March 29, 1927. 1,622,916

O. MALCHER

COMPUTER

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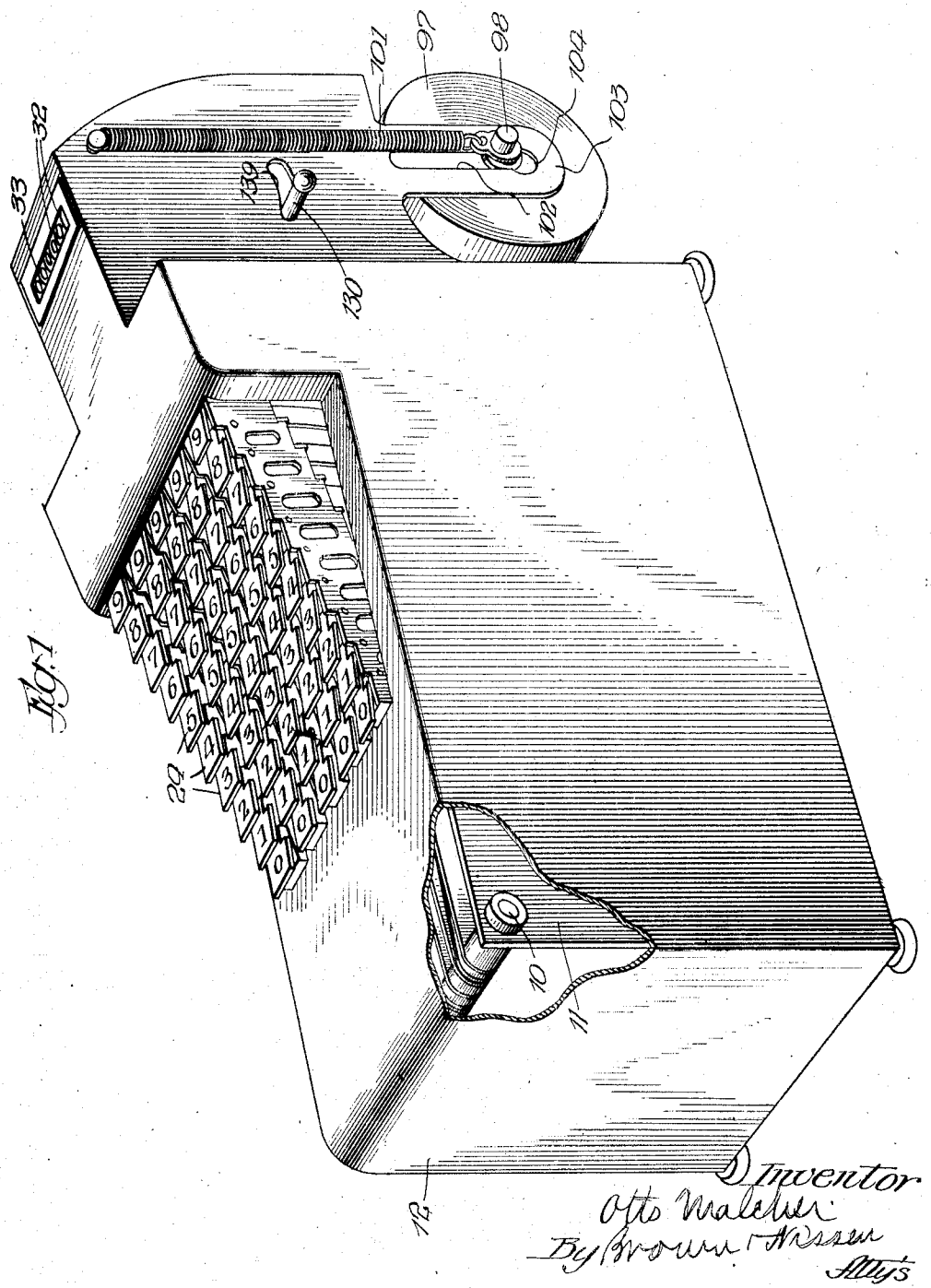


Fig. 1

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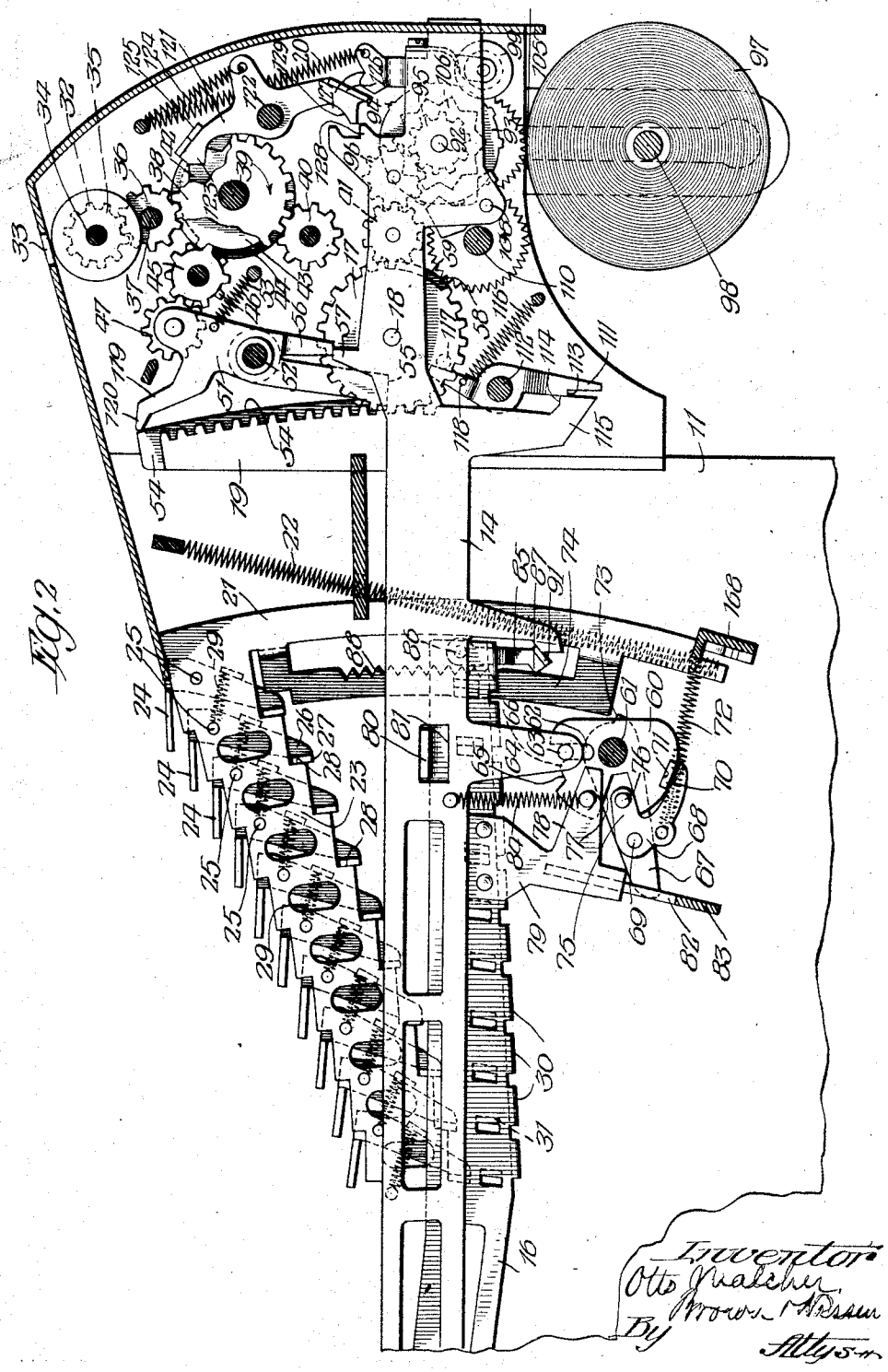


