R. D. KING.

ADDING MACHINE.

APPLICATION FILED FEB. 11, 1918.

1,404,443. Patented Jan. 24, 1922.

7 SHEETS—SHEET 1.

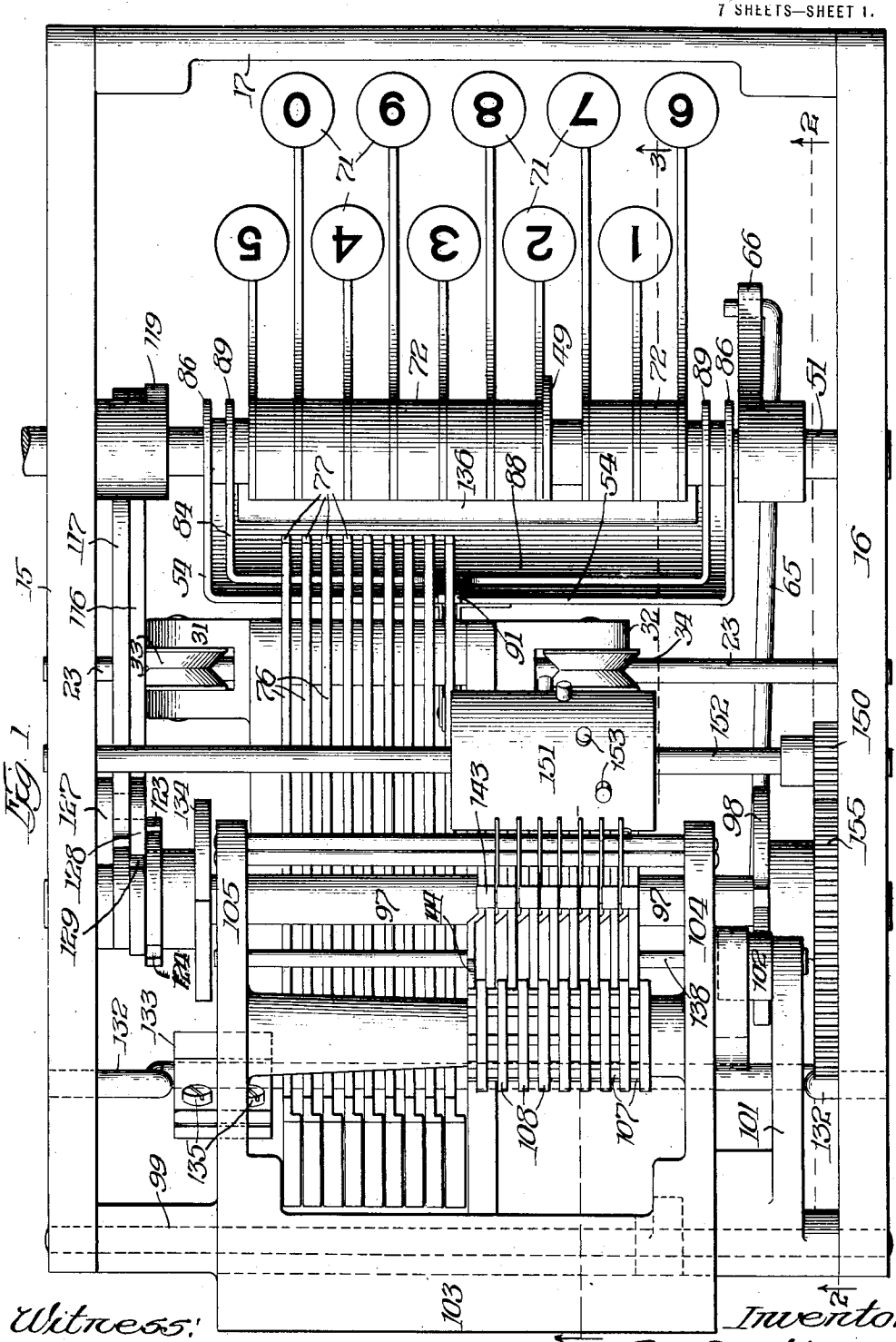


Fig. 1.

Witness:
Fred. C. Dorsey

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By Pond & Wilson Attys.

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7 SHEETS—SHEET 2.

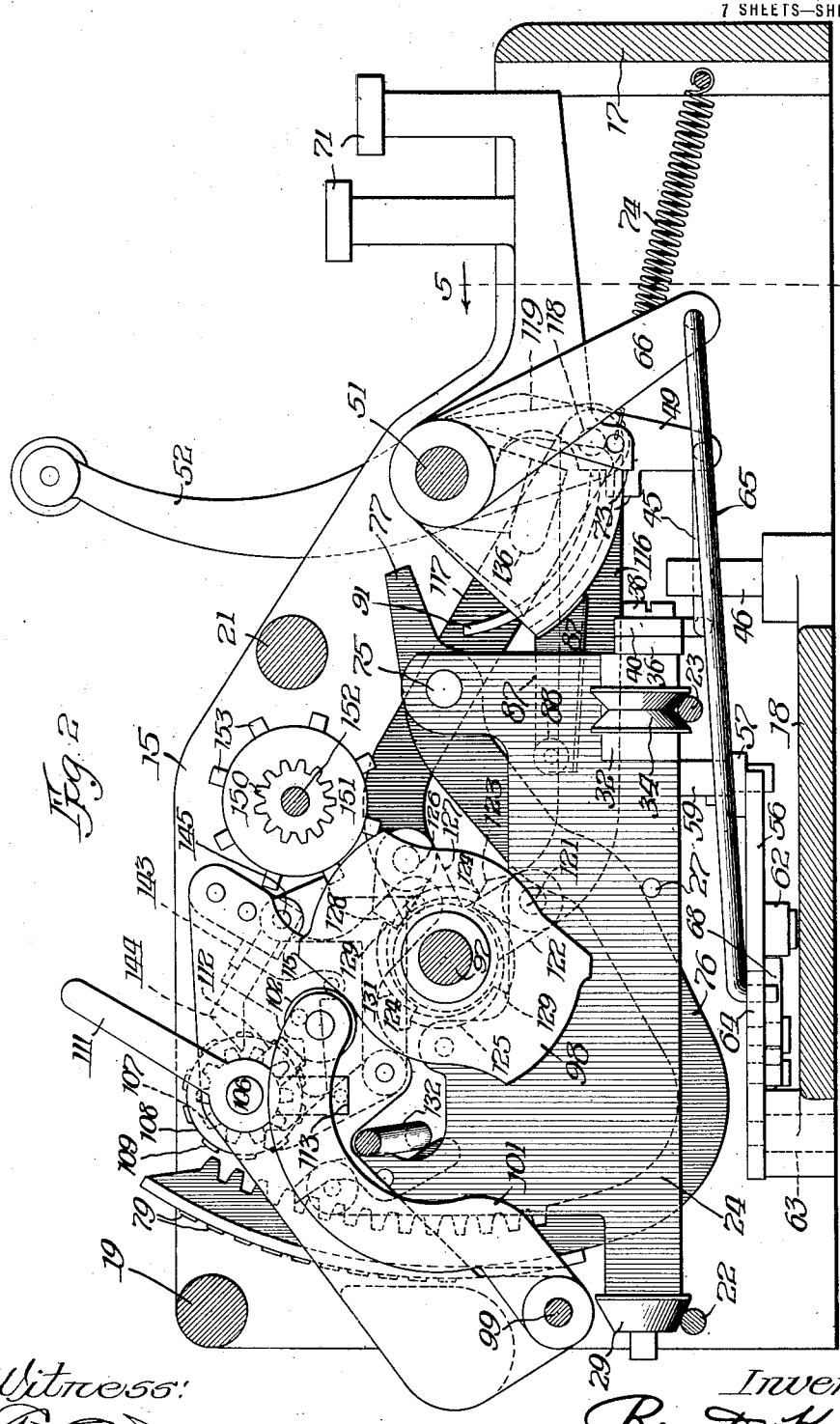


Fig. 2

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7 SHEETS—SHEET 3.

