

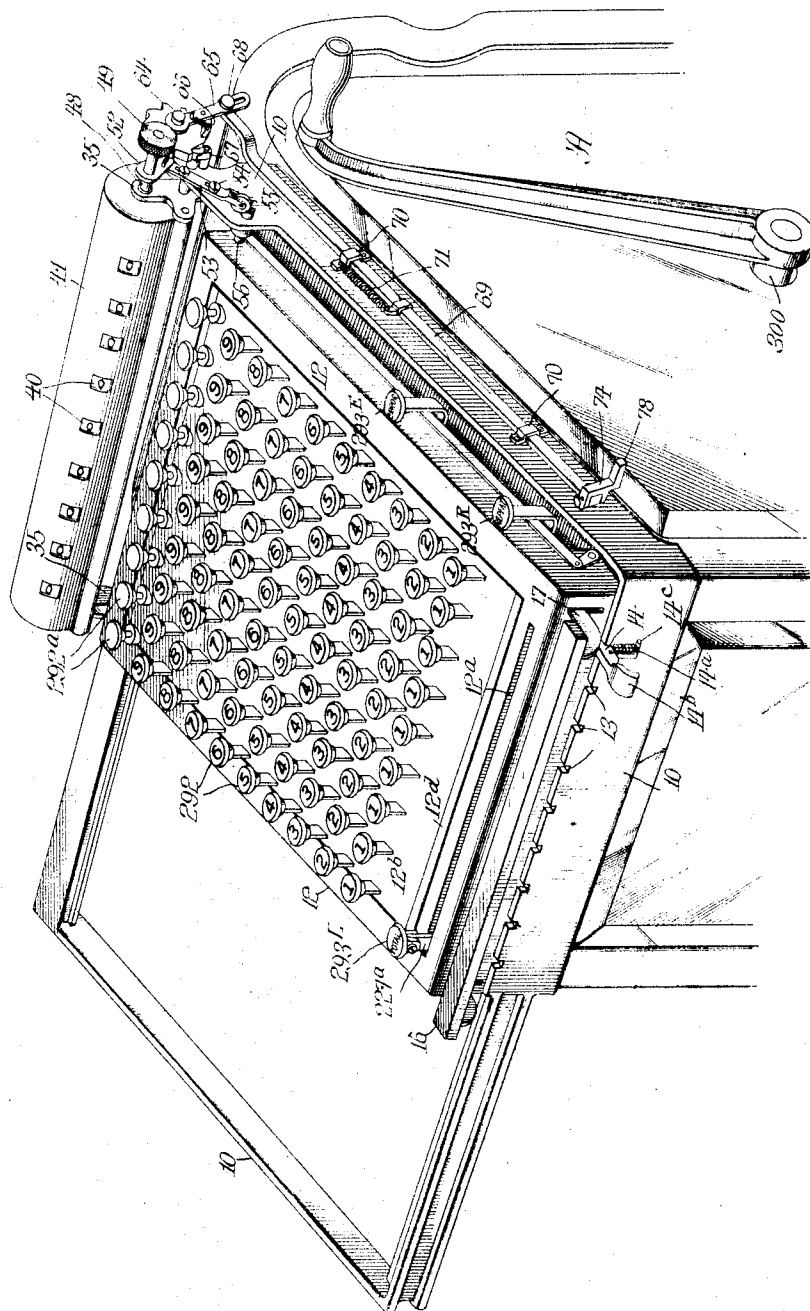
A. L. LANDIS.
COMPUTING ATTACHMENT FOR ADDING MACHINES.
APPLICATION FILED JULY 10, 1906.

987,890.

Patented Mar. 28, 1911.