Fig. 2

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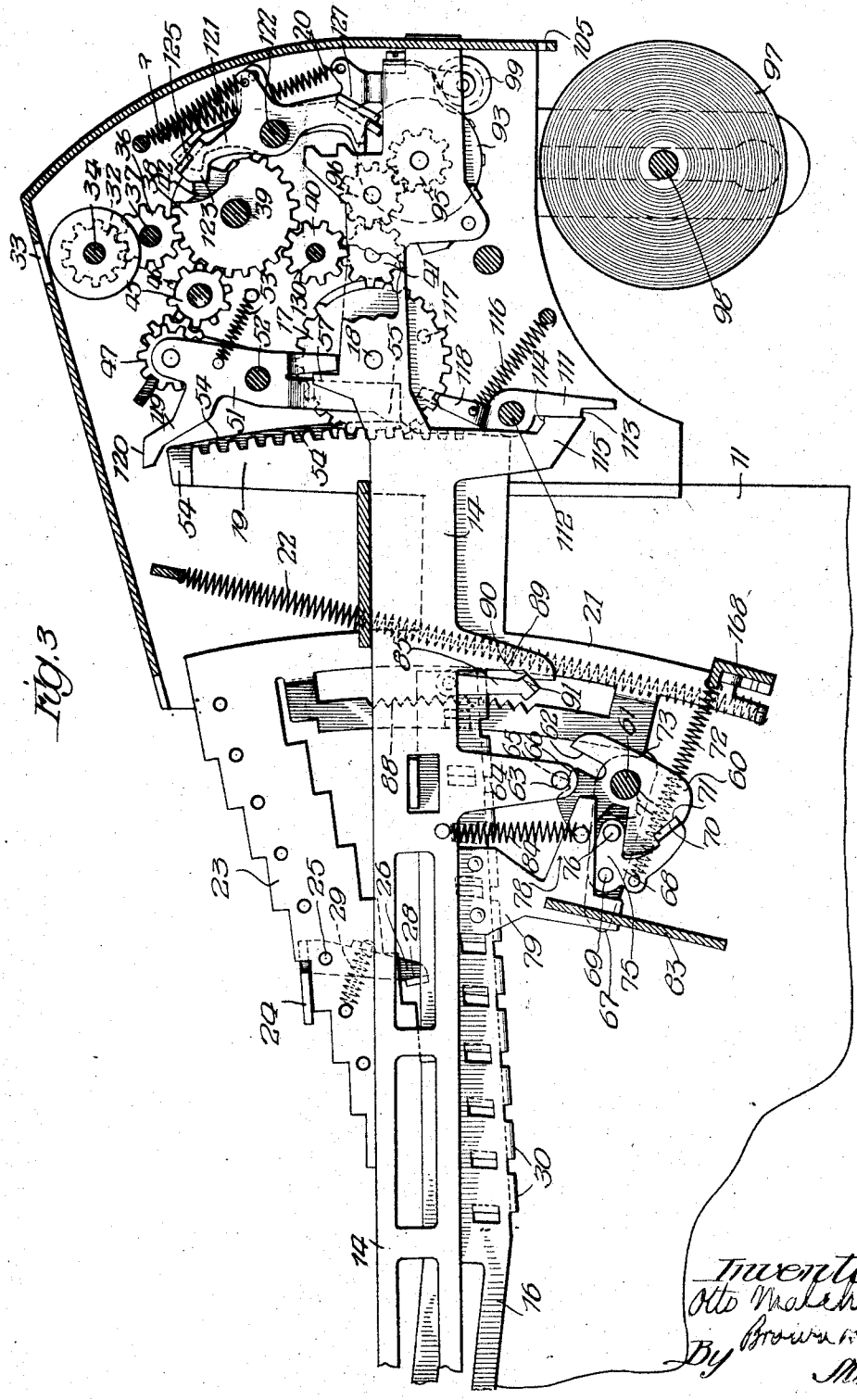


Fig. 3

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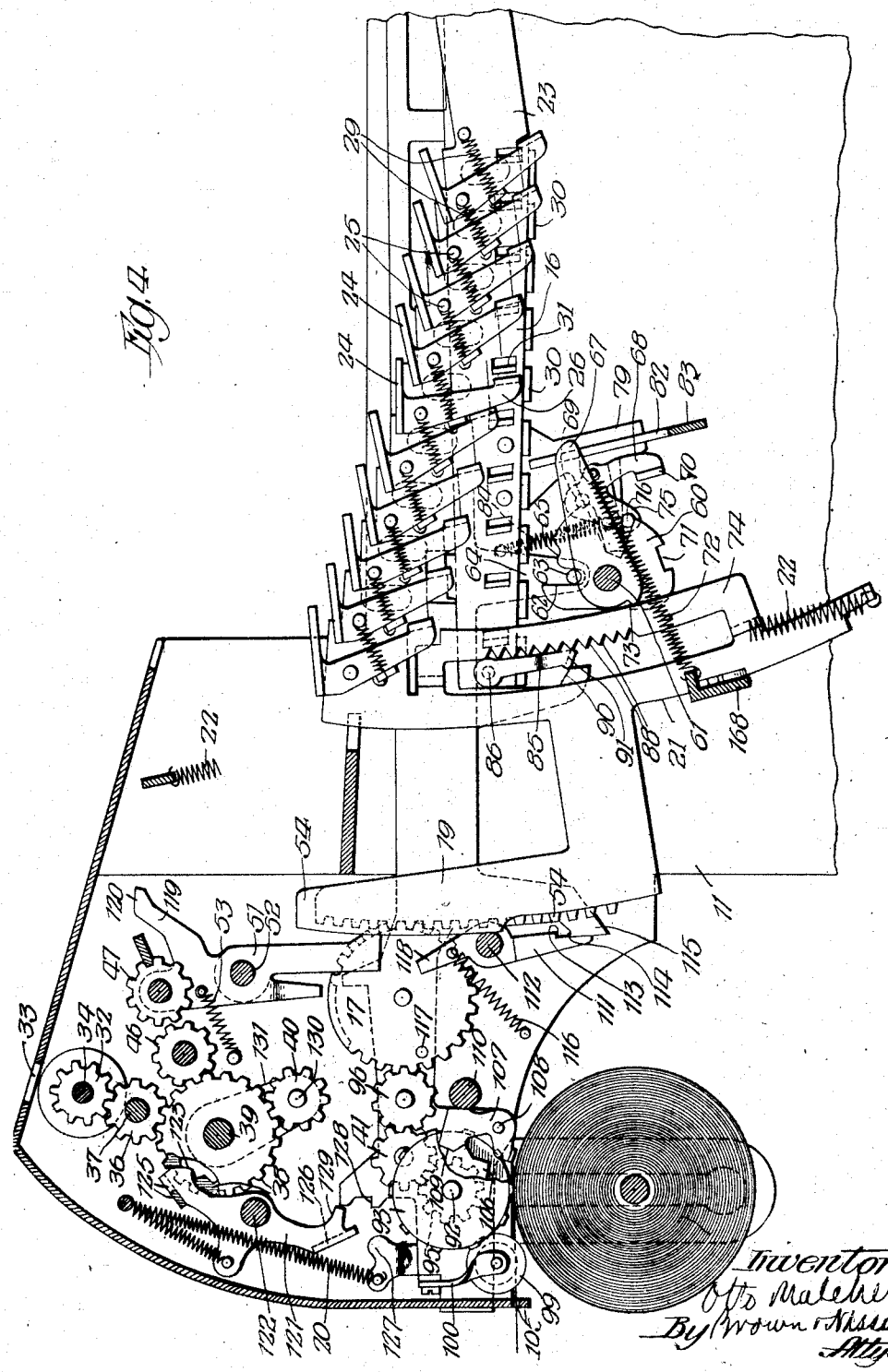
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Fig. 4.



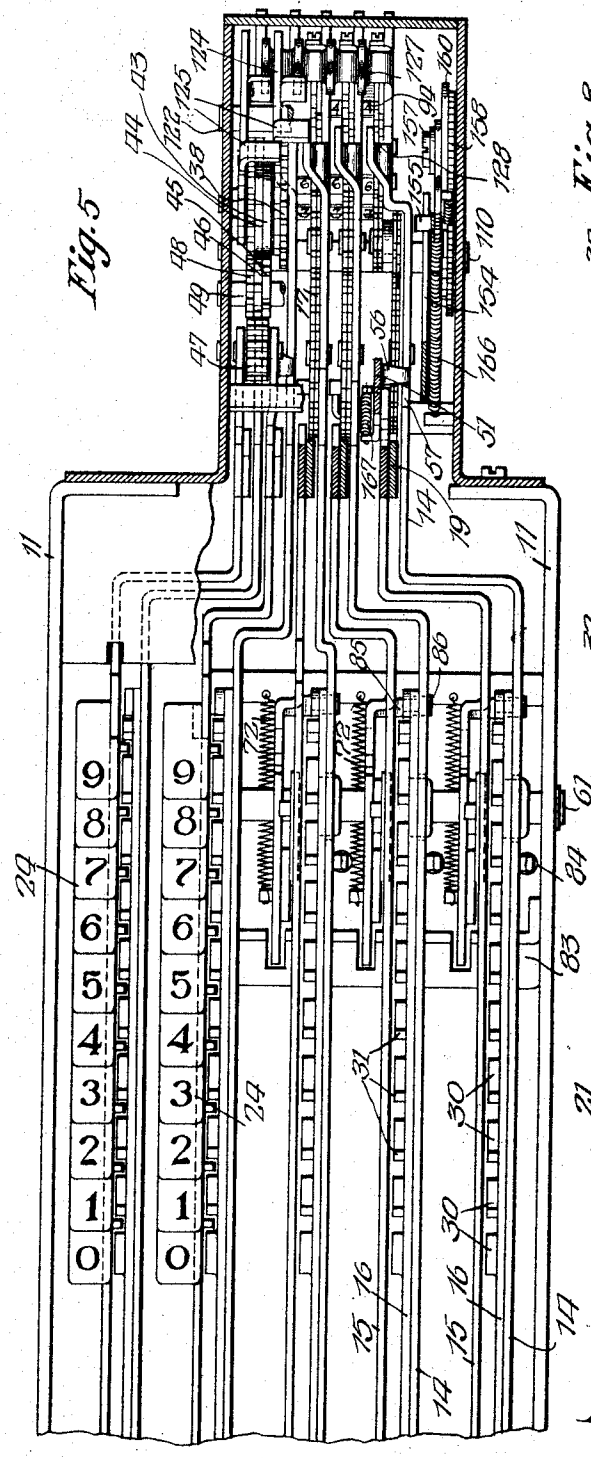
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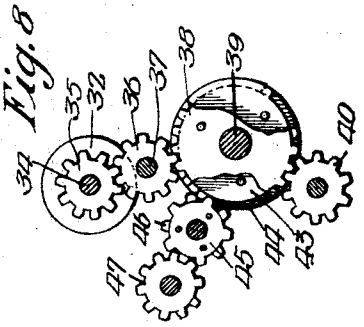
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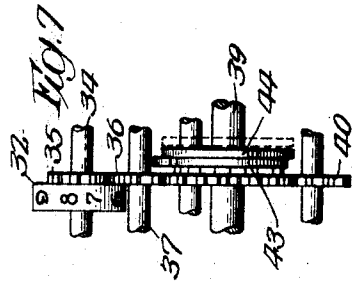
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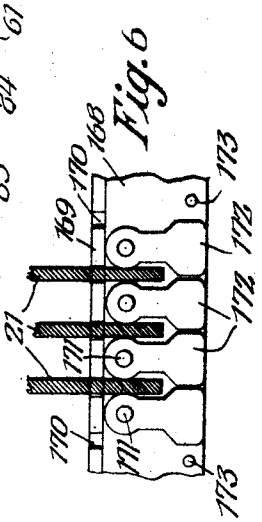
COMPUTER

