Aug. 30, 1932. N. W. PERKINS 1,874,709

MULTIPLE ACCUMULATOR CALCULATING MACHINE

Filed April 17, 1930 14 Sheets-Sheet 1

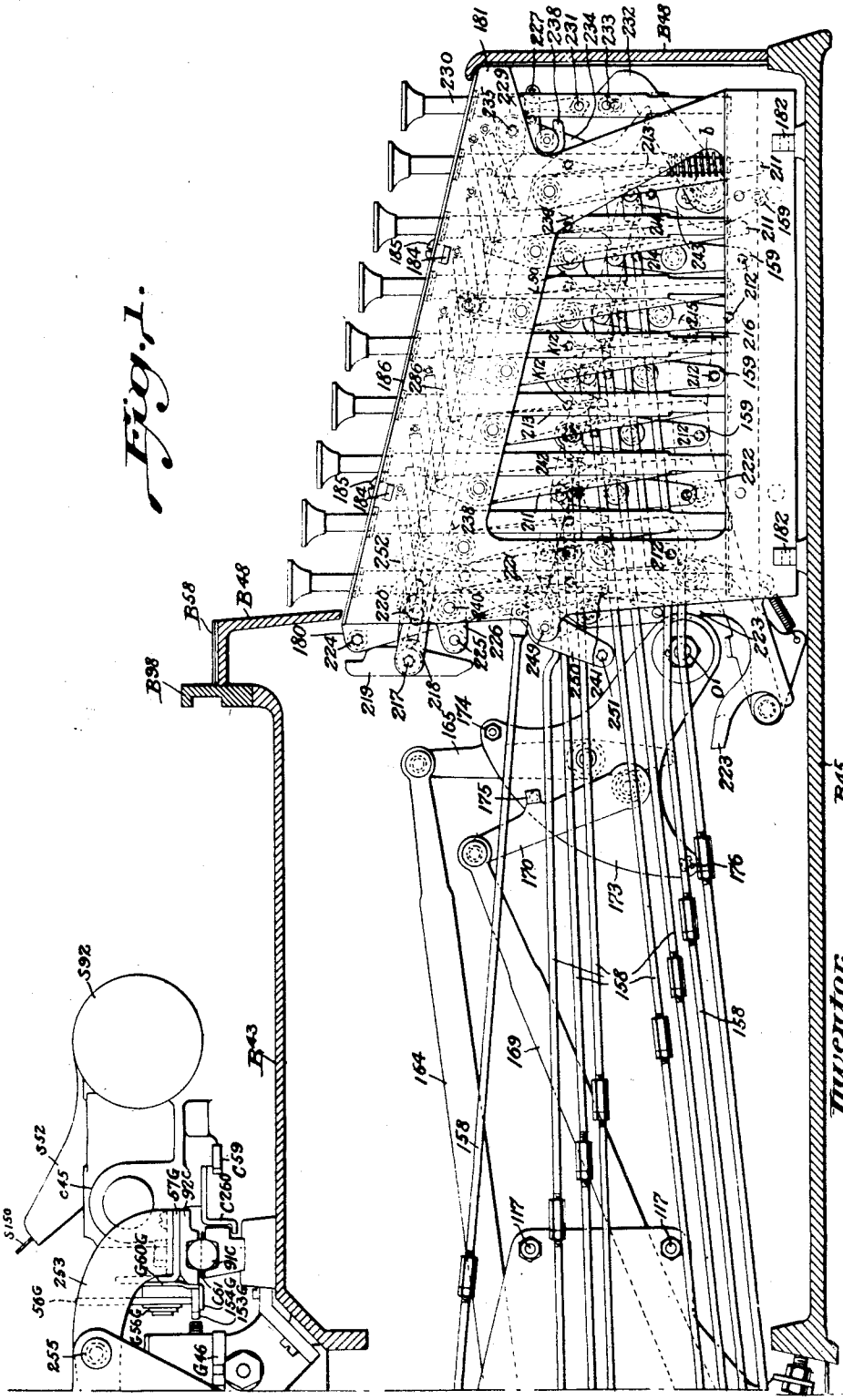


Fig. 1.