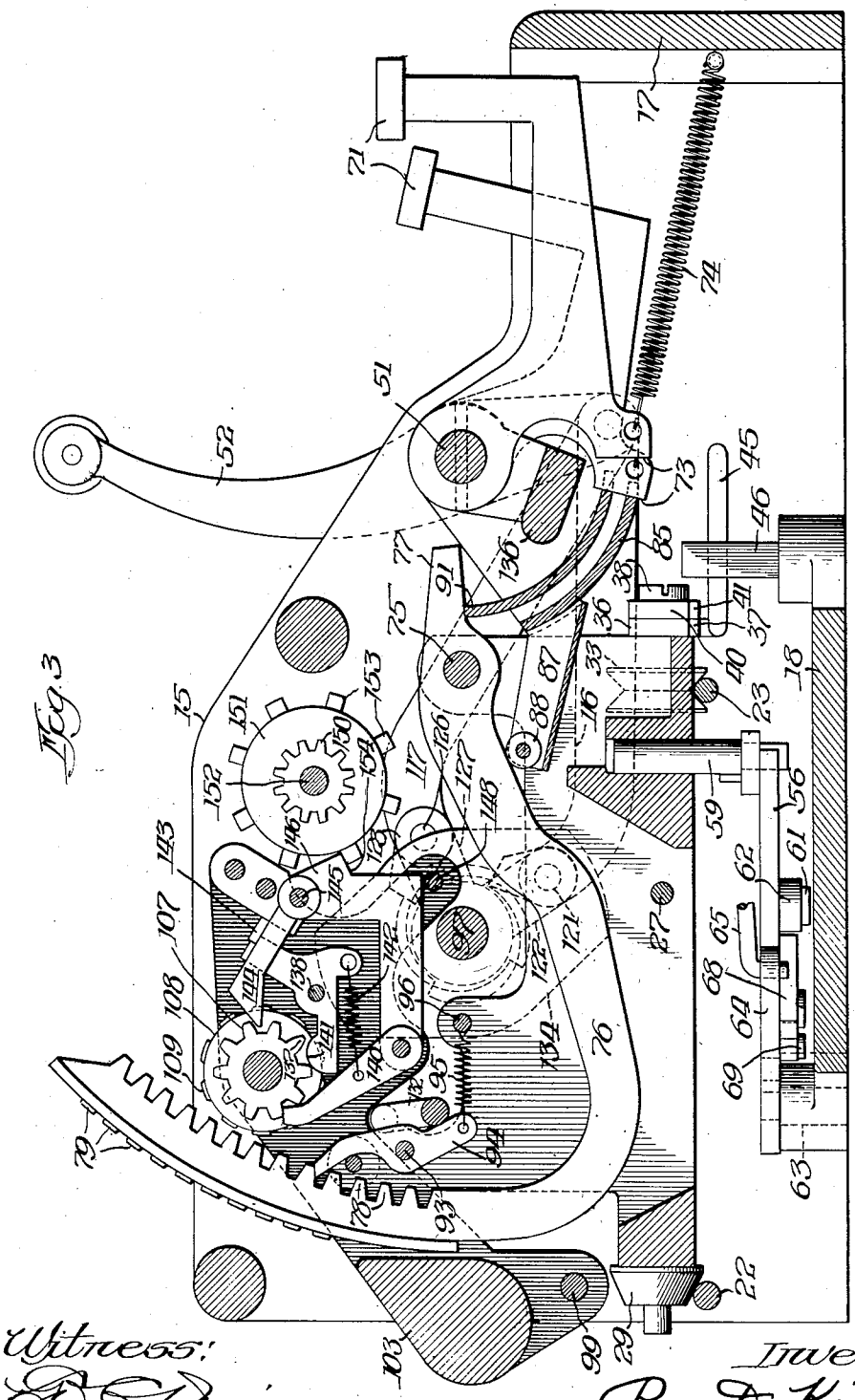


Fig. 3

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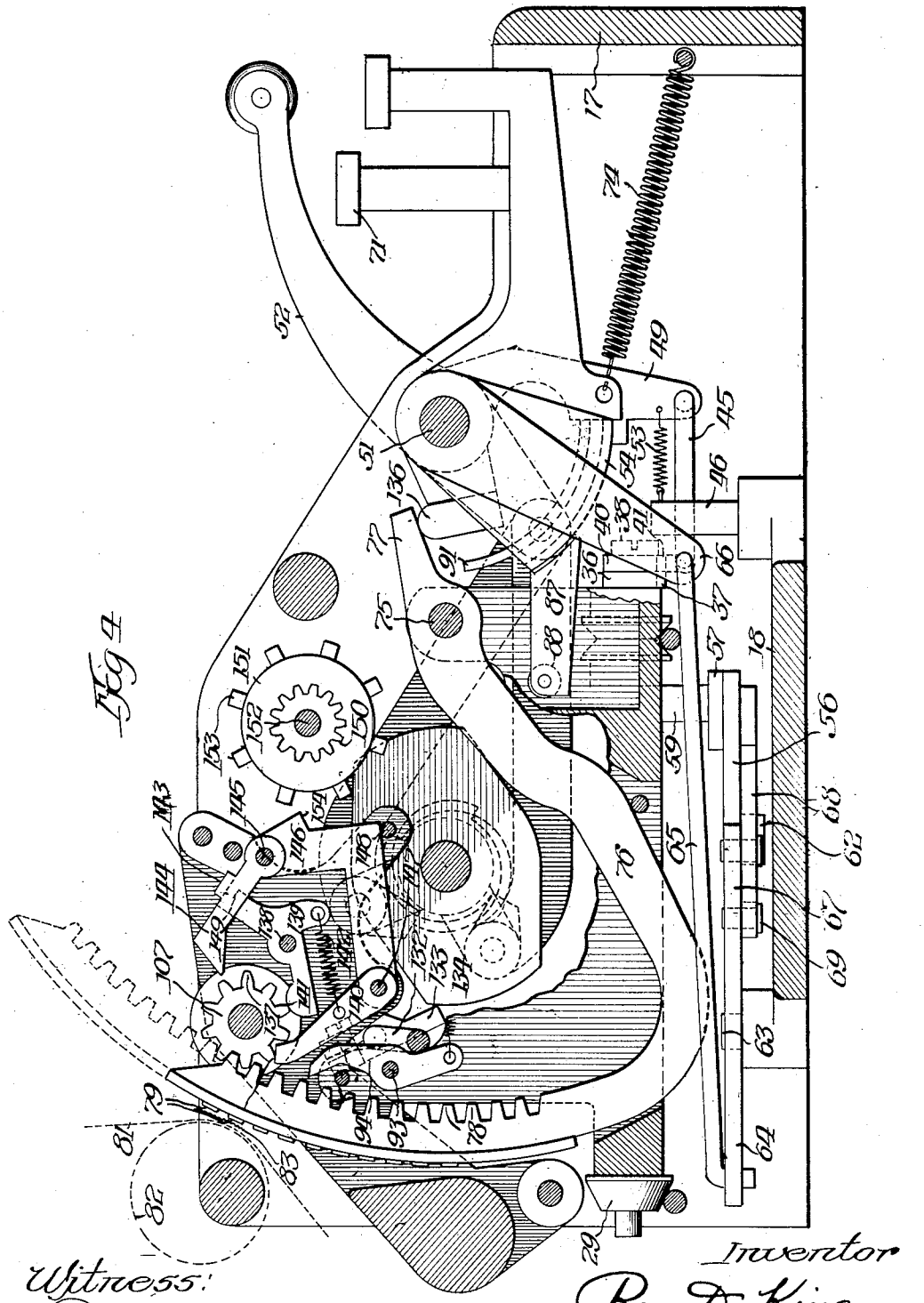


Fig 4

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7 SHEETS—SHEET 5.

Fig. 5.