Filed Jan. 20, 1919 6 Sheets-Sheet 5









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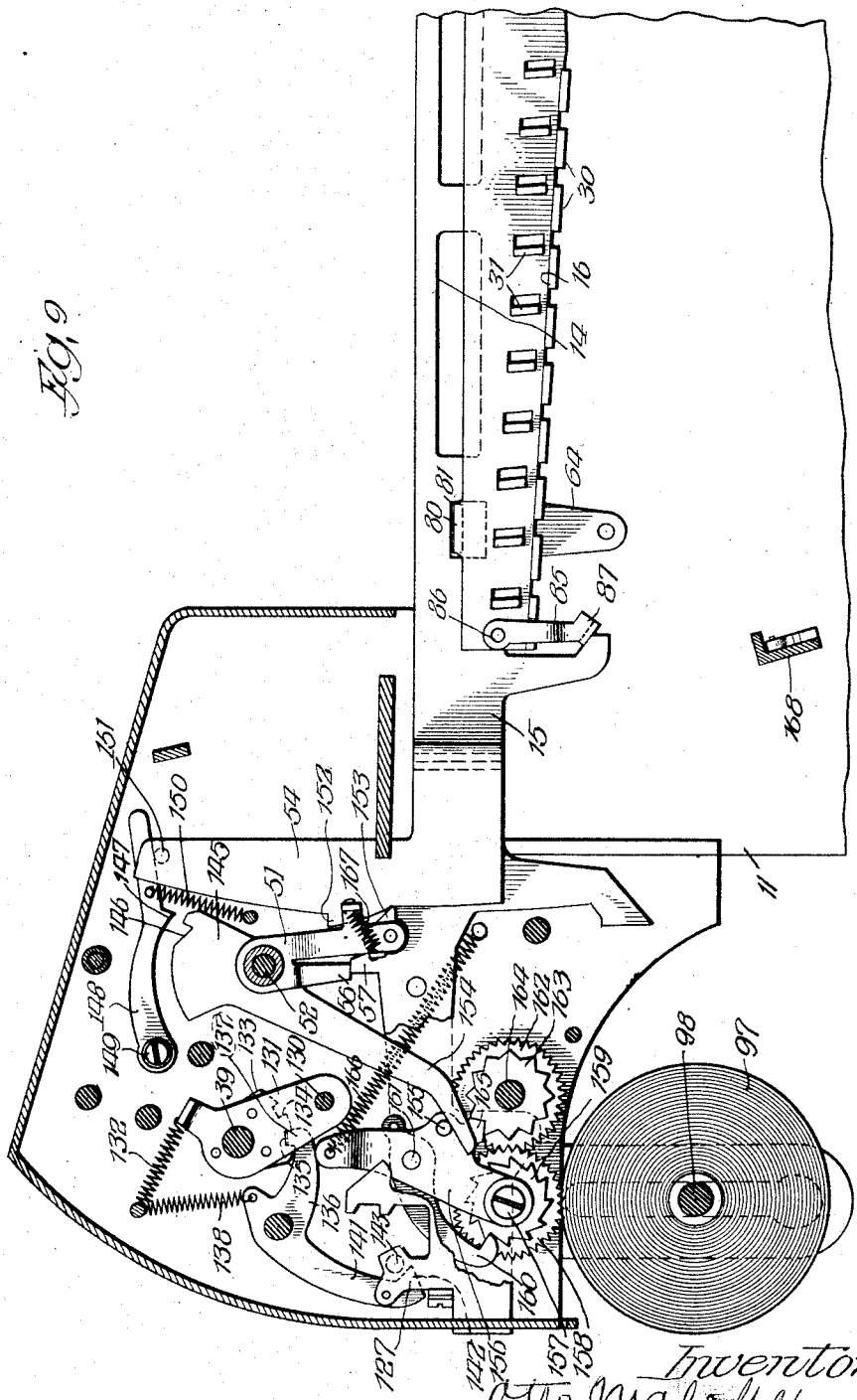
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Fig. 9



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Patented Mar. 29, 1927. 1,622,916

UNITED STATES PATENT OFFICE.

OTTO MALCHER, OF CHICAGO, ILLINOIS.

COMPUTER.

Application filed January 20, 1919. Serial No. 271,993.

This invention has for its object the provision of a device of the class named which shall be of improved construction and operation.

The invention is exemplified in the combination and arrangement of parts shown in the accompanying drawings and described in the following specification, and it is more particularly pointed out in the appended claims.

In the drawings—

Fig. 1 is a perspective of a computing device embodying the present invention a portion of the outer casing being cut away to show features of the interior construction;

Fig. 2 is a fragmentary vertical sectional view showing a portion of the operating mechanism;

Fig. 3 is a view similar to Fig. 2, but showing the operating mechanism in the position it occupies at a different period in the computing operation from that shown in Fig. 2;

Fig. 4 is a view similar to Figs. 2 and 3, but looking at the parts in an opposite direction from that of Figs. 2 and 3;

Fig. 5 is a fragmentary horizontal sectional view;

Figs. 6, 7 and 8 illustrate details of construction; and

Fig. 9 is a vertical sectional view showing the paper feed and other mechanism.

In the embodiment of the invention illustrated in the drawings, a shaft 10 is supported by frame plates 11 which are spaced from one another and held in upright position. A casing 12 encloses the greater part of the operating mechanism.

Pivotally mounted on the shaft 10 and extending rearwardly therefrom are a plurality of bars arranged in sets of three, each set comprising a supporting bar 14, a driving bar 15, and a locking bar 16. Generally speaking, each of the supporting bars 14 is provided with a main driving gear 17 pivotally mounted at 18 near the forward end of the bar, while each of the operating bars 15 is provided with a rack 19 arranged to mesh with the gear 17. Each of the drive wheels 17 operates a numeral wheel of one decimal order of the printing mechanism, and also of the accumulator in a manner to be described. The drive wheel 17 itself is rotated an amount proportional to the digit of the decimal order to which the numeral wheel belongs by movement of the corresponding rack 19. The rack 19 is moved relative to the gear 17 an amount proportional to the digit to be set up in the corresponding decimal order by one of a series of keys carried on the bar 15. After the bar 15 and rack 19 have moved downwardly a sufficient distance to set up the desired number in the printing and computing mechanism, the bars 14 and 15 are caused to move downwardly in unison with one another a further distance to print the number set up in the particular decimal order to which the bars correspond. Thus by simply pressing the proper key in a given decimal order on the keyboard the number which that key bears is added to the corresponding decimal order in the accumulator and printed in its proper position in the tabulated result. The details of the mechanism and operation, together with other functions of the machine will appear in the detailed description which follows.

Keyboard and swinging bars.

Each of the supporting bars 14 is provided at the end opposite the shaft 10 with a spring 20 which normally swings the bar upwardly about the shaft 10. Each bar 15 carries an arcuate segment 21, to the lower end of which is secured a coil spring 22, as shown in Fig. 2, which spring normally swings the bar 15 upwardly about the shaft 10. Extending downwardly and rearwardly from the upper end of each segment 21 and having its lower end connected with the bar 15 is a stepped plate 23 having a series of keys 24 pivotally mounted at 25 on the plate. Each key 24 is provided with a tail piece 26 having a projection 27 at its lower end arranged to engage a stop shoulder 28 on the lower edge of the plate 23. Springs 29 normally hold the lugs 27 against their corresponding stop shoulders and hold the keys 24 in raised position, as shown in Fig. 2. The locking bar 16 lies adjacent its corresponding bar 14 and is provided with a series of laterally extending lugs 30, there being one lug 30 for each of the keys 24. When a key 24 is pressed downwardly it first extends the spring 29 until the key lies flat upon the corresponding step of the plate 23, as shown in Fig. 3. Further pressure upon the key 24 will extend the spring 22 and cause

the bar 15 to swing downwardly about the shaft 10 until the lower end of the tail piece 26 of the depressed key strikes the corresponding laterally projecting lug 30 on the locking bar 16, as shown clearly in Fig. 4. A series of lugs 31 are struck laterally from the locking bar 16, each lug being so located on the locking bar that the projection 27 on a particular tail piece 26 will pass on the left of its corresponding lug, as viewed in Fig. 4, when a key is depressed and the bar 15 moved downwardly by the pressure of the depressed key. The lug 31 precludes any possibility of the end of the tail piece slipping to the right on the projection 30 and thus permitting the depressed key to move downwardly without carrying the projection 30 and the locking bar downwardly in unison therewith. The keys 24 that are not depressed can pass to the right of their corresponding lugs 31, as viewed in Fig. 4, so that they are free to swing upwardly about their pivotal connection with the bar 15 and do not exert pressure upon their corresponding lugs 30. In this way only the particular key depressed will operate upon the bar 16, and since the different keys of each decimal order are spaced at graduated distances from the lugs 30 on the bar 16, it is apparent that the bar 15 will be moved downwardly a distance corresponding to the number on the particular key depressed before the key will contact with the bar 16. It is during this downward movement that the corresponding gear 17 is rotated by the rack 19 to set the numeral wheels of the particular decimal order. Since the rack 19 moves in unison with the stepped plate 23, it is apparent that the numeral thus set up will correspond to the particular key depressed.