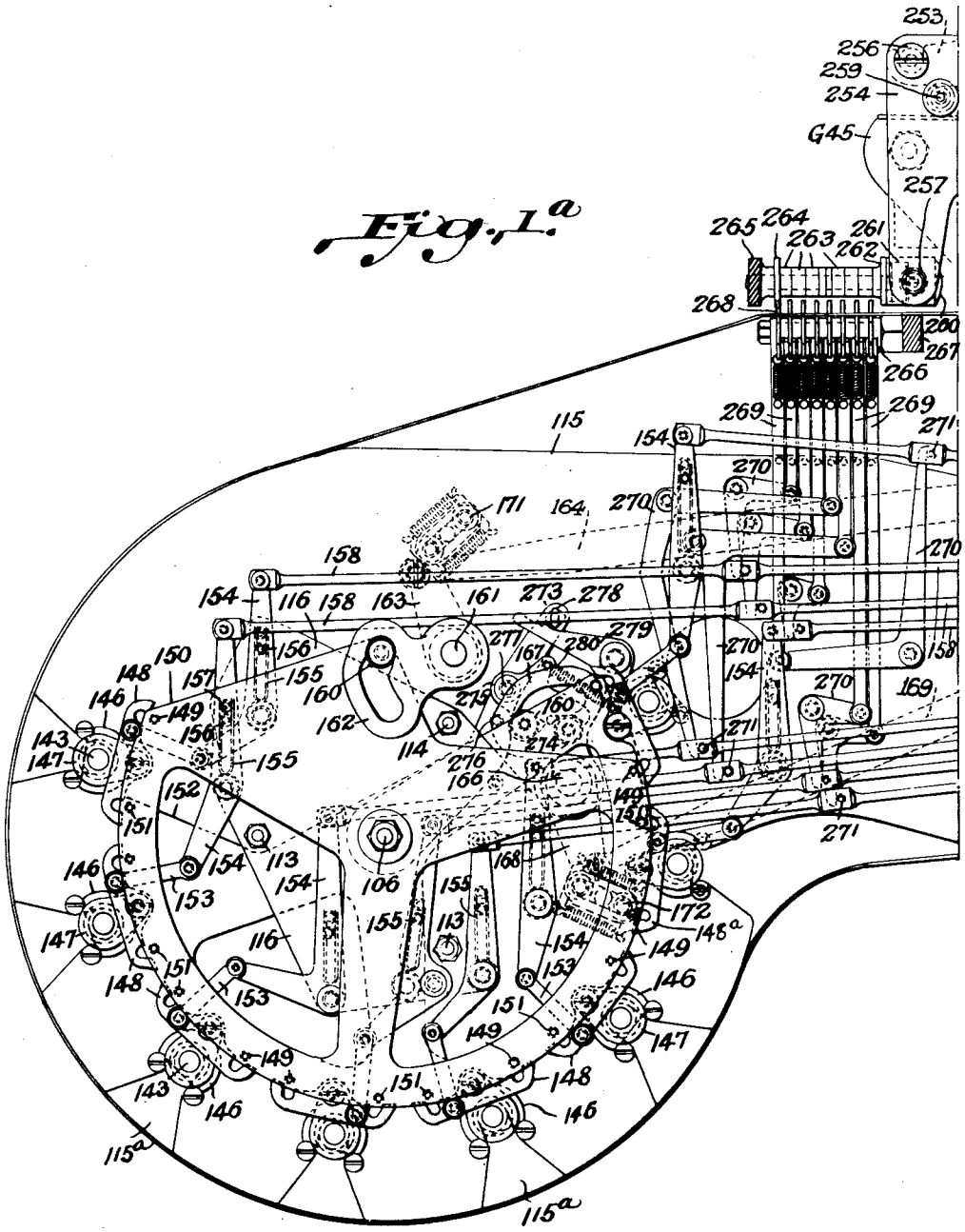
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MULTIPLE ACCUMULATOR CALCULATING MACHINE