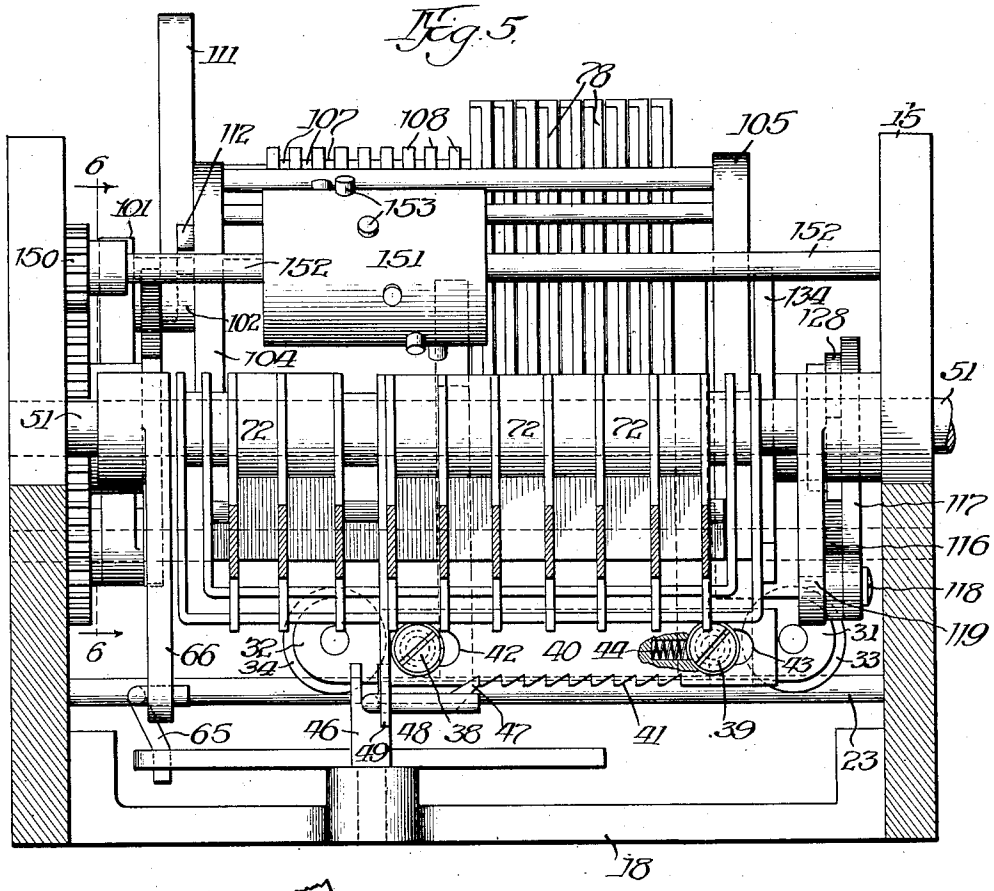
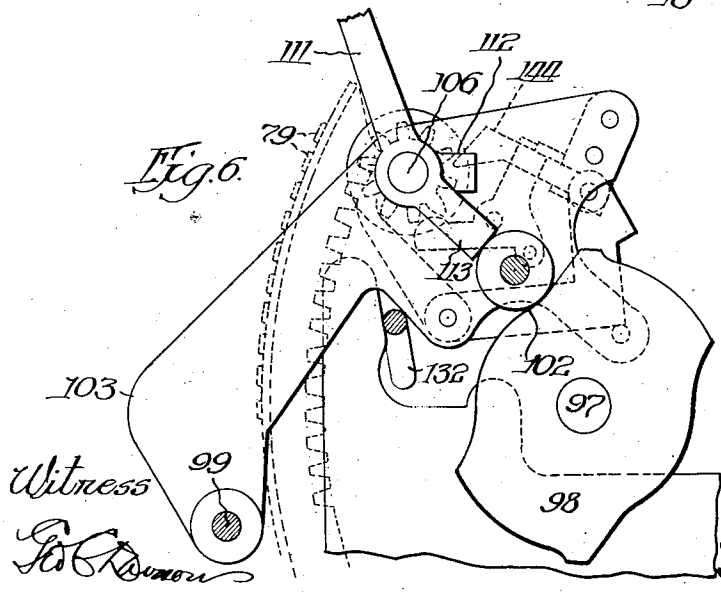


Fig. 6.



Witness

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7 SHEETS—SHEET 6.

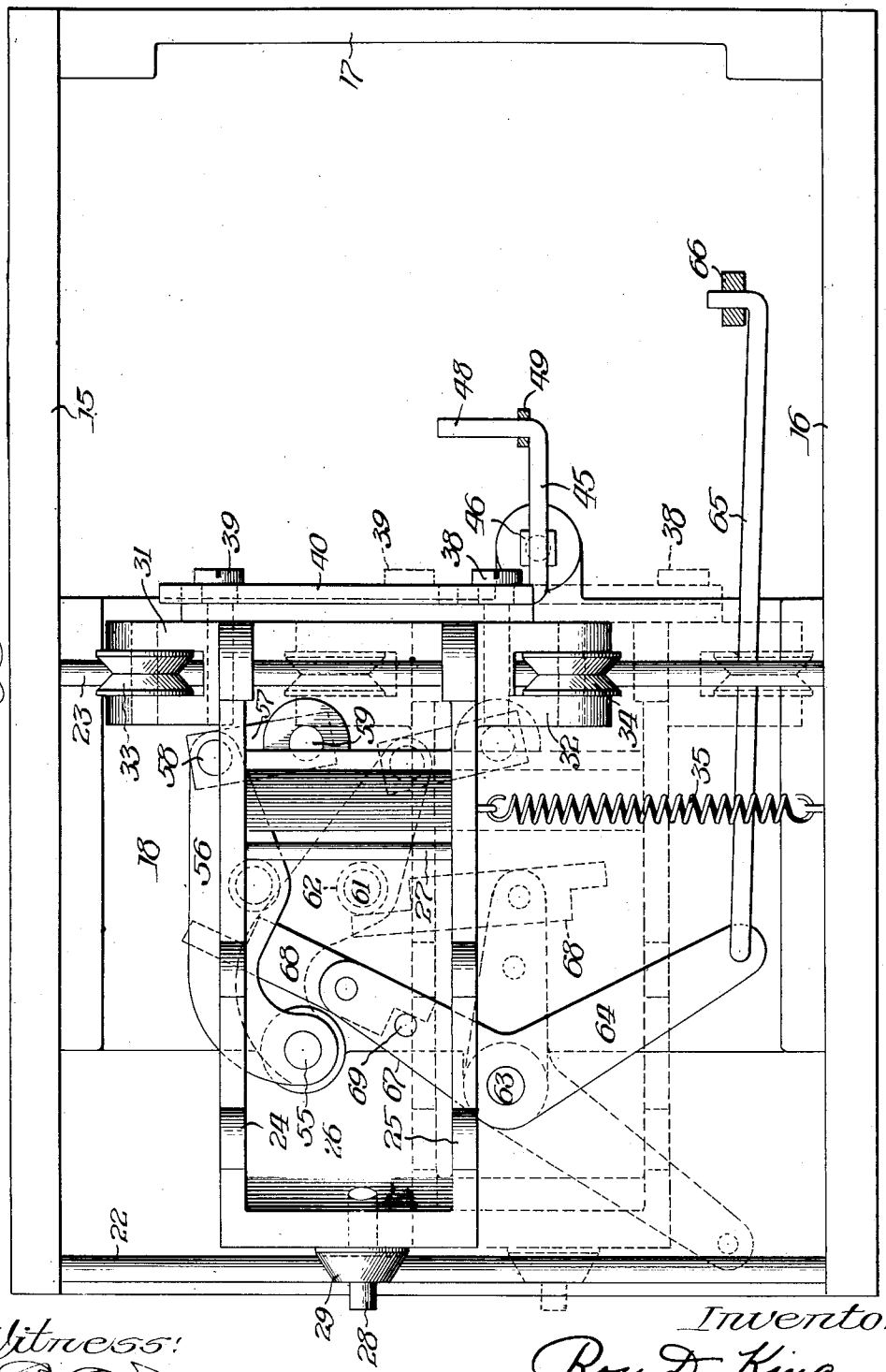


Fig. 7.

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7 SHEETS—SHEET 7.

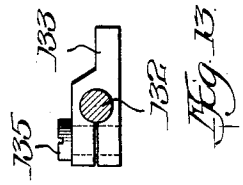


Fig. 13.

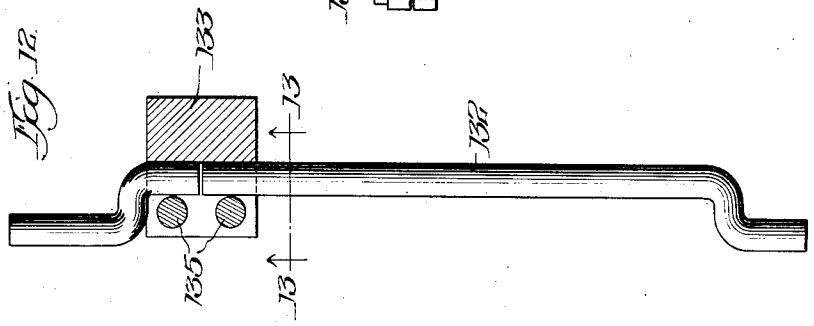


Fig. 12.

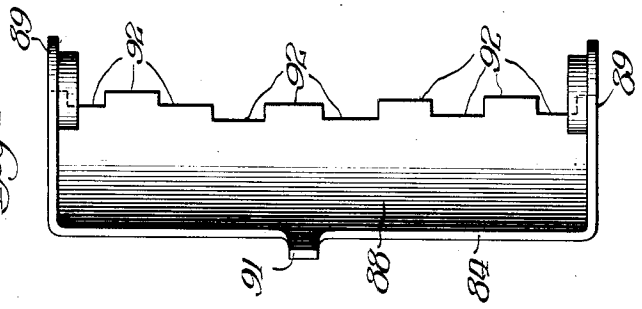


Fig. 10.