Accumulator.

In order to totalize a series of numbers formed by depressing the proper keys an accumulator is provided having a series of numeral wheels 32 which are visible through an opening 33 in the casing 12 shown in Fig. 1. The numeral wheels 32 are freely rotatable on a shaft 34 and each wheel has rigidly connected therewith a pinion 35 which meshes with an idler 36 carried on a shaft 37. Each of the idlers 36 meshes with a twenty-toothed gear 38 mounted to rotate on a shaft 39. Each of the pinions 35 and 36 is provided with ten teeth so that the numeral wheel 32 will make two revolutions for each revolution of the gear 38. The gear 38 in turn is driven by a ten-toothed pinion 40 which meshes with an idler 41 mounted on the bar 14 and driven by the gear 17 when the bar 14 is in its uppermost position, as shown in Fig. 3. Through this chain of gearing the numeral wheel 32 is driven an amount proportional to the number on the key of the corresponding decimal order which is depressed. In order to give a correct total of a series of numbers set up in the keyboard it is necessary, however, to carry from one decimal order to the next higher whenever the numeral wheel of the lower order passes from nine to zero. This carrying mechanism is connected with the twenty-toothed gear 38 mounted on the shaft 39. Each gear 38 has rigidly connected therewith a twenty-toothed star wheel 42 and two discs 43 and 44, two teeth of the star wheel being illustrated in Fig. 2. The discs 43 and 44 have their peripheries cut away, as shown in Figs. 2 and 8, to a depth corresponding to the depth of the teeth on the gear 38, and for a circumferential distance a little less than half the circumference of the disc. The two discs are so positioned relative to one another that the parts not cut away overlap one another at each end a distance equal to the width of a tooth on the gear 38. Arranged to mesh with the discs 43 and 44, respectively, are two mutilated pinions 45 and 46, each pinion having the alternate teeth omitted, and the two pinions being arranged side by side and arranged so that the teeth of one alternate with the teeth of the other. The teeth on each of the mutilated pinions are so proportioned that when the pinion lies opposite the uncutaway portion of the corresponding disc 43 or 44, the pinion will be locked against rotation. At the same time a tooth on the pinion not thus locked will extend into the cut-away portion of the other disc, as shown in Fig. 2. It will be apparent that when the discs 43 and 44 have rotated a half revolution from the position shown in Fig. 2, the tooth on the pinion 45 will engage the end of the slot formed by the cut-away portion in the disc 43, and at the same time the cut-away portion in the disc 44 will be brought into position to receive the next tooth in the pinion 46. Thus for each half revolution of the gear 38, the two mutilated pinions 45 and 46 will be rotated the width of one tooth, and at all other times the mutilated pinions will be locked against rotation. Since each half revolution of the gear 38 corresponds to a complete revolution of the numeral wheel 32, the movement of the mutilated pinions takes place once for each rotation of the numeral wheel 32. The mutilated pinions 45 and 46 mesh with an elongated pinion 47 which extends laterally a sufficient distance, as shown in Fig. 5, to mesh with a ten-toothed pinion 48 which is loosely mounted on a shaft 49 which carries the mutilated pinions 45 and 46. The pinion 48 meshes with the twenty-toothed gear 38 of the next higher decimal order. When the elongated pinion 47 is in mesh with the mutilated pinions 45 and 46 and with the ten-toothed pinion 48, the three

pinions 45, 46 and 48 will rotate in unison with one another, and with the pinion 47 as if they were simple spur gears. In this way each time the mutilated pinions are rotated a space corresponding to one tooth by the discs 43 and 44, the pinion 48 will be rotated a corresponding amount, and since the pinion 48 meshes with the gear 38 of the next higher decimal order, a carrying operation will be accomplished.

It will be readily understood that when a key of any particular decimal order has been pressed and during the rotation of the gear wheel 38 of any particular decimal order, that gear wheel should be connected through the carrying mechanism with the corresponding gear wheels of higher decimal orders, but should be disconnected from those of lower decimal orders. To accomplish this the elongated pinion 47 is moved out of mesh with the mutilated pinions 45 and 46 which connect with the carrying discs of a lower order during the operation of the gear 38 of the order corresponding to the key depressed. The pinions 47 are each carried at the upper end of a dog 51 which is pivotally mounted on a shaft 52 extending transversely of the casing. A spring 53 normally tends to rotate the dog 51 about the shaft 52 to bring the pinion 47 into mesh with the pinions 45, 46 and 48, and these pinions are held in mesh by the spring 53, except when the operating bar of a particular decimal order is depressed. When this occurs the dog 51 is rocked into the position shown in Fig. 3 to disengage the pinion 47 which connects the wheel 38 of the decimal order corresponding to the bar depressed with the carrying discs of the next lower decimal order. The movement of the dog 51 is produced by a cam bar 54 which lies adjacent the rack bar 19 and which is carried by the operating bar 15 and moves in unison with the rack bar. The lower end of the dog 51 is provided with a contact point 55 which is arranged to bear against the cam bar 54 and which is moved to the right, as viewed in Fig. 3, by the cam bar 54 at the beginning of the downward movement of the operating bar 15. This disengages the pinion 47 prior to any rotation of the gear 38 produced by the downward movement of the operating bar.

As will be seen from Fig. 2, the idler 41 does not mesh with the pinion 40 at the beginning of a downward movement of the operating bar 15, and it is necessary to bring these two pinions into mesh in order to drive the accumulator wheel corresponding to the decimal order of the depressed bar. The bar 14 is normally held in the position shown in Fig. 2 by an arm 56 on the dog 51 which engages the upper end of a lug 57 on the bar 14. When the dog 51 is operated by the cam bar 54 at the beginning of the downward movement of the operating bar 15, the two contact members 56 and 57 are moved out of engagement with one another and the spring 20 draws the bar 14 upwardly bringing the pinions 40 and 41 into mesh with one another, as shown in Fig. 3. During the preliminary downward movement of the operating bar 15 and the upward movement of the bar 14 under the influence of the spring 20, it is apparent that there will be relative movement between the gear 17 and the rack 19 by which the gear 17 will be rotated. It is desirable to permit this preliminary rotation of the gear 17 without transmitting the same to the pinion 41 and the parts driven thereby. For this reason a portion of the gear 17 shown at 58 is left blank so that rotation of the pinion 41 will not begin until the gear 17 has been moved by the preliminary movement of the rack 19 a sufficient amount to bring the blank portion 58 of the gear 17 past the pinion 41. During this preliminary rotation of the gear 17, the pinion 41 is held from rotation by a projecting rim 59 on the gear 17 which operates with the projecting portions of two alternate teeth on the pinion 41 in the manner of a Geneva lock. The projected portions on the alternate teeth engage spaced portions on the periphery of the rim 59 and thus prevent rotation of the pinion 41. The stepped plate 23 and the keys carried thereby are so related to the cooperating parts that each key is permitted a movement sufficient to effect this preliminary rotation of the gear 17 prior to the movement of the key necessary to rotate the computing mechanism an amount proportional to the number corresponding to the key depressed.

Locking mechanism.

If the spring 20 alone is relied upon to hold the bar 14 in its uppermost position with the pinions 40 and 41 in mesh during the rotation of the gear 17, it may sometimes happen that a quick stroke upon the key will cause a momentary downward movement of the bar 14 and disengage the pinions 40 and 41 during a portion of their rotation. It might also happen where the spring 20 is the only means for raising the bar 14 that the operation of the spring would not be sufficiently rapid to bring the two gears into mesh before the blank space on the gear 17 has passed the pinion 41. To overcome these difficulties a locking cam 60 for each decimal order is journaled on a shaft 61 which extends transversely of the frame of the machine beneath the swinging bars. The cam 60 is provided with a slot 62 which receives one end of a pin 63 carried by the lower portion of an arm 64 extending downwardly from the bar 14. At one side of the slot 62 is a shoulder 65 connected with the slot by an inclined portion 66 of the edge of the cam 60. A dog

67 journaled on the shaft 61 carries a detent 68 pivoted at 69 to the dog 67. A projecting lug 70 engages a notch 71 in the periphery of the cam 60 and holds the cam in the position shown in Fig. 2 so that the pin 63 engages the slot 62. A spring 72 holds the detent in engagement with the cam and also draws the dog 67 downwardly, as shown in Fig. 2. The dog 67 is provided with a shoulder 73 which extends into the path of a bar 74 carried by the segment 21 on the operating bar 15. The detent 68 is provided with an arm 75 which carries a pin 76, one end of which pin extends into a notch 77 in the cam 60, and the other end of which pin is in the path of an arm 78 on a bracket 79 which extends downwardly from the locking bar 16. The locking bar 16 is provided with an offset lug 80 projecting into an opening 81 in the bar 14, as shown in Fig. 2. The bracket 79 is arranged to move up and down in slots 82 in a cross-plate 83 connecting the sides of the casing.