Filed April 17, 1930 14 Sheets-Sheet 2

Fig. 1.a



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MULTIPLE ACCUMULATOR CALCULATING MACHINE

Filed April 17, 1930 14 Sheets-Sheet 3

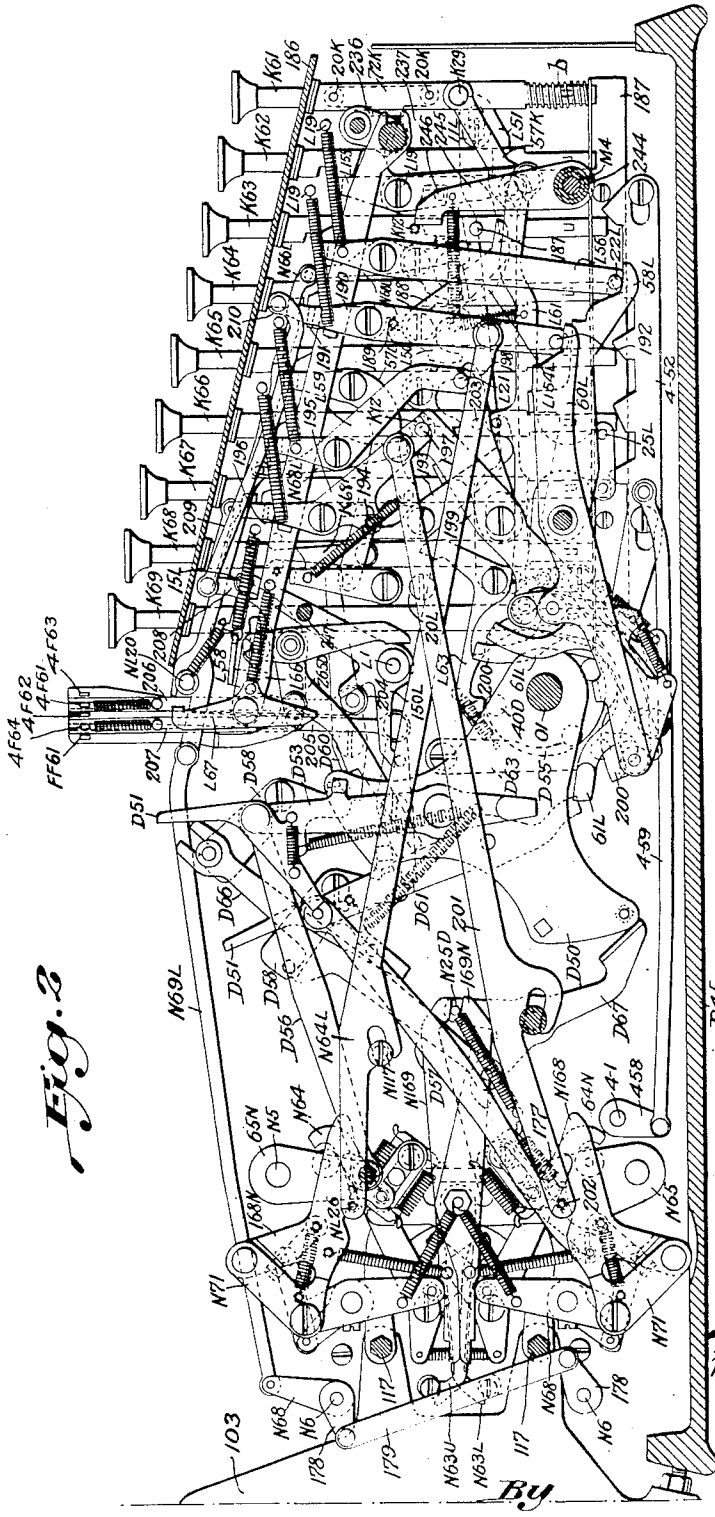


Fig. 2

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Aug. 30, 1932. N. W. PERKINS 1,874,709

MULTIPLE ACCUMULATOR CALCULATING MACHINE

Filed April 17, 1930 14 Sheets-Sheet 4

Fig. 5.