5 SHEETS—SHEET 1.

Fig. 1



Witnesses:
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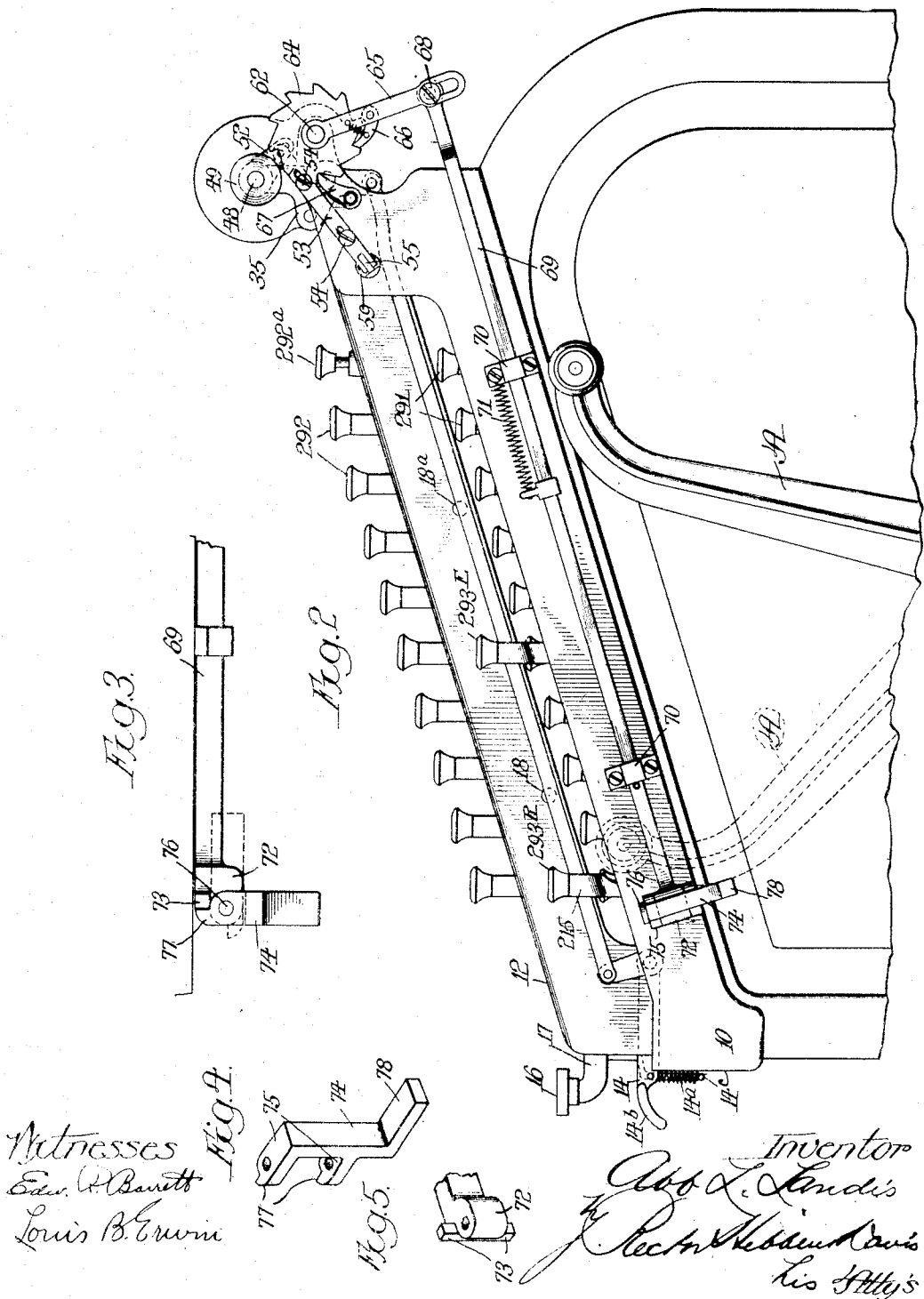
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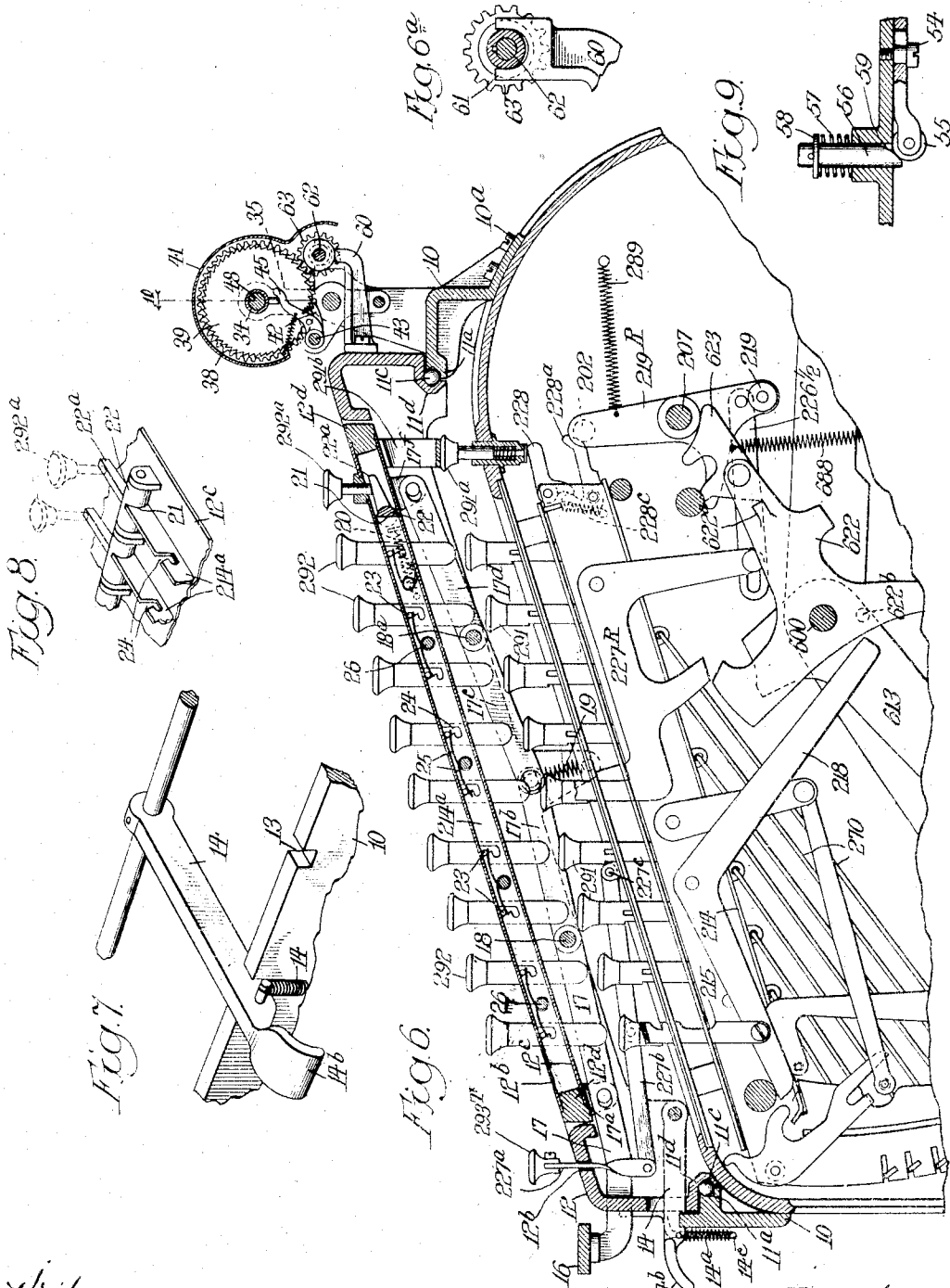


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5 SHEETS—SHEET 3.



Witnesses
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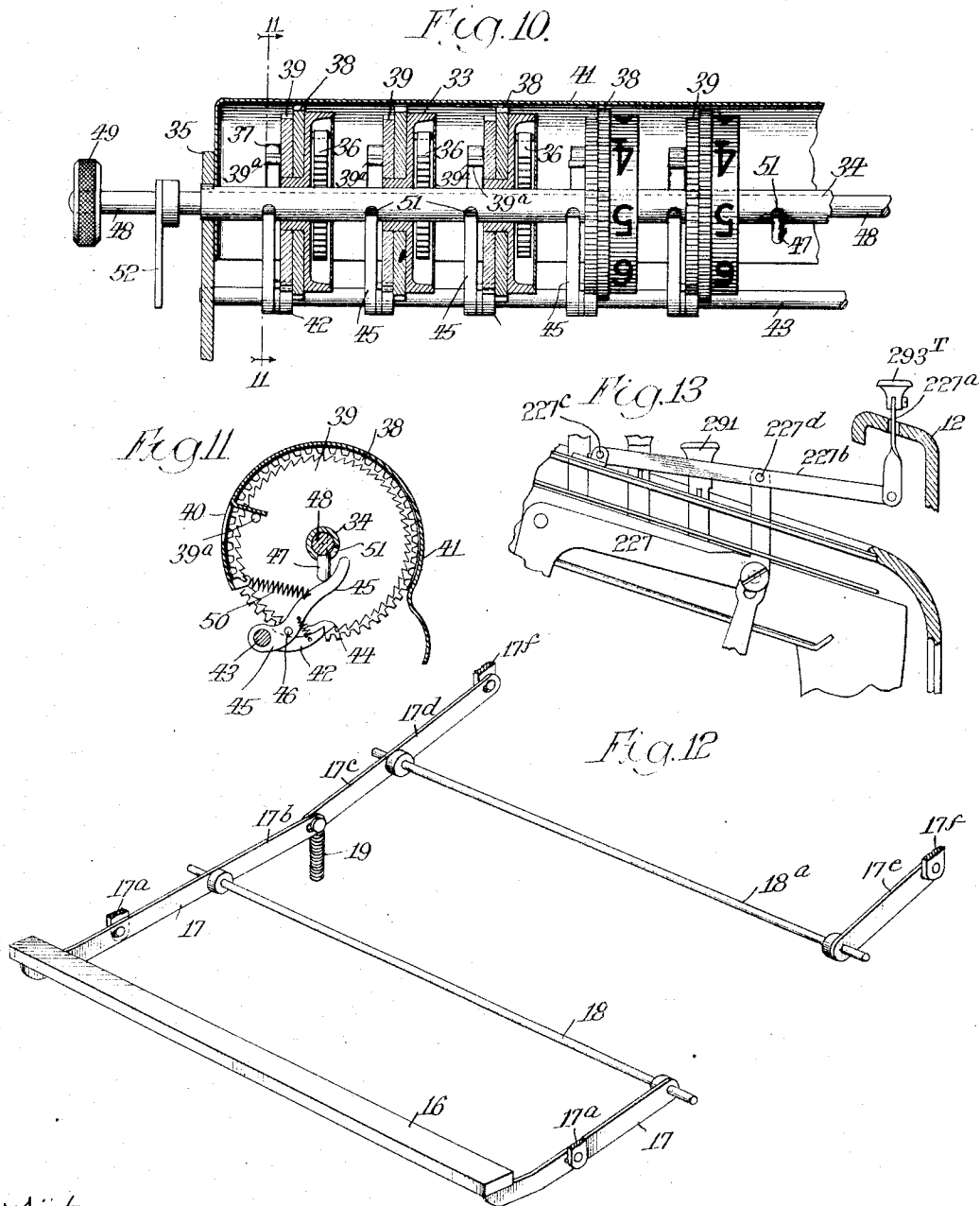
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5 SHEETS-SHEET 4.