When a key is depressed, immediately following the release of the bar 14 from the detent 56, the lower end of the bar 74 strikes the shoulder 73 rotating the dog 67 about the shaft 61, and the rotation of the dog carries with it the cam 60 because of the detent 68 until the cam is brought into the position shown in Fig. 3. This rotation of the cam will bring the shoulder 65 beneath the pin 63 and lock the bar 14 in its uppermost position with the pinions 40 and 41 in mesh. If the spring 20 does not operate sufficiently rapidly to raise the bar 14, the bar will be positively raised by the beveled portion 66 of the cam 60 to insure meshing of the pinions 40 and 41 prior to the rotation of the blank space in the periphery of the gear 17 past the pinion 41. The bar 14 is held in this locked position by the cam 60 until the operating bar 15 has been moved downwardly to bring the lower end of the depressed key into engagement with one of the lugs 30 on the locking bar 16. The locking bar 16 is held upwardly relatively to the bar 14 by a spring 84 connecting the bar 14 with the bracket 79. When the depressed key strikes the lug 30 further downward movement of the operating bar will extend the spring 84 and move the locking bar 16 downwardly relatively to the bar 14 until the projection 80 is brought into contact with the lower edge of the opening 81 in the bar 14. The parts are so proportioned that when the lug 80 engages the lower edge of the opening 81, the numeral wheels will have been rotated an amount corresponding to the number on the particular key depressed. During the downward movement of the locking bar 16 relative to the bar 14, the arm 78 on the bracket 79 is moved into engagement with the pin 76, and at the latter part of the movement of the bar 16 relative to the bar 14, the lower edge of the arm 78 strikes the pin 76 and releases the detent 68 from the cam 60. The pin 76 is caused to bear against the lower face of the notch 77 in the cam 60 so that the cam is rotated in a counterclockwise direction, as viewed in Fig. 3, until the notch 62 is again brought into registration with the pin 63. The cam 60 reaches this position at the same time that the projection 80 strikes the lower edge of the opening 81 so that further downward pressure upon the depressed key will move the locking bar 16 and the bar 14 downwardly in unison with one another, the notch 62 being in position to permit such downward movement. After the release of the bar 14 by the movement of the cam 60, the three bars 14, 15 and 16 will move downwardly in unison with one another since the locking bar 16 is pressed downwardly by the key on the operating bar 15, and the bar 14 is pressed downwardly by the lug 80 on the locking bar 16. During this movement of the three bars in unison with one another there will, of course, be no rotation of the gear 17, since there is no relative movement of the bars, and the pinion 41 will be moved out of engagement with the pinion 40 after the rotation of the gear 17 has ceased.

When the spring 84 alone is relied upon to hold the locking bar 16 in contact with the tail piece of the depressed key during the movement of the locking bar relative to the bar 14, it is sometimes possible to strike a blow upon the key in such a manner as to cause the locking bar 16 to bound away from the key and thus reach its lowermost position relative to the bar 14 ahead of the movement of the operating bar 15. If this should occur it is apparent that the cam 60 would be released by the operation of the arm 78 on the bracket 79 prior to the completion of the movement of the operating bar 15 and the rack 19 relative to the bar 14 and the gear 17. In order to prevent relative movement between the operating bar and the locking bar 16 subsequent to the contact between the tail of the depressed key with the lug on the locking bar 16 a detent 85 is pivotally mounted at 86 on the end of the bar 16 and is provided with a tooth 87 arranged opposite a series of notches 88 in the edge of the bar 74. A downwardly extending arm 89 on bar 14 is provided with an inclined cam surface 90 which engages a projecting lug 91 on the lower end of the detent 85. As soon as the locking bar 16 begins to move downwardly relative to the bar 14, the detent 85 is swung to the left, as viewed in Fig. 3, and caused to enter one of the notches 88 in the bar 74, as shown in Fig. 4. This will lock the two bars 15 and 16 against movement relative to

one another and prevent unlocking of the bar 14 prior to the completion of the downward movement of the operating bar 15 and the rack 19.

Printing mechanism.

Each of the bars 14 carries near its forward end a pivot pin 92 on which is rotatably mounted a numeral wheel 93 having raised type 94 thereon which bear the numbers from zero to nine. Connected with each numeral wheel 93 to rotate therewith is a pinion 95 meshing with a pinion 96 which in turn meshes with the pinion 41 driven by the gear 17. By this chain of gearing the numeral wheel 93 is rotated in unison with the accumulator mechanism and the type are arranged on the numeral wheel 93 so that for any position of the wheel the lowermost type thereon will correspond to the number on the key depressed. The final downward movement of the three bars 14, 15 and 16 in unison with one another carries the lowermost type on the wheel 93 into engagement with the surface of the paper in a roll 97 carried on a shaft 98, as shown in Figs. 2, 3 and 4. An inking roller 99 is supported by a spring 100 and is pressed against the face of the type on the numeral wheel 93 so that when a type is caused to strike the paper 97 the number will be printed on the paper. The roll of paper 97 is held upwardly in position to receive the impression of the type by springs 101, Fig. 1, which are connected with the outer ends of the shaft 98 which extend through slots 102 in downwardly projecting arms 103 on the casing 12. The lower end of the slots 102 are enlarged, as shown at 104, to permit removal of the shaft 98 when it is desired to renew the roll of paper 97 on the shaft. The end of the strip of paper wound upon the roll 97 extends through a slot 105 through which the paper may be drawn after a computing operation and the portion bearing the printed characters torn off. In order to properly aline the type on the numeral wheel 93 at the time they strike the paper, a star wheel 106 is connected with each numeral wheel and its driving pinion and a dog 107 is pivotally mounted at 108 on the end of the bar 14 and is provided with a tooth 109 arranged to enter the notches in the star wheel 106, as shown in Fig. 4, in order to true the numeral wheel 93 if it should be slightly out of alinement due to lost motion in any of the parts of the driving mechanism. The dog 107 is moved into engagement with the star wheel 106 by a stationary shaft 110 which contacts with the rear edge of the dog 107 as the printing mechanism is moved downwardly by the downward movement of the bar 14, as shown in Fig. 4.

After a key has been depressed to the limit of its movement and the number corresponding to the key has been impressed upon the paper, the key is released and the springs 20 and 22 begin to draw the bars 14 and 15 upwardly. After the bar 14 has been raised sufficiently for the numeral wheel 93 to clear the paper, the bar 14 is arrested in its upward movement by a detent 111 pivotally mounted on a shaft 112 extending transversely of the frame of the machine. The detent 111 is provided with a shoulder 113 which engages a shoulder 114 on a downwardly extending arm 115 carried by the bar 14. A spring 116 presses the detent 111 into engagement with the arm 115. When the bar 14 is arrested in its upward movement, the bar 15 and rack 19 continue to travel upwardly, and thus the gear 17 and the connected chain of gearing is driven in the opposite direction from that in which it was rotated during the downward movement of the operating bars. This reverse rotation of the gear 17 will return the numeral wheel 93 an amount equal to that which it was driven during its downward movement and thus reset the numeral wheel at its zero position. As soon as the gear 17 has reached its initial or zero position a pin 117 on the face of the gear will strike the upwardly extending end 118 of the detent 111 and move the shoulder 113 of the detent out of engagement with the shoulder 114 on the arm 115. This will release the bar 14 and permit it to move upwardly a slight distance to bring the stop members 56 and 57 each into engagement with one another, as shown in Fig. 2, leaving the bar 14 in its initial position. In order to insure positive movement of the stop 56 into the path of the stop 57, the dog 51 is provided with an arm 119 having a nosepiece 120 which is struck by the upper end of the cam bar 54 and moved to the right, as viewed in Fig. 2, to positively restore the dog 51 to its initial posision. It will be noted that during the resetting of the printing wheels 93, the operating gears are disconnected from the accumulator so that the number added to the accumulator will remain in the total which it shows.

In order to prevent overthrow of the accumulator, a series of detents 121 are pivotally mounted on a shaft 122 and are provided with teeth 123 in position to engage the notches in the star wheels 42. Springs 124 normally hold the detents in engagement with the star wheels. Each of the detents 121 is provided with a laterally projecting lug 125 which overlies the detent of the next lower decimal order so that when any one detent is raised out of contact with its star wheel it will correspondingly raise the detents of all of the higher decimal orders. The downwardly projecting tail pieces of the detents 121 are provided with laterally extending lugs 126 in position to be engaged

by lugs 127 extending upwardly from the bar 14 of the next lower decimal order, the upwardly extending lugs 127 being offset laterally to bring them into position to engage the lugs 126 of the detents of the decimal order next higher than the one corresponding to the bar 14 on which the particular lug 127 is carried. By this arrangement when the bar 14 is moved upwardly to cause the pinions 40 and 41 to mesh with one another, the lug 127 will engage the detent of the next higher decimal order, and the detents of all the higher orders will thus be raised out of contact with their corresponding star wheels, but the detent of the order corresponding to the bar 14 which is raised and which carries the driving mechanism being operated will remain in engagement with its star wheel. There is no danger of displacement of the numeral wheels of the higher decimal orders during the time their star wheels are released by the corresponding dogs for the reason that each numeral wheel is held from rotation by the carrying mechanism engaging the locking discs 43 and 44 of the next lower decimal order. It is desirable to release the star wheels from their dogs in order to permit easy carrying from the lower decimal orders without the necessity of overcoming the tension of all of the overthrow dogs. It is also desirable to have the overthrow dog of the particular numeral wheel which is being operated in contact with its star wheel, for this numeral wheel as has previously been explained is disconnected from the carrying discs of the lower decimal order and would therefore be liable to overthrow if it were not for the overthrow dog. In order to make the action of the overthrow dog absolutely positive, a beveled tooth 128 is formed on the bar 14 in position to strike a corresponding tooth 129 on the tail piece of the dog 121 so that when the bar 14 begins to move downwardly to disengage the pinions 40 and 41, the dog 121 will be positively moved about its axis 122 and forced into engagement with the star wheel so that any tendency to overthrow is positively checked.