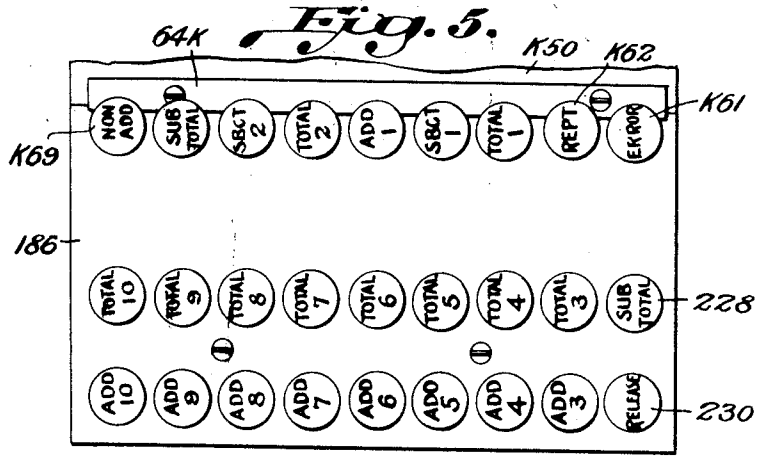
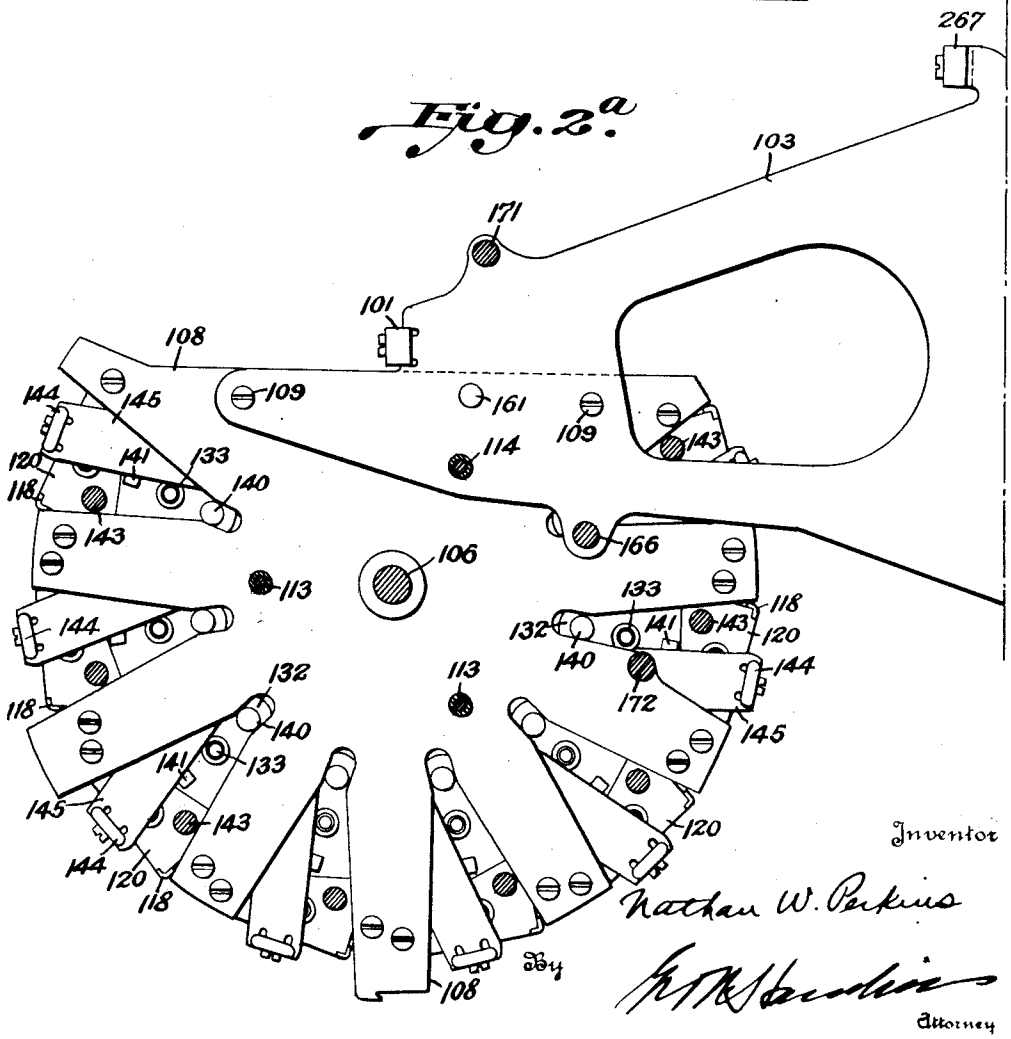


Fig. 2a.