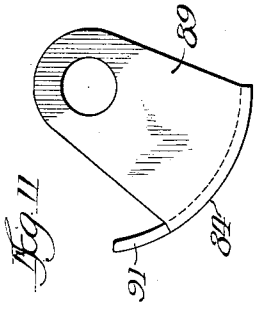


Fig. 11.

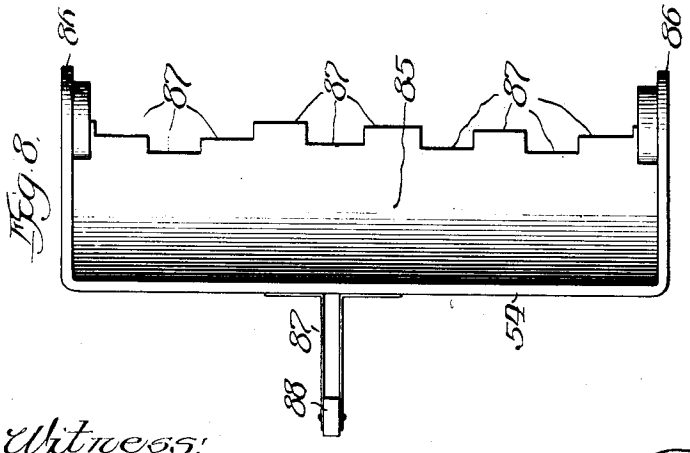


Fig. 8.

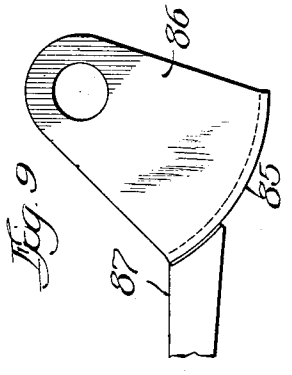


Fig. 9.

Witness:
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UNITED STATES PATENT OFFICE.

ROY D. KING, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO AMERICAN SALES COMPANY, OF MONROE, LOUISIANA, A CORPORATION OF LOUISIANA.

ADDING MACHINE.

1,404,443. Specification of Letters Patent. Patented Jan. 24, 1922.

Application filed February 11, 1918. Serial No. 216,434.

To all whom it may concern:

Be it known that I, ROY D. KING, 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 Adding Machines, of which the following is a specification.

This invention relates in general to adding machines, and more particularly to that type in which the numbers to be added are listed by printing one below another in a column, and the total of the column is printed at the bottom thereof.

One of the primary objects of my present invention is the provision of an adding machine of the general character indicated which shall be simple and economical to manufacture, which shall consist of a small number of parts, which will be easy to operate, and which will be reliable and accurate in operation.

More specifically, one of the advantageous features of my invention resides in the structure, mounting and manipulation of the type bars upon which the numerals appear and from which the listing or printing of the numbers to be added is effected.

Another feature resides in the fact that only ten keys are embodied in the machine, each key representing one of the digits. These keys, together with an operating handle, constitute the sole mechanism necessary to be manipulated by the operator in using the machine.

A further novel and advantageous feature is found in the connection between the keys and the type bars by which a type bar is operated at each manipulation of a key, the mechanism being so constructed that the type bars are actuated in succession by successive actuation of the keys irrespective of the order in which the keys are actuated.

Other novel and advantageous features of my invention are found in the mechanism by which the numbers set up on the type bars for listing are transferred or added to the accumulator mechanism from which the total is obtained, and in the mechanisms which control the movements of the carriage, the movements of the type bars and the movements of the total-printing mechanism.

In order to facilitate an understanding of my invention I have illustrated on the accompanying drawings one preferred embodiment thereof from a consideration of which, when considered in connection with the following description, the structure, operation and many of the inherent advantages of my invention should be readily understood and appreciated by those skilled in the art.

Referring to the drawings:

Fig. 1 is a pan view of an adding machine embodying my invention;

Fig. 2 is a longitudinal sectional view taken inside the frame substantially on the line 2—2 of Fig. 1;

Fig. 3 is a similar sectional view taken farther toward the center of the machine substantially on the line 3—3 of Fig. 1 showing the position of the parts when one of the type bars has been actuated by a key;

Fig. 4 is a view similar to Fig. 3 showing the position of the various elements when the operating handle has been moved from the position shown in Fig. 3 to that shown in Fig. 4;

Fig. 5 is a transverse sectional view taken substantially on the line 5—5 of Fig. 2;

Fig. 6 is a fragmentary view taken substantially on the line 6—6 of Fig. 5 showing the parts disposed in position for total printing;

Fig. 7 is a plan view showing the carriage and the restoring mechanism therefor, the parts mounted on the carriage being removed in this view to more clearly illustrate the carriage itself;

Fig. 8 is a detail view of the oscillating type bar actuating member;

Fig. 9 is an end view of the member shown in Fig. 8;

Fig. 10 is a detail view of the oscillating stop for the type bars;

Fig. 11 is an end view of the stop shown in Fig. 10;

Fig. 12 is a detail view of the rock shaft which releases the type bar holding dogs; and

Fig. 13 is a sectional view on the line 13—13 of Fig. 12.

By referring to the drawings, it will be observed that the machine comprises primarily a bed or frame consisting of the side members 15 and 16 rigidly connected together by a front member 17, a base plate 18 and a plurality of cross-bars or rods 19 and 21 which have been omitted from Fig. 1 in order not to obscure the underlying parts. The side bars are also connected by a pair of cross-bars or rods 22 and 23 which serve as tracks or guides upon which the carriage is supported and is guided in its lateral movements as will be later explained.

Referring now to Fig. 7, it will be observed that the carriage consists primarily of a yoke-shaped member preferably of cast construction and comprising the two longitudinally extending side members 24 and 25 rigidly united at their rear ends by a cross-member 26. The carriage is further strengthened by a cross-rod 27 rigidly uniting the side members intermediate their ends. The cross-member 26 is equipped with a rearwardly projecting pintle 28 upon which is rotatably mounted a truncated roller 29 which travels upon the guide rod 22 and serves to support the rear end of the carriage. The front end of the carriage is provided with a pair of laterally extending ears 31 and 32, respectively, which carry the rotatably mounted, grooved rollers 33 and 34, these rollers being designed to travel upon the guide rod 23, and to support the rear end of the carriage. The carriage is normally urged from the position shown in full lines in Fig. 7 toward the position indicated in dotted lines by a contractile spring 35 attached at one end to the carriage and at its other end to the side member 16 of the main frame.

The full-line position of the carriage shown in Figs. 1 and 7 is its normal position before operation of the machine is begun, and at each actuation of a key the carriage is permitted to automatically move one step or space to the left, viewing Fig. 5, under the influence of the spring 35, and this step-by-step movement is continued until a key for each digit in the number to be added has been actuated, whereupon actuation of the handle serves to restore the carriage to normal position. The mechanism by which this step-by-step spacing movement of the carriage is effected will now be described:

Referring to Figs. 2 to 5, inclusive, and also Fig. 7, it will be seen that upon the lower front edge of the carriage there is fixedly mounted a bar or plate 36 provided on its lower edge with serrations or teeth 37. This bar is secured to the carriage by a pair of screws 38 and 39 which pass through round apertures in the bar of approximately the same size as the screws, and are threaded into tapped openings in the carriage. Upon these screws outside the bar 36 there is slidably mounted a bar 40 also provided on its lower edge with serrations or teeth 41 equal in size and number to the teeth 37 on the bar 36. This bar 40 is slidably mounted upon the screws by reason of elongated slots 42 and 43 through which the screws 38 and 39, respectively, pass. A coiled expansion spring 44 disposed in a socket formed in the plate 40, as shown in Fig. 5, normally tends to move the plate 40 to the left, viewing Fig. 5, so that the right-hand ends of the slots 42 and 43 abut against their respective screws.