Accumulator reverse.

As shown in Figs. 4, 5 and 9, a shaft 130 which carries the pinions 40 is supported by swinging brackets 131 pivotally mounted on the shaft 39 and normally drawn in a counterclockwise direction, as viewed in Fig. 9, by a coil spring 132. Secured to one of the brackets 131 is a ratchet member 133 having two notches 134 and 135 therein. A dog 136 is provided with a tooth 137 for engaging the notches 134 and 135, the tooth being drawn toward the notches by a spring 138. The sides of the tooth 137 and notches 134 and 135 are rather abruptly inclined so that the shaft 130 is held in position with considerable firmness, but may be moved about the shaft 39 as an axis if sufficient lateral force is exerted to move the dog 136 out of engagement with the notches 134 and 135. One end of the shaft 130 projects through a slot 139 in the casing 12 in position to be grasped by an operator and swung about the shaft 39 as an axis to bring the dog 136 into engagement with either of the notches 134 or 135, as the operator may select. When the shaft 130 is in the position shown in Fig. 3, the accumulator will be operated, as previously explained, to add a number set up in the keyboard to that previously displayed through the slot 33. If, however, the shaft 130 is shifted to the right, as viewed in Fig. 3, which would be to the left, as viewed in Fig. 4, the pinion 40 will be moved into position to mesh with the pinion 96 instead of the pinion 41, and when this occurs it will be apparent that the accumulator will be operated in a reverse or subtracting direction when a key is depressed. Since the carrying mechanism will operate for either direction of rotation of the gear 38, it is apparent that when it is desired to subtract a number from the total in the accumulator, all that is necessary is to shift the end of the shaft 130 away from the operator, as viewed in Fig. 1, and proceed in exactly the same manner as in adding. Means is provided for automatically returning the shaft 130 and gears 40 to the adding position after each subtracting operation so that the device will normally be set for addition. This automatic resetting to adding position is accomplished by the tail piece 141 on the dog 136 which is provided with a beveled tooth 142 in position to be struck by a projecting pin 143 formed on the member 127 of the bar 14 in units decimal order. When the bar 14 of the units order is moved downwardly to print the last digit of a number set up in the keyboard, the pin 143 will strike the tooth 142 and move the dog 136 out of engagement with the ratchet member 133 and thus release the swinging arm 131 which will immediately be drawn by the spring 132 into the position shown in Fig. 9 if the device has previously been set in subtracted position. If the device has previously been operating in adding position, the spring 132 will merely continue to hold the device in this position during the short period that the dog 136 is moved out of engagement with the ratchet member 133.

When a series of numbers have been entered in the accumulator and printed on the paper of the roll 97, all that is necessary to clear the machine is to shift the shaft 130 into subtracted position and then set up the total shown by the numeral wheels 32 in the keyboard. As soon as the key corresponding to the units order of the number in the

accumulator has been depressed, the total amount of that number will have been subtracted from the accumulator which will thus leave all of the numeral wheels of the accumulator at zero position. At the same time that the subtracting operation is being performed, the total previously exhibited in the accumulator will be printed upon the paper strip which will now exhibit a ticket showing all of the items tabulated with the total appearing at the foot of the tabulated column.

Paper feed.

In order that the various items may be spaced from one another on the paper strip, it is necessary to feed the paper roll a short distance between each item printed. Since the units key is the last key to be depressed in entering a number, the paper feed is actuated by this key and is arranged to operate after the key has reached the limit of its downward movement and is returning to its normal position. As shown in Fig. 9, the cam bar 54 attached to the units bar 15 is shaped somewhat differently from the corresponding cam bars of the other decimal orders, as is also the dog 51 by which the bar 14 is held in its normal inoperative position. Since the numeral wheel in the accumulator corresponding to the units bar 15 is not connected with the lower decimal order by the carrying pinion, the dog 51 is not extended above the shaft 52 for the purpose of supporting such carrier pinion. It is, however, provided with a catch segment 145 which is rigidly secured to the dog 51 and which is provided with a notch 146 arranged to be engaged by a tooth 147 on a detent 148 pivoted to the side of the frame at 149 and drawn downwardly toward the segment 145 by a coil spring 150. At the beginning of the downward movement of the bar 15, the dog 148 which is held upwardly by a pin 151 on the cam bar 54 is released and contacts with the segment 145 at the right of the notch 146, as viewed in Fig. 9. Further downward movement of the bar 15 causes a cam member 152 to engage a pivotally mounted tooth 153 on the end of the dog 51 and rotate the dog and segment 145 in a clockwise direction. This releases the stop 57 on the bar 14 in the manner previously described, and also swings the segment 145 to bring the notch 146 into engagement with the tooth 147 and holds the dog 51 in the position into which it has been rotated by the cam member 152. The segment 145 is provided with an arm 154 which engages a pin 155 projecting laterally from a lever 156 pivotally mounted on a pin 157 projecting from the side plate of the casing. Journaled to rotate on the pin 157 is a toothed wheel 158 which bears against the surface of the paper roll 97 and rigidly connected with the toothed wheel 158 is a ratchet wheel 159, and a pawl 160 is pivoted at 161 on the lever 156 and engages the teeth of the ratchet wheel 159. A second toothed wheel 162 meshes with the teeth of the wheel 158 and has rigidly secured thereto a star wheel 163, both wheels being journaled on a shaft 164. A tooth 165 on the lever 156 engages the notches in the star wheel 163 and prevents overthrow of the paper-feeding mechanism, as seen in Fig. 9. A comparatively strong coil spring 166 tends to rotate the lever 156 about the pivot 157 and causes the pin 155 to bear against the end of the arm 154 and also presses the tooth 165 into contact with the teeth on the star wheel 163. When the dog 51 is shifted by the downward movement of the bar 15, the arm 154 will raise the pin 155 and rotate the lever 156 about the pivot 157 a sufficient distance to cause the pawl 160 to engage the next forward notch in the ratchet wheel 159. At the same time the tooth 165 is released from the star wheel 163 and the parts are temporarily locked in this position against the tension of the spring 166 by the detent 148 which engages the notch 146 in the segment 145. The extra effort necessary to overcome the resistance of the spring 166 during the downward movement of the units key is not sufficient to be appreciably noticeable to the operator, but sufficient energy is stored in the spring 166 to feed the paper forwardly the necessary amount when the spring 166 is subsequently released. After the computing and printing operation performed by the mechanism of the units order has been completed and the units key is released, the cam bar 54 will move upwardly and is permitted to pass the pivoted tooth 153 which yields against the tension of a spring 167. As the bar 54 approaches its uppermost position, it engages the detent 148, and lifts it out of contact with the segment 145, thus releasing the arm 154 and the spring 166, which immediately rotates the lever 156 in a clockwise direction, as viewed in Fig. 9, and thus by means of the pawl 160 the toothed wheel 158 is caused to rotate and feed the paper into position to receive the next number. The rotation of the segment 145 also swings the stop 56 into position to engage the stop member 57 on the bar 14 to hold the bar 14 in its initial position for purpose previously described.

In order to prevent depression of more than one operating bar at a time, a cross-bar 168 is provided adjacent the path of movement of the segmental bars 21, as shown in Figs. 2 and 6, the upper edge of the bar 168 being provided with a flange 169 having slots 170 therein through which the segmental bars 21 are arranged to slide. Pivotally mounted on pins 171 on the face of the bar 168 beneath the flange 169 are stop mem-

bers 172, the pivotal movements of which are limited by pins 173 in the bar 168. The pivotal movement of the stop members 172 is sufficient to permit one of the bars 21 to pass downwardly between the stop members, but not sufficient to permit two of the bars to pass between the members at one time. Thus after a key of one decimal order has been depressed, depression of a key of any other decimal order is prevented until the key first depressed has been returned to its initial position.

The operation of the various parts has been described in connection with the description of the parts themselves and it is believed that the operation of the device, as a whole, will be readily understood. In performing a computing operation, all that is necessary is to depress the keys corresponding to the digits of the various numbers to be added, the depression of the last or units key of each number being sufficient to feed the paper so that the machine is in position to receive the next number of the series to be computed. If it is desired to subtract any given number from the total this may be done by simply shifting the end of the shaft 130 prior to the depression of the keys corresponding to the number to be subtracted. When all of the numbers of a given series have been listed, the shaft 130 may be shifted and the number appearing in the accumulator is then listed in the regular way, which operation will print the total of the numbers previously listed and will at the same time clear the totalizer and set the machine in readiness for a subsequent computation.

I claim:—

1. In a computing device, an operating member, an inclined key support carried by said operating member, a plurality of keys pivotally mounted on said key support, stops arranged to be engaged by said keys when said operating member is moved, means for holding said keys out of position to engage said stops each key comprising means for swinging it into position to engage its stop when said key is depressed, and means for preventing said key from swinging out of engaging position while said operating member is being moved by said key.

2. In combination, a computing unit, relatively movable driving elements for operating said unit, means for moving said elements relative to one another different amounts to introduce different numbers into said computing unit corresponding to the amounts of relative movement of said driving elements, and means for moving said driving elements in unison with one another after a relative movement sufficient to introduce a given number into said computing unit.

3. In combination, a computing unit, a pair of driving elements movable relative to one another for introducing different numbers into said computing unit, means for limiting the relative movement of said driving elements to an amount proportional to a number which it is desired to introduce into said computing unit and for causing further movement of said driving elements in unison with one another, and means for retaining the numbers introduced into said computing unit in a fixed relation during continued movement of said driving elements.