Witnesses
Edw. R. Barrett
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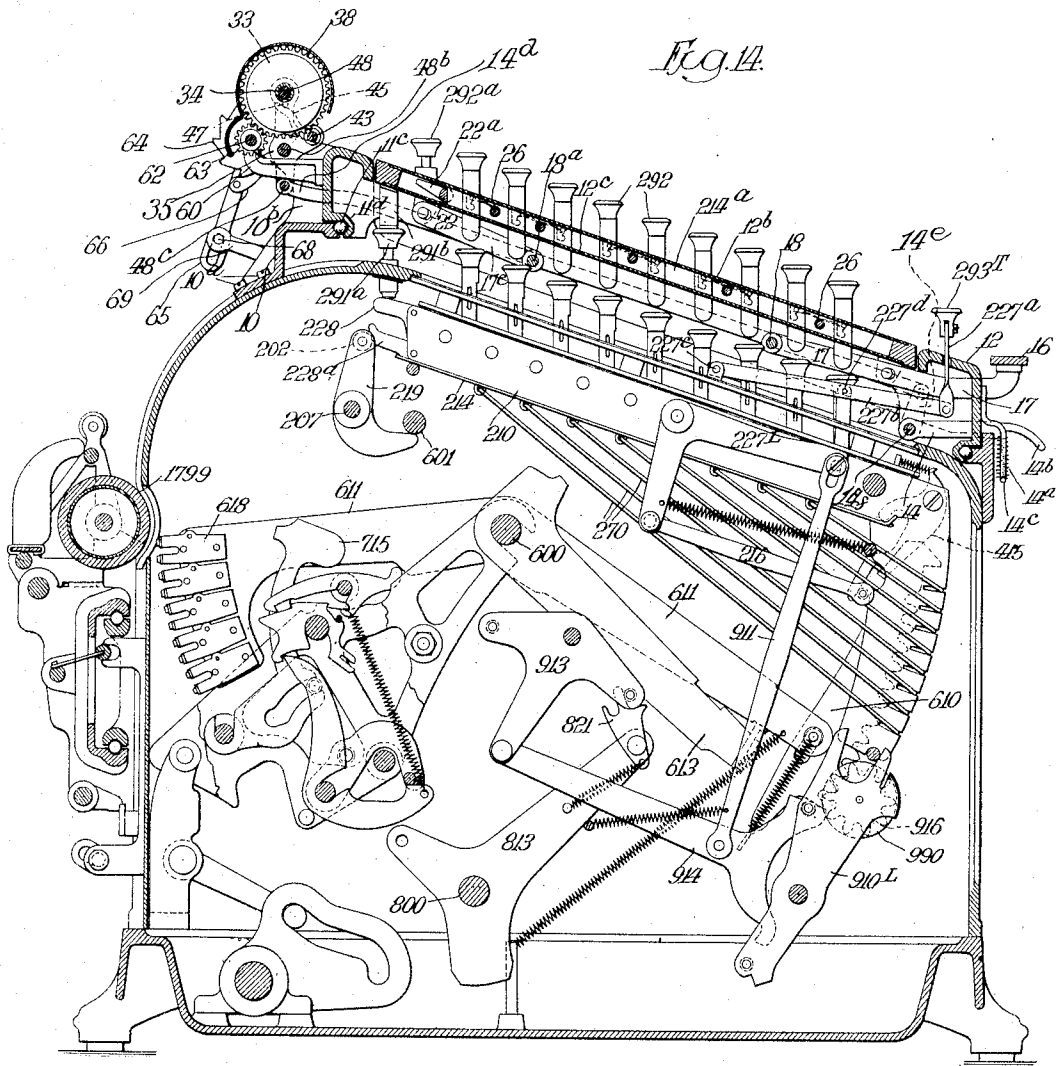
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5 SHEETS—SHEET 5.



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UNITED STATES PATENT OFFICE.

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COMPUTING ATTACHMENT FOR ADDING-MACHINES.

987,890.

Specification of Letters Patent.

Patented Mar. 28, 1911.

Application filed July 10, 1906. Serial No. 325,431.

To all whom it may concern:

Be it known that I, ABB L. LANDIS, a citizen of the United States, residing at Nashville, in the county of Davidson and State of Tennessee, have invented certain new and useful Improvements in Computing Attachments for Adding-Machines, of which the following is a specification.