The carriage is held against spacing movement under influence of the spring 35 by means of a U-shaped member 45 pivotally mounted in a post 46 projecting upwardly from the base plate 18, the rear arm of this member being shaped to provide an upwardly disposed pawl 47 adapted to engage with the teeth 37 and 41 of the bars 36 and 39. The forward arm 48 of the member is attached to the lower end of an element 49 swingingly mounted at its upper end upon the shaft 51 which extends transversely of the machine and is journaled in the side members of the main frame, and is provided at its right-hand end with an operating handle 52 the purpose of which will be later described. A contractile spring 53 attached at one end to the post 46 and at its other end to the element 49 normally tends to move the dog 47 into engagement with the teeth of the bar 36. Return movement of the pawl into engagement with the teeth of the bar 40 is effected by the type bar actuating member 54 swingingly mounted upon the shaft 51 as will be later described. This member is normally maintained by gravity in the position shown in Fig. 4 and its forward edge engaging with the element 49 moves this element to the right, viewing Fig. 4, and retains it in the position shown in this figure with the pawl 47 engaged with the teeth 41 of the bar 40. Upon movement of the member 54 to the left, viewing Fig. 4, by the actuation of a key, as will be later described, the spring 53 moves the member 45 to the left bringing the dog 47 into engagement with the bar 36. Upon disengagement of the dog 47 from the bar 40 this bar is moved by the spring 44 to the left, viewing Fig. 5, a distance equal to one tooth, the extent of movement being limited by engagement of the ends of the slots 42 and 43 with the respective screws 38 and 39. The carriage is thereby held stationary until the member 54 returns to normal position shown in Fig. 4. The return movement of this member through the instrumentality of the element 49 moves the pawl 47 from engagement with the bar 36 into engagement with the bar 40. Since the spring 35 is much

stronger than the light spring 44, the whole carriage will now be moved one step to the left, viewing Fig. 5, the extent of this movement being limited by engagement of the left-hand ends of the slots 42 and 43 with the screws 38 and 39. This operation is repeated at each actuation of a key, and the alternate engagement of the pawl 47 with the rack bars 36 and 40 permits the carriage to be moved to the left one step or tooth at each actuation of a key, which movement is continued until a key corresponding to each digit in the number to be added has been actuated. After the requisite number of keys have been actuated, the carriage is disposed somewhere near the position shown in dotted lines in Fig. 7. Restoration of the carriage to normal position, which takes place after the printing and adding has been effected, as will be later explained, will now be described.

Referring to Figs. 2, 3 and 7, it will be observed that upon a stud 55 projecting upwardly from the base plate 18 there is pivotally mounted a lever 56 which is connected at its other end with the carriage by means of a link 57 pivoted at 58 to the lever 56, and at 59 to the bottom of the carriage. The lever 56 is provided intermediate its ends with a stud 61 preferably surrounded by an anti-friction roller 62.

Upon a stud 63 also projecting upwardly from the base plate 18 there is mounted a bell-crank lever one arm 64 of which is connected by link 65 with the lower end of an arm 66 fixed upon the shaft 51. The other arm 67 of the bell-crank lever has pivoted at its outer end a dog 68, the swinging movement of which is limited in one direction by a stop 69 on the arm 67. Upon swinging movement of the handle 52 from upright position shown in Fig. 3 to the position shown in Fig. 4 the bell-crank lever is swung by the link 65 from the position shown in full lines in Fig. 7 to that shown in dotted lines so that the notched outer end of the dog 68 is disposed to the left of the stud 61 on the lever 56. Upon return movement of the handle 52 from position shown in Fig. 4 to that shown in Fig. 3 the bell-crank lever will be swung in a counter-clockwise direction, forcing the dog 68 against the stud 61, and thereby swinging the lever 56 from the position shown in dotted lines to that shown in full lines in Fig. 7, thus restoring the carriage to normal position. It will be obvious that since the extent of movement of the handle 52, and consequently the bell-crank lever, is always the same, the carriage will be restored to normal position irrespective of the number of spaces that it has moved due to manipulation of the keys in the manner previously explained. To recapitulate, at each actuation of the key the carriage is spaced one step, and at each actuation of the operating handle the carriage is restored to normal.

The operating keys which have been previously mentioned are indicated by reference character 71, and these keys, ten in number, are arranged in two rows as shown, and are pivotally mounted upon the shaft 51. Suitable spacing elements 72 are interposed between the keys to maintain them in the requisite spaced relation. Each key is shaped, as shown in Figs. 3 and 4, to provide a rearwardly disposed abutment face 73, and the keys are normally held in the elevated position shown in Fig. 4 by contractile springs 74 each attached at one end to a key and at its other end to the front portion 17 of the main frame, there being, of course, one spring 74 for each key.

The type bars which are actuated by these keys are pivotally mounted upon a rod 75 carried by the forward end of the carriage. In the present instance the machine is shown as comprising nine of these type bars, although it will be obvious that this number may be increased without affecting the principle of operation if the requirements of the machine should demand more bars. These type bars, indicated generally by reference character 76, are shaped as shown in Figs. 2, 3 and 4, and each comprises a finger 77 projecting forwardly from the shaft 75, and a downwardly and rearwardly projecting portion upturned at its rear end, and provided on the forward face of the upturned portion with a series of teeth 78. The rear faces of these upturned portions are wider than the bodies of the type bars, and these faces are equipped with the ten digit characters indicated by reference character 79 preferably arranged consecutively from top to bottom from 1 to 0, respectively. These characters are elevated above the faces of the bars, and are adapted to print through a ribbon upon a sheet or strip of paper 81 interposed between a platen 82 and the ribbon 83.

One of these type bars is moved about its pivot into position to bring the desired digit character in opposed relation to the platen at each actuation of a key, and the mechanism by which this variable movement will be imparted to the type bars from the keys will now be explained.

Referring to Figs. 1, 3 and 8 to 10, inclusive, it will be observed that upon the shaft 51 there are pivotally mounted two members which I will term the type-bar actuator 54 and the type-bar stop 84. The type-bar actuator, shown in detail in Figs. 8 and 9, comprises an arcuate body or plate 85 provided with forwardly extending ears 86 which are journaled upon the shaft 51. The rearward portion of the actuator is provided substantially centrally with a rearwardly extending arm 87 carrying at its

outer end a roller 88 which is disposed directly beneath the first type bar when the carriage is in normal position. Upon depression of any key 71 the abutment face 73 of this key will engage with the forward edge of the actuator body 85 and swing the actuator upwardly about its pivot shaft 51, thereby causing the roller 88 to engage the type bar forwardly of its pivot 75, and upon continued upward movement of the roller the type bar will be swung upwardly at its rear end from full-line position shown in Fig. 4 toward the dotted-line position shown in this figure, the extent of such movement being dependent upon the particular key which has been actuated.

In order that each key may impart an individual amount of movement to the type bar, the rear edge of the actuator body 85 is provided with ten distinct actuating portions, one for each of the ten keys, and each portion or surface being disposed in a different radial plane about the pivot shaft 51 and in position to be engaged by the abutment face 73 of its respective key. Since all the keys are designed to be depressed a uniform amount at each actuation, any full-stroke mechanism of well-known or preferred construction (not shown) being employed to insure a uniform depression of the keys, it will be obvious that the actuation of any key will impart to the type bar a predetermined movement, and that the extent of this movement will be different for each key depressed. The actuating surfaces 87 are so designed and arranged that the actuation of any key will cause the type bar to present in opposed relation to the platen that digit character on the type bar which is identical with the character on the key which has been actuated. For instance, if key number 2 is depressed, the type bar will be moved upwardly two spaces so that digit character 2 will be in position to print when thrown into cooperative relation with the platen, and if key number 7 should be actuated, the type bar will be moved seven spaces instead of two so as to present digit character number 7 to printing position. It will thus be manifest that the depression of any key will cause the movement of the corresponding digit character on the type bar into printing position.

Since the keys are actuated with considerable rapidity and varying degrees of force depending upon the operator, I have provided mechanism which will prevent overthrowing of the type bars, thereby insuring presentation to printing position of the requisite digit character. This mechanism consists of the stop member 84, Figs. 1, 3, 10 and 11, similar in general construction to the actuator member 54, and comprising a body portion 88 carried by forwardly extending ears 89 journaled upon the shaft 51. The upper edge of the body 88 is equipped with an upwardly projecting stop 91 disposed in a vertical plane coincident with the actuating roller 88 and the overlying type bar, this stop being adapted to engage the rearwardly projecting finger 77 of the type bar to limit the swinging movement of the type bar. For the purpose of positioning the stop 91 in the requisite cooperative relation with the actuating roller 88, the rear edge of the stop body 88 is also provided with ten actuating faces or portions 92 corresponding in position to the faces 87 on the member 54, and each disposed in a different radial plane about the shaft 51 so as to be complementary to its companion actuating face 87. The stop member 84 is, therefore, by reason of the varying positions of the actuating faces 92 adapted to be moved a different distance by the abutting face 73 of each key. When, therefore, any key is actuated both the actuator member 54, and the stop member 84 will be swung about the shaft 51 a distance dependent upon the particular key actuated, and the roller 88 will throw the rear end of the type bar upwardly the required amount, while the stop 91 will at the same time be brought into engagement with the forwardly projecting finger 77 of the type bar so as to prevent overthrow of the type bar. The cooperative action of these two members which are simultaneously operated by any key, positively insures the accurate positioning of a type bar so that the digit character which corresponds with the digit character of the key actuated will be presented to printing position. For instance, key No. 1 will engage the second surface from the right hand end and move the actuator the minimum amount; key No. 2 engages the fourth surface and moves the actuator a slightly greater amount; key No. 3 engages the sixth surface; 4 the eighth; and 5 the last one at the left of the actuator. No. 6 engages the first one at the right; 7 the third from the right; 8 the fifth; 9 the seventh; and 0 engages the second from the left which is cut so deeply that no movement is imparted to the type-bar, the 0 being disposed at the upper end of the bar.