4. In combination, a computing unit, mechanism for printing numbers introduced into said unit, a pair of relatively movable driving members for said unit, and means for producing different amounts of relative movement between said driving members to introduce different numbers into said computing unit and for moving said driving members in unison with one another to operate said printing mechanism.

5. In combination, a computing unit, mechanism for printing numbers introduced into said unit, a pair of pivoted bars associated with said unit, driving gearing for operating said unit, one element of said gearing being mounted upon one of said bars, and another element of said gearing being mounted upon the other of said bars, means for producing relative movement of said bars different amounts to introduce different numbers into said computing unit, and means for moving said bars in unison with one another with the elements of said driving gearing in fixed relation with one another to operate said printing mechanism after the introduction of a number in said computing unit.

6. In combination, a computing unit, a pair of relatively movable members for operating said unit, and mechanism for imparting a preliminary movement to one of said members relative to the other to produce a preliminary setting of said computing unit and for imparting a further relative movement of said members relative to one another to introduce a number into said computing unit.

7. In combination, a computing unit, a pair of relatively movable bars for operating said unit, gearing carried by said bars and arranged to be driven by the relative movement of said bars for operating said computing unit, and mechanism for imparting a preliminary relative movement of said bars to bring said gearing into driving relation with said computing unit and for imparting a further relative movement of said bars to introduce a number into said computing unit depending upon the amount of said further relative movement of said bars; said bars being movable in unison with one

another subsequent to said relative movement after the introduction of a number in said computing unit.

8. In a computing machine, a computing unit, a pair of relatively movable operating members for said unit, gearing carried by said members and driven by the relative movement thereof, means for imparting relative movement to said members, means for bringing said gearing into position to operate said computing unit during the first part of the relative movement of said operating members, means for limiting causing the relative movement of said operating members to an amount proportional to a number to be introduced into said computing unit after said gearing has been brought into position to operate said computing unit, and means for causing said operating members to move in unison with one another to perform a further step in the operation of said computing machine after a number has been introduced in said computing unit.

9. In combination, a computing unit, a pair of pivotally mounted bars movable relative to one another for operating said computing unit, and a third bar for controlling the relative movement of said pair of bars.

10. In combination, a totalizer unit, a pivotally mounted bar having a gear movably mounted thereon for driving said totalizer unit, means for moving said bar to bring said gear into driving relation with said totalizer unit, means for moving said gear on said bar for operating said gear different amounts proportional to different numbers to be inserted in said totalizer unit, and means for moving said gear out of driving engagement with said totalizer unit after an amount of movement necessary to introduce a given number into said totalizer unit.

11. In combination, a totalizer unit, a support having a gear thereon for driving said totalizer unit, means for holding said support in one position with the gear thereon out of driving relation with said totalizer unit, an operating member movable relative to said support for driving said gear, means controlled by said operating member for moving said gear into driving relation with said totalizer unit during the first part of movement of said operating member, means for moving said operating member an amount proportional to a number to be set up in said totalizer unit after said gear is brought into operative relation with said totalizer unit, and means for causing said operating member and support to move in unison with one another to bring said gear out of operative relation with said totalizer unit after said number has been set up in said support.

12. In combination, a totalizer unit, a pivotally mounted bar having a gear thereon arranged to move into and out of operative relation with said totalizer unit, means for holding said bar in position with the gear thereon out of operative relation with said totalizer unit, an operating bar movable relative to said gear-supporting bar, means for bringing said gear into operative relation with said totalizer unit during the first portion of the movement of said operating bar relative to said gear-supporting bar, means for moving said operating bar an amount proportional to a number to be introduced into said totalizer unit after said gear is moved into operative relation with said totalizer unit, and means for causing said gear-supporting bar to move in unison with said operating bar to move said gear out of operative relation with said totalizer unit after a number has been set up in said totalizer unit.

13. In combination, a computing unit, a gear for driving said unit, means for rotating said gear various amounts to impart different movements to said unit, and means for transmitting movement from said gear to said unit, arranged to permit a preliminary movement of said gear prior to the operation of said computing unit by said gear.

14. In combination, a computing unit, a driving device for said unit, means for operating said driving device various amounts to insert different numbers in said unit, and connecting means between said driving device and computing unit arranged to permit a preliminary movement of said driving device prior to the operation of said computing unit by said driving device.

15. In combination, a computing unit, a driving device for said unit, means for operating said driving device various amounts to insert different numbers in said unit, and a gear for transmitting movement from said driving device to said computing unit, said gear having a blank portion thereon to permit a preliminary movement of said driving device prior to the operation of said computing unit by said gear.

16. In combination, a computing unit, a gear for driving said computing unit, a support for said gear, a driving device for said gear arranged to rotate said gear various amounts to insert different numbers into said unit, said gear having a blank portion thereon to permit a preliminary movement of said driving device and gear prior to the operation of said computing unit by said gear, and means for moving said driving device an amount proportional to a number to be introduced into said computing unit after said gear has begun to operate said computing unit.

17. In combination, a computing unit, a gear for operating said computing unit, a

support for said gear, means for holding said support in one position prior to a computing operation, a driving device for said gear, and means for moving said support into a different position to change the operative relation between said gear and said computing unit during the first part of the movement of said driving device.

18. In combination, a totalizer unit, a support having a pair of gears thereon for driving said totalizer unit, means for holding said support in one position with the gears thereon out of operative relation with said totalizer unit prior to a computing operation, means movable relative to said support for driving the gears thereon, and means for moving said support to bring the gears thereon into operative relation with said totalizer unit during the first part of the movement of said driving means relative to said support, the gears on said support having a blank space thereon for permitting movement of one of said gears without transmitting said movement to the other during the portion of the movement of said driving device prior to the bringing of said gears into operative relation with said totalizer unit.

19. In combination, a totalizer unit, a driving element for said unit, and gearing connected with said driving element and movable thereby relative to the totalizing unit for operatively connecting said driving element with said totalizer unit for a portion of the movement of said driving element proportional to a number to be inserted in said totalizer unit said gearing being movable with said driving element out of operative relation with said unit after said member has been inserted in said unit.

20. In combination, a totalizer unit, a driving element for said unit, a plurality of keys corresponding to different digits for moving said driving element, to operate said unit and mechanism for operatively connecting said driving element with said totalizer unit during a portion of the movement thereof proportional to the number represented by the key employed for operating said driving element said mechanism comprising rotary gearing operated by said driving element and movable in unison therewith out of operative relation with said totalizer unit.

21. In combination, a computing unit, a movable element for operating said unit, means for setting said element in operative relation with said computing unit during a portion of the movement of said element so that said computing unit will be operated by said driving element during further movement of said driving element, and means for causing the driving operation of said computing unit to cease while said driving element continues to move when said computing unit has been operated an amount proportional to a number to be set up therein.

22. In combination, a computing unit, a driving device for operating said unit, a plurality of keys corresponding to different digits for moving said driving device to operate said unit, mechanism for establishing operative relation between said driving device and said computing unit during a portion of movement of said driving device so that said computing unit will be operated by said driving device during a subsequent movement of said driving device, and means for causing the operation of said computing unit to be discontinued after said driving device has moved in operative relation with said computing unit an amount proportional to the digit represented by the key depressed.

23. In combination, a computing unit, mechanism for operating said unit, means for holding said operating mechanism in driving relation with said computing unit during various amounts of driving movement of said operating mechanism, and a lock for said holding means arranged to control the duration of operative connection between said unit and said operating mechanism therefor.

24. In combination, a computing unit, mechanism for driving said computing unit, a support for said driving mechanism movable into and out of position to hold said driving mechanism in operative relation with said computing unit, and means for locking said support in position to hold said driving mechanism in operative relation with said computing unit and means for releasing said lock after varying amounts of operative connection between said computing unit and the driving mechanism therefor.

25. In combination, a computing unit, driving mechanism for said unit, a support for said driving mechanism movable into and out of position to hold said driving mechanism in operative relation with said computing unit, a device movable relative to said support for operating said driving mechanism, and a lock controlled by said operating device for holding said driving mechanism in operative relation with said computing unit.

26. In combination, a computing unit, driving mechanism for said computing unit, relatively movable members for operating said driving mechanism, means for locking one of said members in fixed position during a movement of the other of said members proportional to a number to be inserted in said computing unit and means for releasing said locking means when the movement of said other member has reached said proportional amount.

27. In combination, a computing unit,

driving mechanism for said unit, means for shifting said driving mechanism to bring it into operative relation with said computing unit, means for locking said shifting means in position to hold said driving mechanism in operative relation with said computing unit, a device for operating said driving mechanism, and means for moving said operating device to operate said driving mechanism an amount proportional to a number to be inserted in said computing unit while said driving mechanism is locked in operative relation with said computing unit and means for releasing said locking means at the close of a movement of said driving mechanism proportional to the number inserted.

28. In combination, a computing unit, mechanism for driving said unit, a spring for moving said driving mechanism into operative relation with said unit, and a positively driven supplemental device for moving said driving mechanism into operative relation with said computing unit to insure the completion of said movement at the proper time in a cycle of operation.

29. In a computing device, a computing unit, mechanism for driving said unit, a device for operating said driving mechanism, means controlled by said operating device for positively moving said driving mechanism into operative relation with said computing unit during a preliminary movement of said operating device, means for locking said driving mechanism in said operative relation, means for imparting movement to said operating device proportional to a number to be inserted in said computing unit, and means for releasing said locking means at the completion of said proportional movement.