In general the object of the present invention is to facilitate the employment of an adding machine for performing computations other than simple addition, such as multiplication and division. The well-known adding machine such as now extensively used in banks and mercantile establishments can of course be employed for performing multiplication or division by repeating additions and it is so employed to some extent. By setting up a multiplicand for example through depression of keys representing the digits thereof with the right-hand or units digit in the right-hand column of keys the units' multiplication can be performed by operating the machine a number of times equal to the units represented by the right-hand digit of the multiplier, the usual repeat key having been set in order to keep the keys representing the multiplicand depressed. These keys having been released after operation of the machine the requisite number of times the multiplicand will again be set up on the key-board with the right-hand digit in the second column of keys from the right. The machine will then be operated the number of times required by the tens which the second digit from the right of the multiplier represents. Division can be similarly performed by registering the dividend in the machine and then setting up on the key-board, commencing with the left-hand column of keys, the complement of the divisor, after which the machine will be operated until the register shows less than the divisor and the number of operations noted as the first digit of the quotient. Then by again setting up the complement of the divisor commencing in the second column of keys from the left the machine will be again operated the requisite number of times to ascertain the second digit of the quotient. Of course where the first digit of the divisor is greater than the corresponding digit of the dividend the first digit of the complement of the divisor must be one key

column farther to the right than in cases where the first digit of the divisor is less than the corresponding digit of the dividend.

It has been proposed heretofore to employ means for obviating the repeated setting up of a multiplicand or the complement of a divisor as is required when an ordinary adding machine is being used to perform multiplication or division. The William S. Burroughs Patent No. 388,117, issued August 21, 1888, discloses such means in the form of an auxiliary key-board superposing the adder key-board and movable up and down on a hinge so that finger pieces set in positions over the keys of the adding machine representing the digits of a multiplicand for example will, upon the lowering of said auxiliary key-board, depress such keys. In this Burroughs construction the auxiliary key-board is so lowered the number of times represented by the digit of the multiplier, the parts set by the consequent depression of the adder keys being restored between the operations of the auxiliary key-board. The latter coöperates with a counter to assist the operator in keeping track of the number of times the auxiliary key-board has been lowered, such counter, in the case of division, exhibiting the quotient.

By the present invention it is proposed to provide an attachment, complete in itself, which can be readily applied to any well-known adding machine requiring no alteration in the construction of the latter and in no manner curtailing the ordinary uses to which such a machine is put when simple addition or subtraction is to be performed. In fact the present invention provides for so employing the adding machine without the necessity of removing the computing attachment, the key-board of which may be readily moved to one side to fully expose the key-board of the adding machine. By the present invention the counter for showing the number of operations is made a part of the attachment and located prominently before the operator, preferably facing him rearwardly beyond the computing key-board slightly elevated above the same. This counter according to the present invention is operated by the regular actuator of the adding machine, as for example the customary reciprocating crank-handle, and the

engagement between the same and the counter-operating means is preferably a separable one in furtherance of the design to provide a complete attachment applicable to the adding machine without requiring any special construction of the latter.

The invention further provides for depressing the computing key-board bodily preserving its normal plane so that its finger pieces or keys move rectilinearly and those set for operation will directly impinge against the adder keys, there being no sliding of the parts one against another. Thus depression of the adder keys through the medium of the computing key-board is brought about simply by a direct thrust which insures accuracy and ease of operation.

With these and incidental objects in view the invention consists in certain novel features of construction and combinations of parts the essential elements whereof are recited in the appended claims and a preferred form of embodiment of which is illustrated in detail in the accompanying drawings and fully described hereinafter.

Of said drawings Figure 1 represents the computing attachment in perspective applied to the well-known Burroughs type of adding machine; Fig. 2 represents the same in right-side elevation; Figs. 3, 4 and 5 are enlarged details of a tappet device with which the adding machine handle coöperates to actuate the operations-counter; Fig. 6 represents the computing attachment and upper portion of the adding machine in section from front to rear; Fig. 6^a is an enlarged sectional detail of parts appearing in Fig. 6; Fig. 7 represents in perspective on an enlarged scale certain latching or locking devices; Fig. 8 similarly represents certain key-releasing devices; Fig. 9 represents in horizontal section certain turn-to-zero devices for the operations-counter; Fig. 10 represents partly in longitudinal section and partly in rear elevation the right-hand half of said operations-counter; Fig. 11 is a cross-section on the line 11—11 of Fig. 10; Fig. 12 represents in perspective certain means by which the computing key-board is depressed; Fig. 13 represents partly in left-side elevation and partly in section a portion of the adding machine and the laterally movable carriage of the computing attachment illustrating the manner in which the total key of the adding machine is accommodated; and Fig. 14 represents the adding machine proper in left side elevation with the computing attachment in section, the casing of the adding machine being also shown in section as well as certain cross shafts and studs, and the paper carriage attachment at the rear.

In the present instance a computing attachment constructed in accordance with the

invention is illustrated and described as applied to the well-known Burroughs type of adding machine, exemplified in the William S. Burroughs Patent No. 504,963, issued September 12, 1893, but it is of course to be understood that the invention is not applied exclusively to this kind of adding machine, it being capable of the same uses with adding machines of other makes.

In the present embodiment of the invention a rectangular frame 10 is employed of such form as to rest as a saddle upon the front and rear castings of the adding machine cabinet or casing as clearly shown in Fig. 6. In the present instance the rear bar of this rectangular frame is flanged and secured by screws 10^a to said cabinet or casing although this is not essential and the frame might be held in place by various forms of clamps or fastenings. The frame embraces practically the entire top of the adding machine extending completely around the key-board thereof and it is made to project a considerable distance beyond the left-hand side of the adding machine as shown in Fig. 1. The front and rear bars of this frame are formed as race-ways 11^a for balls 11^b and another rectangular frame 12 constitutes the body of a laterally movable carriage traveling within the larger frame 10 on the ball bearings provided by the race-ways 11^a, balls 11^b and the race-ways 11^d on the frame 12, (see Fig. 6). The latter frame is narrower than the frame 10 and conforms approximately in area with the top surface of the adding machine whose keys 291 are encompassed by this carriage frame. These keys 291 are the customary amount keys of the Burroughs machine arranged in parallel columns ranging from front to rear of the machine and bearing numbers from 1 to 9 in each column.

The reference numeral 291^a designates the usual column-release keys whose heads are blank and whose function is to release any depressed key in a column to correct an error. These column release keys act as usual upon bell-cranks 228 which in turn act upon pawls 228^a, the latter adapted to engage detent strips or bars 214 when the same are displaced by the depression of keys 291.

A transverse slot 12^b in the front bar of the carriage frame 12 accommodates the total key 293^a so that the latter is not affected by the lateral shifting of the carriage. Instead of mounting this key directly on the up-standing portion of the usual bell-crank 227 (Fig. 13) it is shown in the present instance as mounted upon the upper end of a short bar 227^a coupled at its lower end to a lever 227^b, said lever being pivoted at its rear end to the casing of the adding machine as shown at 227^c and jointed at its middle to the said up-standing portion of the bell-crank 227 as shown at 227^d. This construc-

tion is not essential but simply put forward on account of the total key being thereby placed more conveniently and where it can be perhaps more readily accommodated by the computing attachment in the form in which it is here shown.