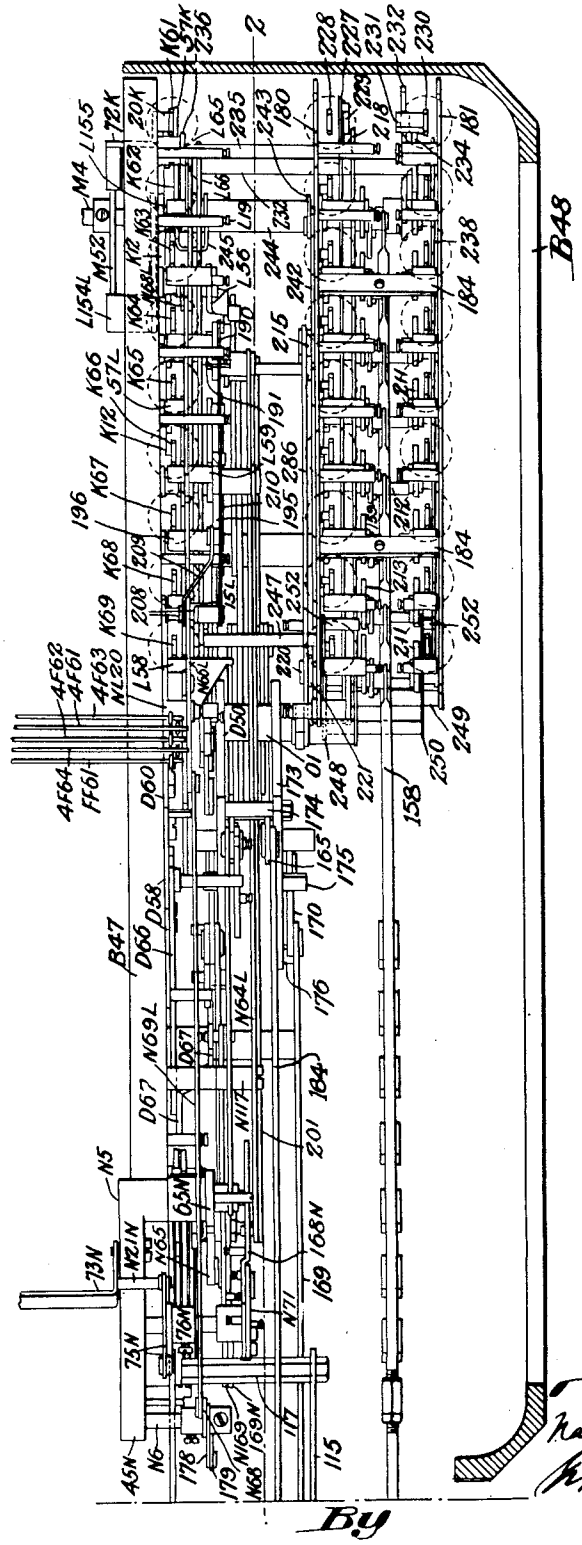


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Aug. 30, 1932. N. W. PERKINS 1,874,709

MULTIPLE ACCUMULATOR CALCULATING MACHINE

Filed April 17, 1930 14 Sheets-Sheet 5



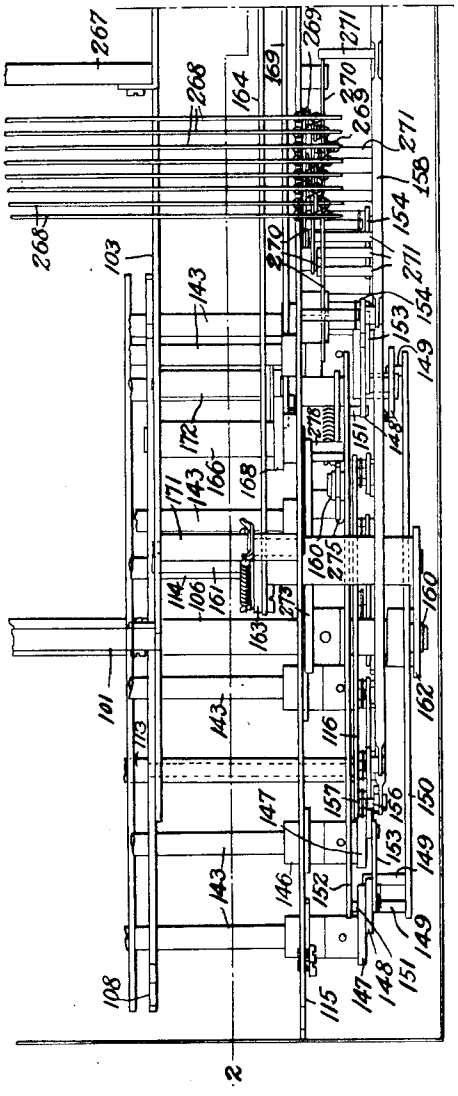
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MULTIPLE ACCUMULATOR CALCULATING MACHINE

Filed April 17, 1930 14 Sheets-Sheet 6

Fig. 3a.