As soon as the pressure on any key is withdrawn, the key is immediately returned to normal position by its spring 74, and the actuator 54 and also the stop member 84 are returned to the normal position shown in Fig. 4 by gravity, or, if preferred, by light springs (not shown). In order to prevent the type bar from also returning to normal position, I have mounted upon a rod 93 extending transversely of the carriage a series of dogs or ratchet pawls 94 one for each type bar and each disposed in alignment longitudinally of the machine

with the forward faces of the type bars, and normally urged into engagement with the teeth 78 by contractile springs 95 each attached at one end to a pawl and at its other end to a rod 96 extending transversely of the carriage. When, therefore, a type bar has been moved into operative position by the actuation of any key, as shown in Fig. 3, it will be maintained in this position by its dog 94 so that it cannot return to normal position upon the return of the key and the actuator.

It has previously been explained how upon each actuation of a key the carriage will be spaced one step with respect to the main frame, and the mechanisms carried thereby. Assume now that a key has been actuated to position a type bar in the manner just explained. Upon release of the key the carriage will be spaced one step so as to bring the next type bar into alignment with the actuating roller 88 and the type bar stop 91. Upon actuation, now, of another key, or the same key, this second type bar will be moved into operative position to present to the printing platen that digit character on the type bar which corresponds to the character on the key actuated. This positioned type bar will likewise be retained in position by its dog 94, and the carriage will be spaced another step. These operations are repeated at each actuation of a key so that the type bars are successively and accurately positioned until the whole number to be added has been set up, so to speak on the type bars by successive key actuations. Since in setting up a number the operator always begins with the left-hand, or largest, figure of the number, it will be obvious that irrespective of the size of the number the various digits of which it is composed will always appear on the type bars in the proper vertical columns. A number having been set up in the manner explained by successive actuations of the keys, the next operation is to move the type bars bodily rearwardly into cooperative relation with the platen to print the set-up number upon the strip of paper. The mechanism by which this printing operation is effected will now be described.

Referring now to Figs. 1 and 2, it will be observed that a transverse shaft 97 is mounted at its ends in the side members of the main frame, and carries near its left-hand end, looking at the machine from the front, a cam 98, the contour of which is repeated for each 180 degrees. Upon a rod 99 extending transversely of the main frame at its rear end there is mounted a curved arm 101 which extends upwardly and forwardly, and is provided at its forward end with a roller 102 overlying the cam 98. An oscillating frame 103 comprising forwardly extending side members 104 and 105 is also pivotally mounted upon the rod 99, and in this frame upon a transversely extending shaft 106 are rotatably mounted a plurality of accumulator wheels each consisting of a spur gear 107 and a digit character carrying disc 108 provided on its periphery with digit characters 109 similar to those upon the rear faces of the type bars. Upon the shaft 106, and at the left-hand end thereof, there is loosely mounted a hub which is provided with a small handle 111 and two radially projecting shoulders 112 and 113, the shoulder 113 being considerably longer than the shoulder 112 for a purpose which will be later explained. Normally the handle is positioned as shown in Fig. 2 so as to interpose the shoulder 112 between the shaft 106 and the roller 102 with the result that when the cam 98 is rotated in a counter-clockwise direction, viewing Fig. 2, upward and rearward movement of the roller will impart through the shoulder 112 a similar movement to the shaft 106 and the frame 103 in which this shaft is mounted. This movement will bring the spur gears 107 into mesh with the gear teeth 78 on the type bars which have been positioned and spaced by the key actuations into longitudinal alignment with these gears.

Initial movement of the cam 98 from the position shown in Fig. 2 will produce interengagement between the spur gears and the type bar teeth, and as the high point 115 of the cam passes beneath the roller 102 it will impart an additional upward and rearward movement to this roller in the direction of the platen, which, through the shoulder 112, the shaft 106 and the gears 107 will move the type bars bodily rearwardly into cooperative relation with the platen to effect the printing of the digit characters which have been positioned by the type bars in opposed relation to the platen. This bodily movement of the type bars into printing position does not take place relatively to the carriage, but on the contrary the entire carriage moves rearwardly under the influence of the type bars, this movement being a rearward movement of the carrying rollers 29, 33 and 34 rearwardly with respect to their guide rods 22 and 23. As a result of the inclination of the faces of these rollers the entire carriage is caused to move rearwardly and upwardly so as to bring the type bars into cooperative relation with the platen to accomplish the printing. After the high point 115 of the cam has passed the roller 102 and the printing has been effected, the gears 107 of the accumulator wheels will still be maintained in mesh with the teeth of the type bars by the cam 98 in its further movements for a purpose which will presently appear.

The shaft 97 and the cam 98 carried there-

by are rotated through 180 degrees upon each rotation of the handle 52, ninety degrees of the rotation being effected upon the downward movement of the handle, and the other ninety upon upward or return movement thereof. For the purpose of effecting these movements of the shaft 97 from the handle two links 116 and 117 are employed, these links being both pivotally connected at their forward ends by a pin 118 with an arm 119 projecting downwardly from the shaft 51 upon which the handle 52 is fixed. The rear end of the link 116 is pivotally connected at 121 with an arm 122 sleeved on the shaft 97, and at this pivotal connection it is provided with a pawl 123 adapted to engage in the notches 124 of a member 125 fixed on the shaft 97. The arm 117 is likewise pivoted at 126 to an arm 127 sleeved on the shaft 97 and is provided at its pivotal connection with a pawl 128 adapted to engage with the notches 129 formed in the periphery of a member 131 fixed on the shaft 97. Upon downward movement of the handle 52 from the position shown in Fig. 3 to that shown in Fig. 4 the rear ends of the links 116 and 117 and the pawls carried thereby will move in opposite directions about the axis of the shaft 97. The pawl 128 during this movement will by its engagement with one of the notches 129 rotate the shaft 97 ninety degrees in a counter-clockwise direction, viewing Fig. 2, while the pawl 123 will move idly. Upon return or upward movement of the handle the pawl 123 will engage with one of its notches 124 and rotate the shaft 97 ninety degrees farther in a counter-clockwise direction, pawl 128 during this movement returning idly to the position shown in Fig. 2. It will thus be obvious that at each complete actuation of the handle 52 the shaft 97 will be rotated through 180 degrees as the result of the two ninety-degree movements imparted to it successively by the links 117 and 116. The position of the parts at the limit of the downward movement of the handle 52 is illustrated in Fig. 4. After the printing has been effected and while the accumulator gear wheels 107 are still in mesh with the rack teeth on the type bars, the type bars are restored to normal position, thereby rotating the accumulator wheels a distance dependent in each wheel upon the extent of movement of its type bar necessary to restore it to normal position. In order to permit of the restoration of the type bars to normal position, it is, of course, necessary that the retaining dogs 94 be withdrawn from engagement with the type bar teeth 78. This result is accomplished by means of a rock shaft 132, a detail showing of which appears in Fig. 12. This rock shaft has its ends journaled in the side members 15 and 16 of the main frame, and intermediate its ends the shaft is offset as shown in the drawings, the offset portion lying just forwardly of the tails of the dogs 94. Upon the shaft there is adjustably mounted a tappet block 133, and upon the shaft 97 in alignment with this block is mounted a cam 134. This cam is designed to engage the tappet block just after the printing operation has been performed, and to swing the offset portion of the shaft rearwardly against the tails of the dogs 94, thereby withdrawing these dogs from engagement with their respective type bar rack teeth so as to permit return movement of the type bars. For convenience in assembling, the rock shaft 132 is preferably made in two parts, as shown in Fig. 12, and these parts are rigidly connected together by the tappet block 133 which is clamped thereon by clamping-screws 135, the position of the tappet block on the shaft being readily adjustable so that it may be properly positioned with respect to the cam by simply loosening these clamping-screws.

After the retaining dogs have been withdrawn from engagement with their type bars a restoring member 136 fixed to the shaft 51 and disposed beneath the fingers 77 of the type bars engages these type bar fingers as the handle approaches its downward limit, thereby swinging the type bars about their pivots until when the handle reaches its extreme downward movement, as shown in Fig. 4, the type bars are all restored to normal position as shown in this figure. In other words, if a type bar when in set-up position was disposed as shown in dotted lines in this figure, it would be restored from the dotted-line position to the full-line position shown by the restoring member 136 upon downward movement of the handle 52.