The reference numerals 293^R and 293^E designate the usual repeat and error key buttons whose stems are shown in the present instance as off-set (Fig. 1) so as to carry them beyond the carriage frame 12 when the latter is in its farthest position to the right. These two keys act as usual, the one to prevent the customary release of depressed amount keys at the conclusion of an operation of the adding machine when it is desired to repeat addition of the same amount, and the other to release all depressed keys before an operation of the machine begins to correct an error. The stem of the error key is part of a bell-crank lever 227^R (Fig. 6) whose depending arm is coupled through a slot and pin connection with a link 226 1/2 jointed to one side arm 219^R of a bail comprising a cross-rod 202 which acts against the pawls 228^a to release the keys in a well-known manner and also to thrust the detent strips or bars 214 forwardly in forcibly elevating depressed keys 291. The bail is drawn rearwardly by a spring 289 and is rocked forwardly in the usual operation of the machine by the camming action of a pawl 623 against a roller 219 on a depending portion of the arm 219^R. This pawl is pivoted on an arm 622 which rocks on the shaft 600 and has a stop projection 622^a against which the tail of the pawl 623 is held by a spring 688, the latter serving to draw the arm 622 downwardly. Through means not necessary to describe this arm is normally held in the elevated position shown in Fig. 6 but in an operation of the adding machine is released from restraint so that the spring 688 may draw said arm downwardly, the pawl 623 wiping over the roller 219 and passing beyond the same. Near the close of an operation of the adding machine said arm 622 is again elevated so that the pawl 623 acting against the roller 219 will cause the cross-rod 202 to act in the manner above described.

The stem 215 of the repeat key is coupled to a bell-crank lever 218 which, when the repeat key is depressed, stands in front of a pin 622^b on the arm 622 thus preventing the lowering of the latter by its spring 688 so that the above described key release and restoration will not take place.

Further describing the machine proper (Fig. 14), 611 designates the usual levers independently pivoted upon the shaft 600 and carrying racks 610 at their forward ends and type 618 at their rear ends. The type are arranged to be driven against the platen 1799 in the usual way by hammers 715, the latter being controlled and operated

by familiar mechanism not necessary to describe in detail. The racks 610 are, as usual, normally upheld by latches 415 and restoring frame 613. The stop rods 270 when operated by depression of amount keys 292 determine the extent of movement of the racks 610 when the machine is operated and the restoring frame 613 swung down. The numeral 916 designates the usual pinions which engage the racks 610 and 990 designates the number wheels compounded with said pinions. The accumulator comprising such pinions and number wheels is, as usual, mounted in the rocking frame 910^L, and the usual pitman 914 coöperates with said frame, being coupled by link 911 with the bell crank 227^L. The reference numeral 913 designates the usual three-armed lever which is jointed to said pitman and rocked back and forth by a wipe plate or pawl 821, mounted upon a swinging arm 813 carried by a rock shaft 800. For a more detailed description of the construction and mode of operation of these parts of the machine proper, reference may be had to the Burroughs patent hereinbefore mentioned No. 504,963.

Within the carriage frame 12 is located the computing key-board proper, the same comprising upper and lower plates 12^b and 12^c spaced apart and held together by marginal bars 12^d. Keys 292 occupy guiding slots in the plates 12^b and 12^c, these keys being arranged in columns the same as the keys of the adding machine and correspondingly numbered from 1 to 9 in each column. Detent bars or strips 214^a are placed on edge between the plates 12^b and 12^c, one of these bars or strips extending along each column of keys 292. Irregular slots 24 in the strip or bar receive respectively pins 23 projecting from the sides of the key-stems, the contour of the slots being such that when any key is depressed its pin acting against an inclined edge of the slot will have the effect of sliding the strip or bar forward against the stress of a spiral spring 20, and then the pin having passed the inclined edge of the slot a shoulder thereof will take over the pin as the spring 20 restores the strip or bar to its normal position. It will be seen that with this arrangement depression of one key will release another in the same column. Springs 25 mounted on suitable studs 26 bear against the undersides of the pins 23 to hold the keys normally elevated. In order to release any depressed key in a column without necessarily depressing another amount key in that same column special release keys 292^a are provided beyond the highest denomination amount keys, these special keys acting respectively upon arms 22^a of short rock-rods 22 which are slotted on their forward sides as shown at 21 to receive the rear ends of the strips or bars 214^a

as shown in Figs. 6 and 8. The bottoms of the slots extend diametrically of the rock-rods 22 and the ends of the strips or bars squarely engage the same so that the depression of any key 292^a will immediately result in the thrusting forward of the detent strip or bar with which it is associated. These special keys 292^a thus serve as a ready means for correcting any errors in setting up amounts upon the auxiliary key-board. This key-board is vertically movable in the carriage frame 12 without any rocking or pivotal movement, the means employed to this end being of the following description:

A bar 16 extends across the front of the carriage, being mounted on the front ends of a pair of arms 17 which are pivotally connected with ears 17^a on the under-side of the auxiliary key-board at the front thereof and thence extending rearwardly to a cross-rod 18 which constitutes a pivotal support for the frame composed of these arms 17 and the cross-bar 16. One of the arms 17 has a rearward extension 17^b jointed to a similar extension 17^c of one side arm 17^d of a somewhat similar frame comprising another side arm 17^e. The two arms 17^d and 17^e are pivotally mounted on a cross-rod 18^a similar to the cross-rod 18 and are jointed respectively to ears 17^f on the underside of the auxiliary key-board at the rear portion thereof. The two cross-rods 18 and 18^a are supported in the side-bars of the carriage 12 and it will be seen that depression of the cross-bar 16 results in the rocking of the two supporting frames for the auxiliary key-board and the consequent lowering of the latter equally at front and rear. A spring 19 attached at one end to a depending lug 19^a of the carriage 12 and at the other end to the joint between the frames acts to depress them at their point of union and thus to elevate their opposite ends and hence the key-board which normally lies flush with the top of the carriage 12 as shown in Figs. 1 and 6.

The arrangement of the keys 292^a is such that the several columns may be brought in line with the columns of keys of the adding machine with one auxiliary key standing directly over each amount key of the regular key-board but spaced therefrom so that the mere depression of a key in the auxiliary key-board does not produce any depression of the regular amount key below. However, depression of an auxiliary key followed by depression of the auxiliary key-board through pressure on the cross-bar 16 will cause depression of the regular amount key below the depressed auxiliary key. At the rear part of the auxiliary key-board there is secured to its underside a yoke 291^b with a horizontal portion in the form of a cross-bar extending above the regular column release keys 291^a so that when the auxiliary key-board is depressed these column release keys

will be likewise depressed and the detent pawls 228^a moved to and held in an inoperative position so that when the auxiliary key-board rises the regular amount keys which were depressed thereby in its downward movement will be immediately restored to normal position.