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Aug. 30, 1932. N. W. PERKINS 1,874,709

MULTIPLE ACCUMULATOR CALCULATING MACHINE

Filed April 17, 1930 14 Sheets-Sheet 7

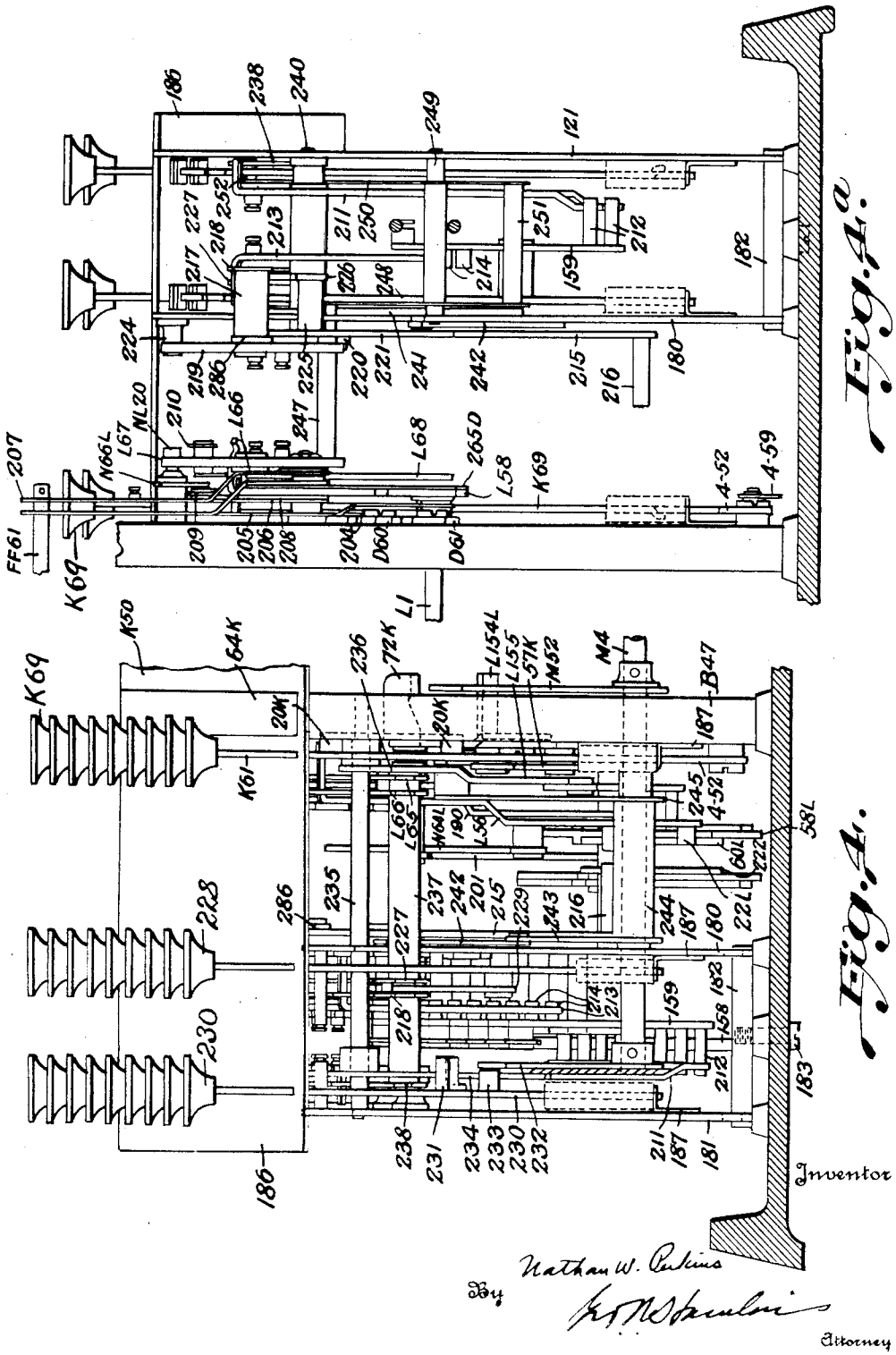


Fig. 4a.

Fig. 4.