During the restoring movement of the various type bars each type bar with which a gear 107 was engaged would rotate such gear a distance dependent upon the extent of movement of the type bar. For instance, if one type bar had been moved upwardly two spaces to present the digit character 2 to printing position, its restoring movement would rotate its accumulator wheel two teeth, and if another type bar had been moved so as to present digit character 7 to printing position, its restoring movement would rotate its accumulator wheel seven teeth. Whatever numbers, therefore, were set up on the type bars would be transferred by the restoration of the type bars to the accumulator wheels. Overthrow or accidental displacement of the accumulator wheels is prevented by spring-pressed pawls 140, as best shown in Fig. 4.

The accumulator wheels it will be understood are each actuated independently from another by the type bars with which their spur gears are in mesh. Each of these ac-

cumulator wheels carries ten digit characters as is customary, and it will be obvious that when any wheel has made a complete revolution, the next higher wheel should be moved one step to carry the total represented by the wheel into the next column. Obviously this result coult not be accomplished by a direct connection between the wheels adapted to be actuated at each revolution of a wheel for the reason that the wheels are simultaneously in mesh with their type bars, and the additional movement of one wheel could not be imparted to it by the adjacent wheel of the next lower order so long as this meshing engagement between the accumulator wheel and its type bar existed. I have, therefore, made provision for carrying or transferring from a lower to a higher order of wheel after the accumulator gear wheels have been withdrawn from mesh with the type bars. This disengagement of the accumulator wheels from the type bars automatically takes place when the cam 98 has completed practically a half revolution so as to permit the roller 102, and consequently the pivoted frame 103 to move away from the type bars.

Referring now particularly to Figs. 3 and 4, it will be observed that one tooth on each accumulator wheel is longer than the others, this long tooth being indicated by reference character 137. Upon the rod 138 extending transversely of the frame 103 I have pivotally mounted a series of latch members 139, one for each accumulator gear wheel. The rear end of each of these latch members is provided with a rounded boss 141 which is maintained in engagement with the periphery of its spur gear 107 by means of a contractile spring 142 which connects the dog 137 with the latch member 140, thus maintaining both the dog and the latch member in contact with the gear wheel. The other arm of the latch member is adapted normally to underlie a horizontal shoulder 143 formed on a pawl 144 pivotally mounted at 145 upon a member 146, which in turn is pivoted upon a rod 147 carrying the dogs 137, this member 146 being adapted to normally rest upon a rod 148 extending transversely of the frame 103.

It will be observed that the operative end of the pawl 144 is normally held by the latch member 139 out of engagement with the teeth of the spur gear 107. When, however, during the rotation of the gear the long tooth 137 thereof engages the boss 141 of the latch, the opposite end is withdrawn from the shoulder 143 permitting the pawl to drop into the position shown in Fig. 3 where it is supported by engagement of the shoulder 143 with the cut-out shoulder 149 of the latch member, 139. There is one of these sets of pawl mechanisms for each accumulator gear 107, and it will be obvious that when a pawl has been lowered into the position shown in Fig. 3 its rear end is in position to engage with the tooth of its gear 107 and rotate the gear a distance of one tooth upon rearward movement of the pawl which is effected by upward swinging movement of its carrying member 146 about its pivotal shaft 147.

Referring now to the mechanism for actuating these accumulator pawls, attention is first directed to a cylinder 151 mounted upon a shaft 152 which is journaled at its ends in the side members 15 and 16 of the main frame, the cylinder being disposed in alignment longitudinally of the machine with the accumulator wheels and their actuating pawls, as will be evident from Fig. 1. This cylinder is provided on its periphery with radially projecting pins or studs 153 each of which is disposed in alignment longitudinally of the machine with a shoulder 154 formed upon the forward face of the upturned portion of its respective member 146. Upon rotation of this cylinder in a clock-wise direction, viewing Figs. 2, 3 and 4 when the frame 103 is in lowered position, as shown in Figs. 2 and 3, the shoulder 154 of each member 146 will be engaged by its respective stud 153, whereby this member will be swung by the stud in a counter-clockwise direction about its pivot 147. If the pawls 144 are supported upon the end of the members 139 so that they are in position to engage the teeth of the gears 107, this rocking movement of the members 146 will simply carry the pawls rearwardly in an idle movement which will not actuate the gears 107. When, however, a pawl 144 has been dropped into operative relation with respect to its gear 107 by the engagement of the long tooth on the gear with the member 139 as has been previously explained, the pawl, then being in the position shown in Fig. 3, will upon rearward movement move this gear a distance of one tooth in a counter-clockwise direction, thereby bringing the next higher digit numeral into registering position on the accumulator wheel.

The shaft 152 is given a complete rotation upon each downward movement of the handle 52, and also upon each rearward movement thereof. This rotation of the shaft 152 and its cylinder is effected by means of a gear 150 mounted upon the shaft 152 in position to continuously mesh with a larger driving gear 155 fixed upon the cam-shaft 97. The ratio between the gears 150 and 155 is a one to four ratio so that a complete rotation of the shaft 152 and its cylinder 151 will be effected at each ninety-degree rotation of the shaft 97. Since initial downward movement of the handle 52 rocks the frame 103 through the instrumentality of the cam 98, as has been previously explained, so as

to elevate the forward end of this shaft and bring the gears 107 into mesh with their respective type bars, it will be evident that the shoulders 154 are disposed by the movement of the frame 103 out of the path of travel of the studs 153 so that upon downward movement of the handle 52 the cylinder 151 rotates idly. Near the completion of the downward stroke of the handle 52 the frame 103 returns to normal lowered position, and the type bars are subsequently restored to normal position as has been previously explained so that upon rearward movement of the handle all of the pawls 144 will be actuated by the cylinder studs 153. Only those pawls, however, which have been positioned in cooperative relation with their gear wheels 107 by the action of the long tooth on the gear wheel will perform any function, and these pawls will move their gears to perform the carrying operation which results in the presentation of a next higher digit character on those accumulator wheels which are next higher in order than the wheels which have completed a revolution so as to bring their long teeth into pawl-releasing operation.

From the foregoing it will be understood that the restoring movement of each type bar will add to its respective accumulator wheel a number of digits equal to the number presented in printing position by the type bar, and these numbers are added to the accumulator wheels irrespective of the previous position of the wheels and without at this time carrying from any wheel to the wheel of the next higher order. After the restoring movement of the type bars has been completed and the accumulator wheel gears have been disengaged from the type bars, return movement of the handle 52 will then perform the carrying operation by moving higher one space, each wheel of the higher order the pawl of which has been disposed in operative relation thereto by the long tooth of the wheel of the next lower order. Thus upon a complete cycle of the handle 52 the number represented by the actuated type bars will be accurately added to the number previously appearing upon the accumulator wheels. It should be noted that the printing platen is positioned in alignment longitudinally of the machine with the accumulator wheels, and that the type bars are moved successively into position between the accumulator wheels and the platen upon each actuation of a key by the spacing mechanism which has previously been described, and that upon each complete actuation of the operating handle 52 the carriage upon which the type bars are mounted is restored to normal position, as shown in Fig. 1, so that there is nothing interposed between the accumulator wheels and the platen. Whenever it is desirable to print upon the paper strip the sum total of the numbers which have been listed and printed by the type bars, it is only necessary to bring the accumulator wheels into printing relation with the platen, whereupon the total appearing on the accumulator wheels will be printed. It might be stated at this point that the paper is fed across the platen by a step-by-step movement after each type bar printing operation, but the mechanism for accomplishing this result is not shown herein as it may be of any well known or preferred construction.

The printing of the total by the accumulator wheels is accomplished in the following manner:—

After the listing has been completed and the parts have been restored to normal position as indicated in Fig. 1, the handle or lever 111 is swung on its pivot in a counter-clockwise direction, viewing Figs. 2 and 6, to withdraw the shoulder 112 from between the shaft 106 and the roller 102 and dispose the longer shoulder 113 in operative relation between these members. This operation moves the shaft 106 and the accumulator wheels carried thereby upwardly and rearwardly with respect to the roller 102 so as to bring the faces of the accumulator wheels which are opposed to the printing platen substantially into the plane that the rear faces of the type bars assume during the listing operation and before printing is effected. After lever 111 has been adjusted into the position shown in Fig. 6, the handle 52 is then given a full downward and upward stroke. This operation through the instrumentality of the cam 98 moves the accumulator wheels into printing relation with the platen so as to impress upon the paper strip the number appearing on the accumulator wheels, which number is the total of the numbers previously listed. During this total-printing operation effected by the handle 52 the carrying mechanism and the carriage-restoring mechanism are idly operated since the carrying pawls are all in inoperative position with respect to their gears, and the type-bar carriage is already disposed in normal or restored position. After the total has been printed it is usually desirable to restore the accumulator wheels to zero before the next listing operation is begun. This may be accomplished by manually turning each of the accumulator wheels forwardly or backwardly to zero, or, if preferred, automatic mechanism may be employed for performing this function, I have not deemed it necessary, however, to show this accumulator wheel restoring mechanism in this application as it is not a part of my present invention.