In the right-hand position of the carriage 12 illustrated in Fig. 1 there is a column of auxiliary keys standing over each column of regular amount keys but this carriage may be shifted to the left to bring the right-hand column of auxiliary keys over any one of the columns of regular amount keys to the left of the right-hand column. In the present instance this shifting of the key-board is done simply by hand, the front bar of the primary frame 10 being notched in its upper edge as shown in Fig. 1 at 13 to properly fix the different positions of the carriage for registering the auxiliary key columns with the regular amount key columns of the adding machine. A latch 14 is pivoted to an interior part of the carriage 12 as shown in Fig. 6 and extends out through a slot in the front of the same for engagement with any one of the notches 13. This latch is normally depressed by a spring 14^a and is formed at its outer end as a finger piece or handle 14^b by which to lift the latch when the carriage is to be shifted. A suitable bracket 14^c depends from the front of the carriage to support the lower end of the spring 14^a.

The counter for showing the number of times the machine is operated is inclosed within a casing 41 of substantially cylindrical form and comprises a series of drums 33 mounted to turn upon a sleeve 34 fixed at its ends in arms 35 supported by the primary frame 10, the latter having at the right-hand side a rearward extension 10^b for the purpose and at the left-hand side an upright 10^c. Springs 36 secured at their inner ends to said sleeve and at their outer ends to the drums tend to turn the latter to positions where they will exhibit zeros through sight-openings 40 in the front of the casing 41, the material of the latter which is cut out to form said sight-openings being turned back as shown in Fig. 11 so as to constitute stop projections 37 for stop pins 39^a carried by the drums. The latter are compounded by the drums. The latter are compounded with gear wheels 38 and ratchet wheels 39 and pawls 42 mounted upon a cross-rod 43 are held by springs 44 in engagement with said ratchets to prevent the turning of the drums by the springs. Arms 45 mounted upon the same cross-rod which supports the pawls 42 have laterally projecting pins 46 to engage said pawls and these arms extend past the ends of pins 47 projecting from a shaft 48 which runs through the sleeve 34 and may be turned by means of a knob 49 at one end thereby to rock the arms 45 and

through the medium of the pins 46 disengage the pawls 42 from the ratchets 39 and permit the drums to be turned to zero by their springs. Springs 50 connecting the arms 45 with the casing 41 normally retract said arms as clearly shown in Fig. 11. The sleeve 34 is slotted as shown at 51 to permit the necessary movement of the pins 47 by the rocking of the shaft 48. This rocking of said shaft, besides being effected by hand whenever desired, is produced automatically by the restoration of the carriage 12 to its right-hand position. To this end an arm 52 is secured to said shaft 48 and slotted to receive a pin on a bar 53, slidably mounted upon the right-hand end of the primary frame 10 as by means of the screws 54 engaging slots in the bar and entering said side of the primary frame. The forward end of this bar carries a roller 55 and in a suitable bearing in the primary frame there is mounted a plunger 56 normally retracted by a spring 57 surrounding it between the frame bearing and a collar 58 on the plunger as shown in Fig. 9. The carriage 12 is allowed a movement slightly beyond that which it requires to bring its right-hand column of keys over the right-hand column of keys in the regular key-board, this extra movement providing for projecting the plunger 56 through the bearing of the frame 10. The outer end of the plunger is beveled as shown at 59 for engagement with the roller 55 so that when the plunger is so projected its action on said roller will result in sliding the bar 53 rearwardly and thus rocking the shaft 48 in such manner as to permit return of the drums 33 to zero position as described.

In order to provide for successively counting the operations of the machine under the different adjustments of the auxiliary key-board, the carriage 12 is equipped at the rear with a bracket 60 having a fork 61 engaging the grooved hub of a gear wheel 63 splined to a shaft 62, journaled in bearings on the rearward extension 10^b and the upright 10^c of the primary frame 10.

It will be seen that the gear wheel will follow the movements of the carriage while at the same time maintaining its rotative connection with the shaft. When the carriage is moved from one columnar position to another the gear wheel is moved out of mesh with one of the gears 38 into mesh with another of said gears. When the said gear wheel is to be disengaged from one of the gears 38 and engaged with another it is preferable to separate the intermeshing gears rather than to simply slide the small gear wheel or pinion from one of the larger gears into the other. Provision is therefore made for rocking the gear wheels 38 away from the small gear wheel 63 whenever the latch 14 is lifted. To this end, the arms 35 which

support the sleeve 34 and shaft 48 are secured to a rock shaft 48^b and united below the latter by a cross rod 48^c. The latter is loosely embraced by the rear end of a long link 14^a which extends along the right-hand side of the frame 12 and at its forward end is jointed to an arm 14^e secured to the shaft 14^f which carries the latch 14. It will be seen that with this arrangement whenever the latch is lifted the link 14^a will be thrust rearwardly, thereby rocking the frame (comprising the arms 35) which carries the gears 38 and the latter separated from the small gear wheel or pinion 63. Thus, when the pinion is shifted laterally, it will have been disengaged from one gear wheel 38 and will move to position for engaging with another gear wheel 38, while the latter is out of position for meshing with the pinion. When the latch 14 is released and its spring 14^a is permitted to draw it down into engagement with one of the notches 13, the link 14^a is, of course, drawn forward and the set of counting gears moved rearwardly so that the one in line with the pinions 63 will become engaged therewith.

The shaft 62 has secured to its right-hand end a ratchet-wheel 64 and there is loosely mounted upon said shaft an arm 65 carrying a spring-pressed pawl 66 engaging said ratchet as shown in Fig. 2. A restraining pawl 67 also engages the ratchet to prevent backward movement of the same and of the shaft. The arm 65 is slotted at its lower end to receive a pin 68 at the rear end of a bar 69 which slides through guides 70 secured to the right-hand end of the primary frame 10. A spring 71 secured at one end to a collar on said bar and at the other end to one of said guides 70 tends to draw the bar rearwardly and thus retract the pawl 66. At its front end the bar 69 is formed with a hinge member 72 and square stop lugs 73. An angular tappet piece 74 is formed with ears 75 which extend above and below the said hinge member 72 and are connected therewith by a pintle 76. The said ears have stop lugs 77 to co-act with the stop lugs 73. The laterally projecting portion 78 of said tappet piece is adapted to be struck by the operating handle A of the adding machine at the end of the latter's forward stroke as illustrated in dotted lines in Fig. 2. This occurs when the tappet piece is adjusted to project at right angles to the bar 69 as shown in Fig. 1 and in full lines in Fig. 3. The engagement of the stop lugs 73 and 77 prevents movement of the tappet piece beyond this right-angle position so that the action of the operating handle A against it results in drawing forward the bar 69 and hence swinging the arm 65 and turning the ratchet wheel 64. In this manner each operation of the adding machine is registered on one or another of

the drums 33. When the operations of the adding machine are not to be counted the tappet piece 74 is swung on its hinge to the dotted line position illustrated in Fig. 3 where it is out of the path of movement of the operating handle A.