Inventor

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By

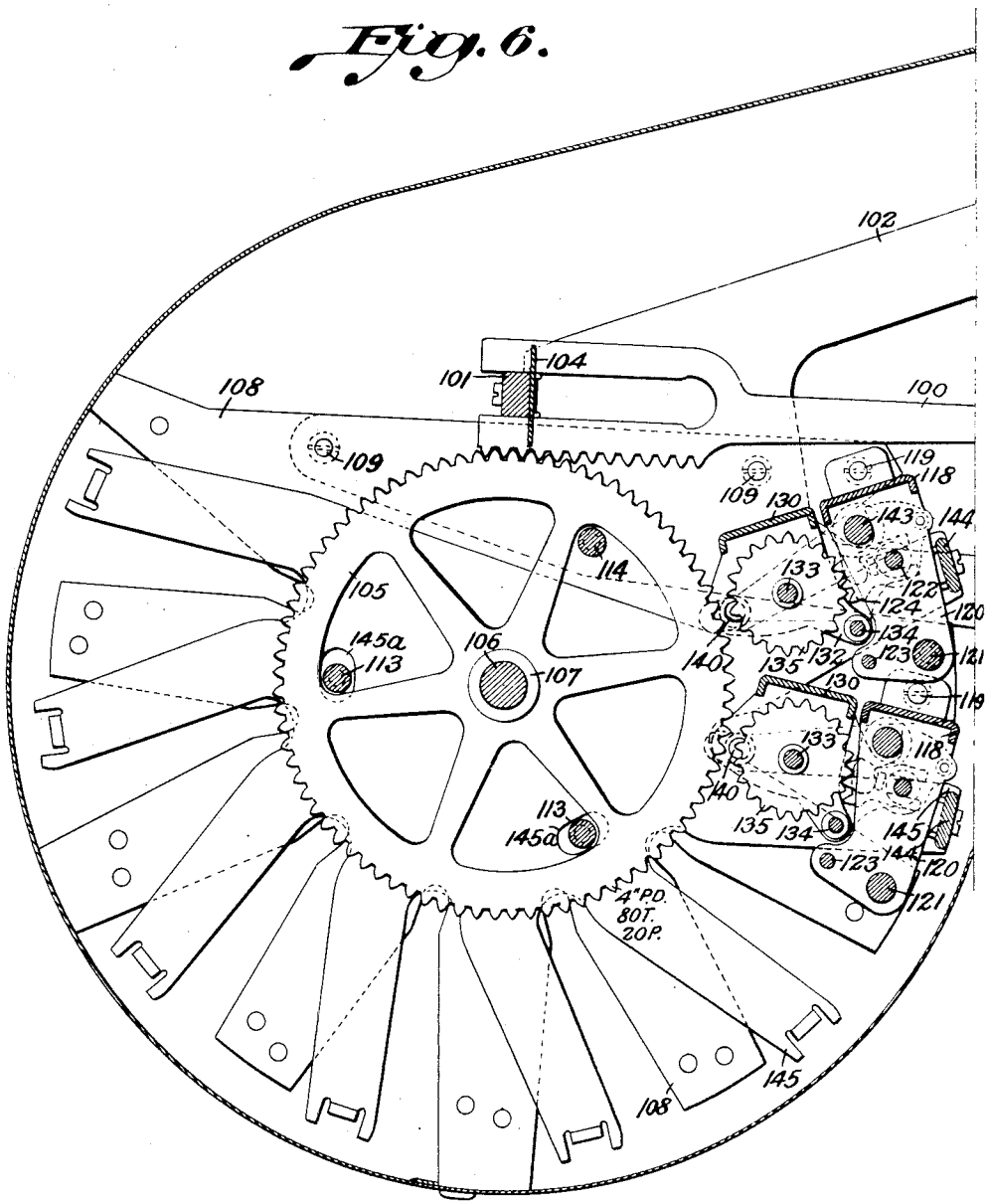
Attorney

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MULTIPLE ACCUMULATOR CALCULATING MACHINE

Filed April 17, 1930 14 Sheets-Sheet 8

Fig. 6.



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ATTORNEY

Aug. 30, 1932. N. W. PERKINS 1,874,709

MULTIPLE ACCUMULATOR CALCULATING MACHINE

Filed April 17, 1930 14 Sheets-Sheet 9

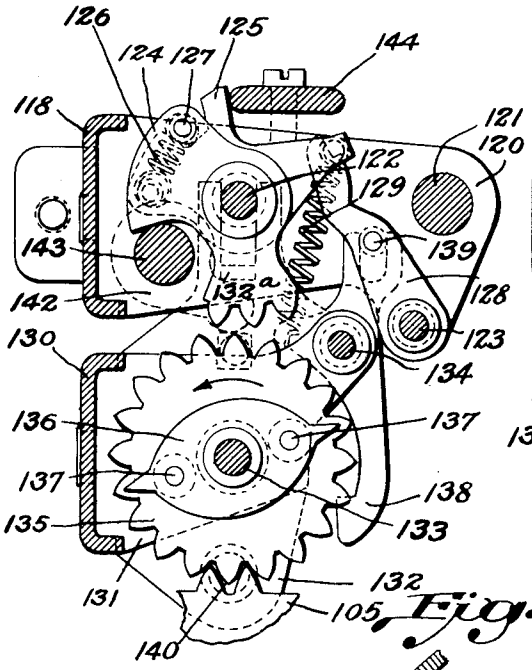


Fig. 9.