30. In combination, a computing unit, gearing for operating said unit, a support for said gearing movable into and out of position to hold said gearing in operative relation with said computing unit, means movable relative to said support for driving said gearing, and a locking device controlled by said driving means for positively effecting the movement of said gearing support at a given time in a cycle of operation and for holding said gearing in operative relation with said computing unit during a movement of said driving means proportional to a number to be inserted in said computing unit.

31. In combination, a computing unit, a pair of relatively movable members for operating said unit, means controlled by one of said members for imparting a preliminary movement to the other thereof, and a supplemental means controlled by said first-mentioned member for positively effecting the completion of said preliminary movement at the proper period in the relative movement of said members.

32. In combination, a computing unit, a pair of relatively movable members for driving said unit, a spring for imparting a preliminary movement to one of said members to establish driving relation between said relatively movable members and said computing unit, and means for positively moving said member to insure the completion of said preliminary movement at the proper period in the relative movement of said driving members.

33. In combination, a computing unit, a pair of relatively movable members for driving said unit, a spring controlled by one of said units for imparting a preliminary movement to the other thereof to establish a driving relation between said relatively movable members and said computing unit, and means for locking said spring-moved member in position to maintain said operative relation during a subsequent relative movement of said driving members proportional to a number to be inserted in said computing unit.

34. In combination, a computing unit, a pair of relatively movable members for driving said unit, a spring controlled by one of said members for imparting a preliminary movement to the other of said members to establish operative relation between said driving members and said computing unit, means for positively effecting the completion of said preliminary movement at a predetermined time in the relative movement of said driving members and for locking the member so moved in position to maintain operative relation between said computing unit and said driving members during relative movement of said driving members proportional to a number to be inserted in said computing unit, and means for releasing the member so locked at the completion of said proportional movement to permit further movement of said members in unison with one another.

35. In combination, a computing unit, a pair of relatively movable bars for driving said unit, and a lock operated by one of said bars for controlling the movement of the other of said bars relative to said computing unit.

36. In combination, a computing unit, driving mechanism for said computing unit, a pivotally mounted bar for supporting said driving mechanism, a pivotally mounted bar for operating said mechanism, and a locking device for controlling the relative movement of said bars.

37. In combination, a computing unit, a driving mechanism for said computing unit, a pivotally mounted bar for supporting said mechanism, a pivotally mounted bar for op-

erating said mechanism, locking mechanism for controlling the relative movement of said bars, and a third bar for controlling said locking mechanism.

38. In combination, a computing unit, driving mechanism for said computing unit, a pivotally mounted bar for supporting said driving mechanism, means for moving said bar to bring said driving mechanism into and out of operative relation with said computing unit, a second bar movable relative to said first bar for operating said driving mechanism, locking mechanism controlled by the movement of said second bar for holding said driving mechanism in operative relation with said computing unit, and a third bar controlled by said second bar for releasing said locking mechanism after said second bar has operated said driving mechanism an amount proportional to a number to be inserted in said computing unit.

39. In combination, a computing unit, means for driving said unit, means for moving said driving means into operative relation with said unit, a lock for holding said driving means in said relation, means for operating said driving means while in said relation, and mechanism for releasing said lock and for moving said driving means out of operative relation with said computing unit when said driving means has been operated an amount proportional to a number to be inserted in said computing unit.

40. In combination, a computing unit, a pair of relatively movable bars for operating said unit, locking mechanism operated by one of said bars for holding the other of said bars in a fixed position during a movement of said first bar for driving said computing unit, a third bar for releasing said lock, and keys movable with said first bar for contacting with said third bar to release said lock when said computing unit has been driven an amount proportional to a particular key depressed.

41. In combination, a computing unit, driving mechanism for said computing unit, a spring-actuated device for controlling said driving mechanism, and positively acting supplemental means for insuring proper operation of said spring-actuated device.

42. In combination, a computing unit, driving mechanism for said unit, spring-actuated means for controlling said driving mechanism, a device for operating said driving mechanism, and positively acting means controlled by said device for insuring proper occurrence of the movement of said spring-actuated means relative to the movement of said operating device.

43. In a computing device, a movable operating member therefor, locking mechanism for controlling the movement of said operating member, a device having a limited movement relative to said member for controlling said locking mechanism, and resilient means for holding said controlling device at one extremity of said limited movement.

44. In a computing device, a movable operating member, a second operating member movable relative to said first member, a locking mechanism for controlling the position of said first member, a third member arranged to be actuated by said second member for controlling said locking mechanism, and means for holding said second and third member in fixed relation with one another during the movement of said third member by said second member.

45. In combination, a computing unit, a gear-shifting bar for said unit, locking mechanism for said gear-shifting bar, an operating bar for said unit, a lock-controlled member arranged to be moved by said operating bar for controlling the locking mechanism for said gear-shifting bar, and a detent for holding said operating bar and locking member in fixed relation relative to one another during the movement of said locking member by said operating bar.

46. In combination, a computing unit, gearing for driving said unit, a bar for supporting said gearing and for shifting said gearing into and out of operative relation with said computing unit, an operating bar movable relative to said gear-supporting bar for operating said gearing, locking mechanism for said gear-supporting bar, means controlled by said operating bar for releasing said gear-supporting bar at the beginning of the movement of said operating bar to permit said gear-supporting bar to shift said gearing into operative relation with said computing unit, means controlled by said operating bar for locking said gear-supporting bar in said position, a lock-controlling bar having a limited movement relative to said gear-supporting bar, a spring for holding said lock-controlling bar at one extremity of its limited movement, keys on said operating bar corresponding to different digits and arranged when depressed to move said operating bar relative to said gear-supporting bar and to engage said lock-controlling bar and move said bar to release said locking mechanism, a detent carried by said lock-controlling bar and arranged to engage said operating bar when said lock-controlling bar is moved relative to said gear-supporting bar to prevent displacement of said lock-controlling bar relative to said operating bar during the movement of said lock-controlling bar to release said locking mechanism.

47. In combination, a computing unit comprising a totalizer wheel and a printing wheel, gearing for driving said wheels, mechanism for moving said gearing into one position to cause said wheels to be operated corresponding amounts and for subsequently

moving said printing wheel to form an impression therefrom representing the number introduced into said totalizer by the rotation of said gearing.

48. In combination, a numeral wheel having type thereon, a totalizer, gearing for driving said numeral wheel, means for shifting said gearing to connect said numeral wheel and totalizer to operate in unison with one another, means for preventing rotation of said numeral wheel during the shifting of said gearing, mechanism for driving said numeral wheel and totalizer while connected by said gearing an amount proportional to a digit to be inserted in a unit of said totalizer, and means for subsequently moving said numeral wheel to print the digit inserted.

49. In combination, a totalizer unit, a numeral wheel having type thereon, a support for said numeral wheel having gearing thereon for driving said wheel, said support being movable into position to connect said gearing with said totalizer unit, to drive said unit and numeral wheel in unison with one another, mechanism for operating said gearing to drive said numeral wheel and totalizer unit an amount proportional to a number to be inserted in said totalizer unit and printed by said numeral wheel, means for shifting said support to print said number, and mechanism for preventing rotation of said numeral wheel during the shifting of said support.

50. In combination, a numeral wheel having type thereon, gearing for driving said numeral wheel, a movable support for said gearing, a totalizer unit, means for shifting said support to connect said gearing with said totalizer unit, mechanism for driving said gearing while so connected an amount proportional to a number to be introduced in said totalizer unit and said numeral wheel, means for shifting said support to disconnect said gearing from said totalizer unit and to print the number thus inserted, means for preventing rotation of said numeral wheel during said shifting movements, means for withdrawing said numeral wheel from printing position, and means for driving said gearing in a reverse direction while said numeral wheel is withdrawn from printing position and while said gearing is disconnected from said totalizer to reset said numeral wheel at zero position.

51. In combination, a numeral wheel, a support for said numeral wheel, gearing on said support for rotating said numeral wheel, an operating member for driving said gearing, means for shifting said operating member relative to said support to rotate said gearing an amount proportional to a number to be printed by said numeral wheel and for subsequently shifting said operating member and support in unison with one another to print said number, means for shifting said operating member in a reverse direction relative to said support to return said numeral wheel to zero position, and means controlled by said gearing for preventing further relative movement of said operating member and support after said numeral wheel has reached its zero position.

52. In combination, a totalizer, means for printing numbers set up in said totalizer, mechanism for operating said totalizer and for setting said printing means, paper-feeding mechanism, and mechanism for storing energy during the operation of said printing means for setting said paper-feeding mechanism subsequent to the operation of said printing means.

53. In combination, a computing unit, a gear for driving said unit, means for rotating said gear various amounts to impart different movements to said unit, means for transmitting movement from said gear to said unit arranged to permit a preliminary movement of said gear prior to the operation of said computing unit by said gear, and means for shifting said transmitting means into operative relation with said computing unit during said preliminary rotation of said gear.

54. In combination, a computing unit, a driving device for said unit, means for operating said driving device various amounts to insert different numbers into said unit, means for shifting said driving device into cooperative relation with said computing unit and for simultaneously operating said driving device, a second member operated by said driving device, and means for transmitting movement from said driving device to said second member, said transmitting means being arranged to permit a preliminary movement of said driving device prior to the operation of said second member while said driving device is being brought into operative relation with said computing unit.

55. In combination, a computing unit, a gear for operating said unit and movable into and out of operative relation therewith, a second member operated by said gear, and means for transmitting movement from said gear to said second member, said transmitting means and gear being arranged to permit a preliminary rotation of said gear during the movement of said gear into operative relation with said computing unit.

In testimony whereof I have signed my name to this specification on this 18th day of January, A. D. 1919.

OTTO MALCHER.