It will be seen that mathematical work such as referred to at the outset of this specification can, with great facility, be performed on an adding machine with such a computing attachment as that above described. For example if multiplication is to be done the multiplicand is set up on the auxiliary keyboard by depressing keys in different columns from right to left, *i. e.*, with the units digit of the multiplicand in the right hand column of auxiliary keys. The auxiliary keyboard will be positioned with the latch 14 engaging the farthest notch to the right in the fixed frame 10, so that the right hand column of auxiliary keys will stand over the right hand column of regular amount keys and the other columns of auxiliary keys in similar relation to the other columns of regular amount keys. Depression of the auxiliary keyboard by pressure on the bar 16 will result in depression of regular amount keys immediately below the depressed keys of the auxiliary keyboard. The repeat key 293^a having been depressed and caught down in the regular way so as to disable the automatic key release of the adding machine, the operating handle A will be drawn forward as many times as there are units in the right hand number of the multiplier, the operations of the adding machine thus produced being registered by the turning of the right hand wheel or drum 33 of the counting device, so that by watching the latter the operator can always be informed of the number of times the handle has been operated and is not required to carry this in his head. When the operating handle has been vibrated the requisite number of times the auxiliary keyboard is released and the depressed keys of the adding machine rise with it for the reason that the depression of the auxiliary keyboard disables the detent devices of the adding machine through the action of the yoke 291^b upon the column release keys 291^a, as heretofore described. The necessity for keeping the repeat key depressed during the operations arises from the circumstance that in the type of adding machine here shown the restoring bail ordinarily acts to forcibly elevate the depressed keys at the end of each operation of the machine by the action of the rod 202 against the strip or bar 214. The multiplicand having thus been multiplied by the units digit of the multiplier and the product registered in the regular adding machine counter, the carriage 12 is shifted to the left and the latch 14 engaged with the next notch 13, which results in po-

sitioning the right hand column of auxiliary keys over the next to the right hand column of regular amount keys. The auxiliary keyboard is then again depressed and the handle A operated the number of times represented by the tens numeral of the multiplier. In this manner the tens multiplication is added to the units multiplication in the regular counter of the adding machine. The operation proceeds until the highest decimal number of the multiplier has been used, and the final result will obviously be the correct multiplication. Of course with each shift of the carriage 12 to the left a different wheel or drum of the operations counter is brought into gear with the counting devices operated by the handle A. The final result can of course be recorded by depressing the total key 293^c and operating the handle A according to the usual method of taking a total or subtotal in a Burroughs machine. As such an operation is not to be registered in the operations counter, the tappet piece 74 will be moved to its inoperative position in the manner hereinbefore described.

In performing division, the carriage 12 will be moved entirely to one side of the adding machine keyboard and the dividend will be registered in the latter by simply depressing the proper amount keys and operating the handle A. Then the carriage will be moved back until that column of keys of the auxiliary keyboard in which the left hand digit of the divisor occurs, stands over the left hand column of amount keys in the adding machine keyboard. The complement of the divisor is then set up on the auxiliary keyboard by depressing keys in as many columns as necessary to bring the right hand digit into the right hand column of keys. The depression of the keyboard then of course sets up this complement of the divisor on the keyboard of the adding machine. The handle A is then operated until the regular counter of the adding machine shows a less amount on the wheels thereof which take part in the operation, than the divisor itself. Meantime the number of vibrations of the handle A have been registered on the appropriate wheel of the operations counter so that the first numeral of the quotient will be exhibited through the associated sight opening 40. If the first numeral of the dividend happens to be less than the first numeral of the divisor, then the carriage 12 is set one step farther to the right than as above described. The first numeral of the quotient having been determined in the manner above described, the auxiliary keyboard is released and the carriage 12 moved to the right and then again depressed and the operations of the handle A resumed in determining the second numeral of the quotient. If the first numeral of the remainder

is greater than the first numeral of the divisor the carriage is moved but one step to the right, but if less than the first numeral of the divisor then the carriage is moved two steps to the right before commencing to operate the handle A.

The computing attachment herein disclosed is not only useful in greatly facilitating multiplication and division, but it is advantageous where addition of the same amount is to be repeated and a subtotal taken between each operation. In such case the constant may be preserved on the auxiliary keyboard and does not have to be set up again after each subtotaling operation, as would be the case when using the adding machine for such purposes without the computing attachment. The attachment will also be found useful in facilitating computations where multiplication is performed and an amount then added to the product and then the multiplication repeated. Of course in such a case the multiplicand would change, requiring the release of keys in the auxiliary keyboard and setting up of a new amount after addition of an amount to the first product. Similarly, where division and subtraction are to be alternately performed, the attachment of the present invention will be found useful. Of course instead of performing division in the manner above described the quotient can be ascertained by a process of multiplication using the reciprocal of the divisor as a multiplier.

While means have been here shown and described for disabling the detent devices of the adding machine when using the computing attachment, such means are not necessarily employed. Without them the attachment is perfectly operative and in fact more advantageous in some respects than with such disabling means; for the reason that without such means it is not necessary to hold down the auxiliary keyboard during the operations of the adding machine. With the regular detent devices operating in the adding machine, the auxiliary keyboard can be immediately released after depression because such detent devices will hold down the keys of the adding machine which have been depressed by the depressed keys of the auxiliary keyboard. Of course in such case the repeat key must be set in order to prevent release of the adding machine keys as the operating handle returns to its rearward position. Furthermore it will be necessary at the conclusion of a series of operations of the adding machine to depress the error key 293^e, so as to release depressed keys of the adding machine, or else to release the repeat key before the last operation of the adding machine in a series of multiplying or dividing operations.

While the form of embodiment of the invention here detailed is well adapted to ful-

fill the objects primarily stated, it is to be understood that various modifications can be made therein without departing from the spirit and scope of the invention. Hence in claims which follow the essential elements of the invention are recited without limitation to details of construction.

What is claimed is:

1. A computing attachment for adding machines having rows of depressible keys, the same comprising a depressible and laterally movable keyboard having rows of depressible keys corresponding with those of the adding machine, a detent for each row of computing keys adapted to hold any one of said keys depressed, and a release device for each detent.

2. A computing attachment for adding machines, the same comprising a supporting frame for location in fixed position upon the adding machine with a portion projecting laterally beyond the latter, a carriage laterally adjustable on said frame, and a depressible key-board on the carriage.