It is believed that the principle of my invention, one preferred embodiment thereof. its mode of operation, and many of the

attendant advantages will be understood from the foregoing without further description, but it should be obvious that the details of construction illustrated and described are capable of considerable modification and variation without departing from the essence of the invention as defined in the following claims.

I claim:

1. In an adding machine, the combination of a pivotally mounted type bar, a plurality of keys, an actuator disposed between each of said keys and said type bar, and adapted to be moved a different distance by each key to positively move said type bar into a predetermined position, depending upon the key depressed, and means also movable a different distance by each key for positively limiting the extent of movement of said type bar to prevent overthrow thereof.

2. In an adding machine, the combination of a type bar, a series of keys, an oscillatable actuator interposed between said type bar and said keys, said actuator being constructed to be moved a different distance by each key depressed, whereby said type bar is moved to a position corresponding to the particular key depressed, and means movable a different distance by each key for positively preventing overthrow movement of said type bar.

3. In an adding machine, the combination of a series of type bars, a series of keys, an actuator interposed between said type bars and said keys, said actuator being provided with abutment surfaces in the path of movement of said keys, said surfaces being each disposed in a different plane, means movable simultaneously with said actuator and by said keys for preventing overthrow of said type bars, and means for presenting said type bars successively in co-operative relation with said actuator.

4. In an adding machine, the combination of a series of pivotally mounted type bars, a series of pivotally mounted keys, a pivotally mounted actuator interposed between said type bars and said keys, said actuator having abutment surfaces disposed in different planes so that upon depression of a key, a type bar will be moved by said actuator into the position depending upon the particular key depressed, an overthrow preventor movable by each key a different distance and means for presenting said type bars in succession in co-operative relation with said actuator.

5. In an adding machine, the combination of a series of pivotally mounted type bars, a series of pivotally mounted keys, an actuator interposed between said type bars and said keys and adapted when actuated by a key to move a type bar a distance corresponding to the particular key depressed, means also interposed between said type bars and said keys for positively preventing overthrow of an actuated type bar, and means for presenting said type bars in succession into position to be actuated by said actuator.

6. In an adding machine, the combination of a series of pivotally mounted type bars, each having an arm projecting on the opposite side of its fulcrum from the type carrying portion of said bar, a series of keys, a pivotally mounted actuator interposed between said type bar arms and said keys, said actuator being equipped with abutment surfaces in different planes so that a different degree of movement is imparted to said actuator by each key, a member provided with abutment surfaces complementary to the abutment surfaces on said actuator for positively limiting the extent of movement of said type bars by said actuator, and means for presenting the type bars in succession into co-operative relation with said actuator after each key actuation.

7. In an adding machine, the combination of a series of type bars, a plurality of keys, means whereby successive key actuations will move said type bars in regular succession irrespective of the order in which the keys are actuated, and a single actuator regulating the extent of movement of each type bar in conformity with the particular key by which its movement is caused.

8. In an adding machine, the combination of a type bar, a plurality of keys, key actuated means for positively moving said type bar a predetermined distance, dependent upon the particular key actuated, key actuated means for preventing overthrow of said type bar, and independent means for locking said type bar in the position to which it has been moved.

9. In an adding machine, the combination of a series of type bars, a series of keys, means interposed between said keys and said type bars for positively moving a type bar upon the depression of a key an amount determined by the particular key depressed, means also actuated by a key for preventing overthrow of an actuated type bar, and means independent of the type bar actuating means for locking each type bar in the position to which it has been moved.

10. In an adding machine, the combination of a plurality of keys, a type bar actuator and a complementary type bar stop, each adapted to be operated by the actuation of any key, a series of type bars, and means for successively presenting said type bars into position to be controlled by said actuator and stop upon successive actuation of said keys.

11. In an adding machine, the combination of a frame, a carriage movable longitudinally and transversely relatively thereto, a series of type bars mounted on said

carriage and each equipped with a series of digit characters, key mechanism including a plurality of keys each adapted to move a type bar so as to present to printing position a digit character corresponding to the particular key actuated, and means including a rotatable cam for moving said carriage and the type bars thereon longitudinally relatively to the frame to produce an impression from said presented digit characters.

12. In an adding machine, the combination with a frame, a carriage movably mounted thereon, a series of type bars arranged on said carriage, a plurality of keys mounted on the frame, a single key-actuated means for positively moving said type bars a distance dependent upon the particular key actuated in each instance, means for moving the carriage so that the type bars are successively positioned for actuation, and means for moving the carriage so as to simultaneously print from all of the positioned type bars.

13. In an adding machine, the combination of a frame, a plurality of keys mounted thereon, a carriage movable on the frame, a series of type bars mounted on the carriage, means for moving said carriage so as to present the type bars successively into position to be actuated, a single key-actuated device whereby said type bars are disposed in various positions dependent in each instance upon the particular key actuated, means for preventing overthrow of each type bar, independent means for locking said type bar in the position to which it has been moved, and means for taking an impression simultaneously from all of the positioned type bars.

14. In an adding machine, the combination of a frame, a plurality of keys mounted thereon, a carriage movable with respect to the frame, a series of type bars coaxially mounted on said carriage, each type bar being equipped with characters corresponding to the various keys, a single key-actuated means movable by each key a different distance for positively positioning a type bar so as to present that character which corresponds to the particular key actuated, and means for moving the carriage with respect to the frame so as to print the characters presented by all of said positioned type bars.

15. In an adding machine, the combination of a frame, a plurality of keys and a handle mounted thereon, a carriage movably mounted on the frame, a series of type bars arranged on said carriage, key-actuated means for moving said type bars relatively to the carriage, means for moving the carriage at each actuation of a key, and means including a rotatable cam for moving said carriage at each actuation of said handle.

16. In an adding machine, the combination of a frame, a plurality of keys and a handle mounted thereon, a carriage movably mounted on said frame, means for moving said carriage transversely of the frame in one direction a predetermined amount upon each actuation of a key, and means operated by said handle for positively moving the carriage longitudinally of the frame, and positively restoring said carriage to normal position transversely of the frame at each complete actuation of said handle.

17. In an adding machine, the combination of a frame, a plurality of keys and a handle mounted thereon, a carriage movable with respect to said frame, a series of type bars pivoted upon said carriage, key-actuated means for positively positioning said type bars on the carriage, key-actuated means for moving said carriage transversely of the frame in one direction at each actuation of a key, means for moving said carriage longitudinally of the frame upon movement of said handle in one direction, and means for restoring said carriage to normal position transversely of the frame upon movement of said handle in the opposite direction.

18. In an adding machine, the combination of a movable carriage, a series of type bars pivotally mounted thereon, a plurality of operating keys, means whereby a type bar will be moved about its pivot to a predetermined position upon the actuation of any key, means whereby said carriage is moved one step transversely of the machine upon each actuation of a key, a handle, a series of dogs for holding said type bars in position, a series of accumulator wheels, means operated by the handle for establishing an operative connection between the positioned type bars and said accumulator wheels, means actuated by the handle for releasing said dogs after said connection has been established, handle-actuated means for restoring said type bars to normal position, thereby rotating said accumulator wheels, and handle-actuated means including a cylinder provided with radial studs for subsequently imparting additional rotary movement to certain of said accumulator wheels, said last-mentioned means being controlled by the position of an accumulator wheel of the next lower order.

19. In an adding machine, the combination of a frame, a carriage movable transversely thereof, a series of type bars pivotally mounted on said carriage, a plurality of keys mounted on the frame, and a type bar actuator interposed between said keys and said type bars, said actuator being provided with a plurality of abutment faces each positioned in the path of travel of a key and each disposed in a different plane, and also having an actuating arm adapted to engage a single type bar upon depression of a key.

20. In an adding machine, the combination of a frame, a carriage movably mounted

thereon and a series of type bars co-axially and pivotally mounted on said carriage, each type bar having a character-carrying portion disposed concentrically with the pivotal mounting of the type bars, a plurality of keys mounted on the frame, a type bar actuator interposed between the keys and said type bars, said actuator having a plurality of abutment faces each adapted to be engaged by a key, and also having a type bar engaging portion adapted to engage a single type bar, and means for moving said carriage upon each actuation of a key to present the type bars successively into position to be operated upon by said actuator.

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