheels on which the amount has been set up into register with the accumulator wheels and printing platen, an escapement to govern such movement of the carriage, connections between said number-wheels and accumulator wheels, stops to hold said connections with the number-wheels at 0 position, means to stop said accumulator wheels at 0 position, means to release said stops to transfer the amount on the accumulator wheels to the number-wheels and restore said accumulator wheels to 0 position, means to actuate said printing platen, means to return said number-wheels to 0 position, means to restore said carriage to original position, and a common handle to actuate the releasing means for the connection stops and the release for the escapement, substantially as described.

19. In a computing machine, the combination of a plurality of number-wheels, a pinion fastened to each of said number-wheels, a rack in mesh with each of said number-wheel pinions, a plurality of accumulator wheels, a pinion for each of said accumulator wheels, means to shift said accumulator wheel pinions into mesh with said racks, means to turn said accumulator wheels including a pawl for each of said accumulator wheel pinions, a movable member connected to each of said pawls, carrying mechanism including carrying elements cooperating with said accumulator wheels and each acting to normally lock the movable member of the next pawl against movement, a bar, springs connecting said bar and pawls, said springs being adapted to move the unlocked members to effect the carrying operation, and means to move said bar to advance to normal position the pawls which have effected the carrying operations and to tension the springs when moved in the opposite direction to cause the unlocked pawls to turn the accumulator wheels, substantially as described.

20. A computing machine, comprising in combination, a plurality of interfitting cooperating instrumentalities including keys and key levers having a common support, a carriage supporting number wheel mechanism, and accumulator mechanism, said accumulator mechanism, said carriage and number wheel mechanism and said key, key-lever and support mechanism, all being formed as separate, readily removable units, substantially as described.

CHARLES R. MORSE.

Witnesses:
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