3. A computing attachment for adding machines having rows of depressible keys, the same comprising a laterally adjustable carriage and a depressible key-board movably mounted thereon and having rows of depressible keys corresponding with those of the adding machine, and means for holding the computing keys depressed.

4. A computing attachment for adding machines having rows of depressible keys, the same comprising a supporting frame for location in fixed position upon the adding machine with a portion projecting laterally beyond the latter, a carriage laterally adjustable on said frame, and a depressible key-board on the carriage and having rows of depressible keys corresponding with those of the adding machine, and means for holding the computing keys depressed.

5. A computing attachment for adding machines, comprising a depressible and laterally movable key-board superposing the adding machine key-board and means for bodily depressing said computing key-board, the same comprising levers pivoted intermediate their ends and coupled together at their inner ends and to the key-board at their outer ends.

6. A computing attachment for adding machines, comprising a depressible and laterally movable key-board superposing the adding machine key-board and means for bodily depressing said computing keyboard, the same comprising levers pivoted intermediate their ends and coupled together at their inner ends and to the keyboard at their outer ends, and a spring normally depressing the levers at their inner ends.

7. A computing attachment for adding machines comprising a laterally movable carriage, a depressible key-board mounted

thereon, and means for depressing said keyboard the same comprising levers pivoted intermediate their ends and coupled together at their inner ends and to the keyboard at their outer ends.

8. A computing attachment for adding machines comprising a laterally movable carriage, a depressible keyboard mounted thereon, and means for depressing said keyboard, the same comprising levers pivoted intermediate their ends and coupled together at their inner ends and to the keyboard at their outer ends and a spring normally depressing the levers at their inner ends.

9. The combination with an adding machine, of a computing attachment comprising a depressible and laterally adjustable keyboard, means for counting the operations of the adding machine, and means for returning the operations counter to zero controlled by the lateral adjustment of the computing keyboard.

10. The combination with an adding machine, of a computing attachment comprising a depressible and laterally adjustable keyboard, spring-held means for counting the operations of the adding machine, and means for releasing the operations counter by lateral adjustment of the computing keyboard.

11. The combination with an adding machine, of a computing attachment comprising a depressible and laterally adjustable keyboard, counting wheels, operating connections between the same and the adding machine including a member carried by and laterally adjustable with the keyboard, springs for restoring the wheels to zero, and means for restraining said springs controlled by the lateral position of the keyboard.

12. The combination with an adding machine, of a computing attachment comprising a depressible and laterally adjustable keyboard, counting wheels, operating connections between the same and the adding machine including a member carried by and laterally adjustable with the keyboard, ratchets in the wheels, pawls engaging said ratchets, and means for displacing said pawls controlled by the lateral position of the keyboard.

13. The combination with an adding machine, of a computing attachment comprising a depressible and laterally adjustable keyboard, gear-toothed counting wheels, and operating connections between the same and the adding machine including a gear carried by and laterally adjustable with the keyboard.

14. The combination with an adding machine, of a computing attachment comprising a depressible and laterally adjustable keyboard, gear toothed counting wheels, op-

erating connections between the same and the adding machine including a gear carried by and laterally adjustable with the keyboard, ratchets on the wheels, pawls engaging said ratchets, and means for displacing said pawls controlled by the lateral position of the keyboard.

15. The combination with an adding machine, of a computing attachment comprising a depressible and laterally adjustable keyboard, counting wheels, operating connections between the same and the adding machine including a member carried by and laterally adjustable with the keyboard, ratchets on the wheels, pawls engaging said ratchets, a rock shaft extending through the centers of the wheels and having projections to displace said pawls, and means for turning the shaft by the keyboard in lateral adjustment of the latter.

16. The combination with an adding machine and its actuator; of a computing attachment comprising a depressible and laterally adjustable keyboard with provisions for setting up a certain amount to be repeated varying numbers of times under different decimal adjustments of said keyboard, and a counter driven by the adding machine actuator to show the numbers of such repetitions under the different adjustments of the keyboard, with provisions for disabling the connection between the actuator and the counter at will.

17. The combination with an adding machine and its actuator; of a computing attachment comprising a depressible and laterally adjustable keyboard with provisions for setting up a certain amount to be repeated varying numbers of times under different decimal adjustments of said keyboard, a series of counter wheels, and means for turning the same step-by-step impelled by the adding machine actuator and comprising gearing shifting laterally with the keyboard.

18. The combination with an adding machine and its actuator; of a computing attachment comprising a depressible and laterally adjustable keyboard with provisions for setting up a certain amount to be repeated varying numbers of times under different decimal adjustments of said keyboard, a counter for showing the numbers of such repetitions, and means for driving the counter including a tappet-piece arranged to be struck by the adding machine actuator.

19. The combination with an adding machine and its actuator; of a computing attachment comprising a depressible and laterally adjustable keyboard with provisions for setting up a certain amount to be repeated varying numbers of times under different decimal adjustments of said keyboard, a counter for showing the numbers of such repetitions, and means for driving the coun-

ter including a tappet-piece movable into and out of the path of movement of the adding machine actuator.

5 20. The combination with an adding machine and its actuator; of a computing attachment comprising a depressible and laterally adjustable keyboard with provisions for setting up a certain amount to be repeated varying numbers of times under different decimal adjustments of said keyboard, 10 a series of counter wheels for showing the numbers of such repetitions under different adjustments of the keyboard, and means for turning said wheels comprising gearing shifting laterally with the keyboard, and a 15 tappet piece arranged to be struck by the adding machine actuator.

20 21. The combination with an adding machine and its actuator; of a computing attachment comprising a depressible and laterally adjustable keyboard with provisions for setting up a certain amount to be repeated varying numbers of times under different decimal adjustments of said keyboard, 25 a series of gear-toothed counter wheels for showing the numbers of such repetitions under different adjustments of the keyboard, and means for turning said wheels compris-

ing a gear shifting laterally with the keyboard to engage one or another of the counter wheels, and a tappet piece arranged to be struck by the adding machine actuator to turn said gear. 30

22. The combination with an adding machine and its actuator; of a computing attachment comprising a depressible and laterally adjustable keyboard with provisions for setting up a certain amount to be repeated varying numbers of times under different decimal adjustments of said keyboard, 35 a series of gear-toothed counter wheels for showing the numbers of such repetitions under different adjustments of the keyboard and means for turning said wheels comprising a gear shifting laterally with the keyboard to engage one or another of the counter-wheels, a ratchet compounded with said gear, a pawl engaging said ratchet, a vibrating carrier for said pawl, a spring drawing said carrier one way, and a tappet piece arranged to be struck by the adding machine actuator to impel the carrier the other way. 40 45 50

ABB L. LANDIS.

Witnesses:

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