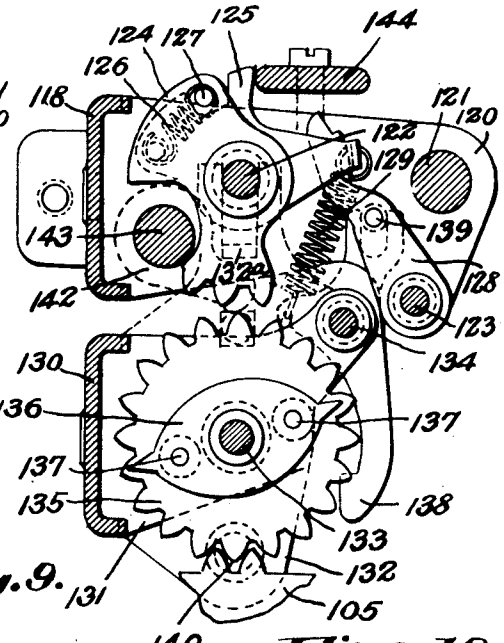


Fig. 10.

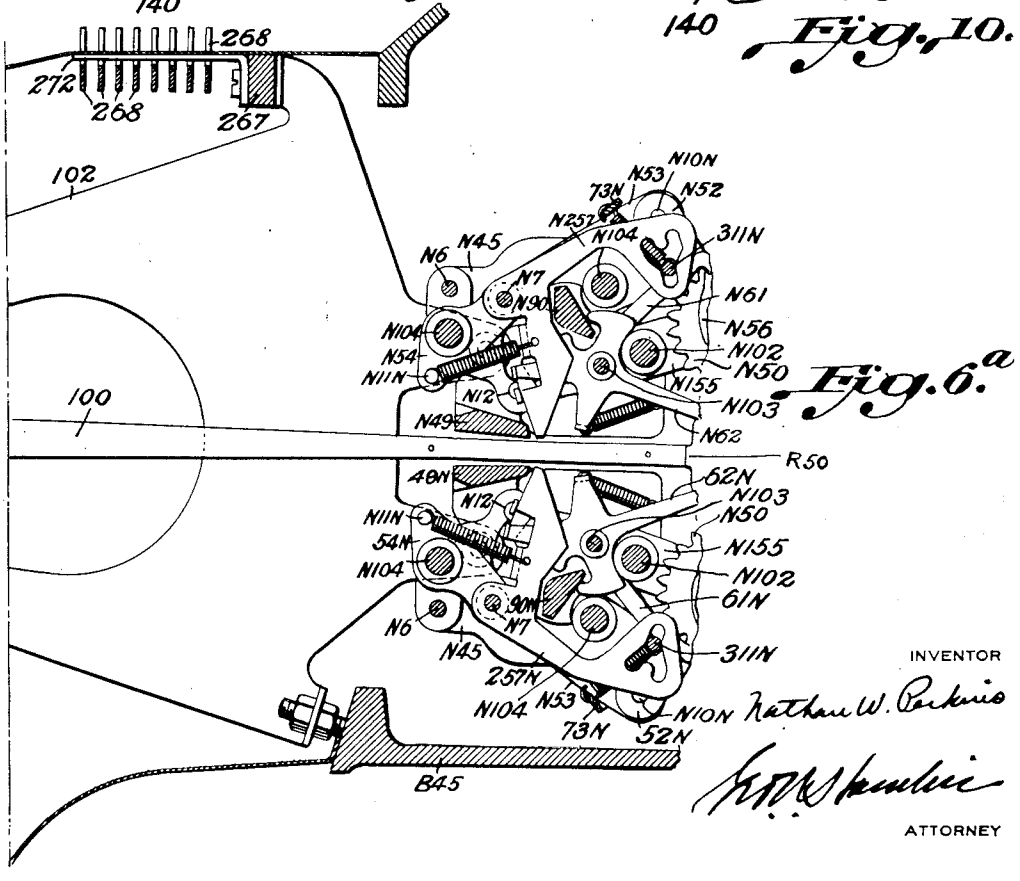


Fig. 6.a

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Aug. 30, 1932. N. W. PERKINS 1,874,709

MULTIPLE ACCUMULATOR CALCULATING MACHINE

Filed April 17, 1930 14 Sheets-Sheet 10

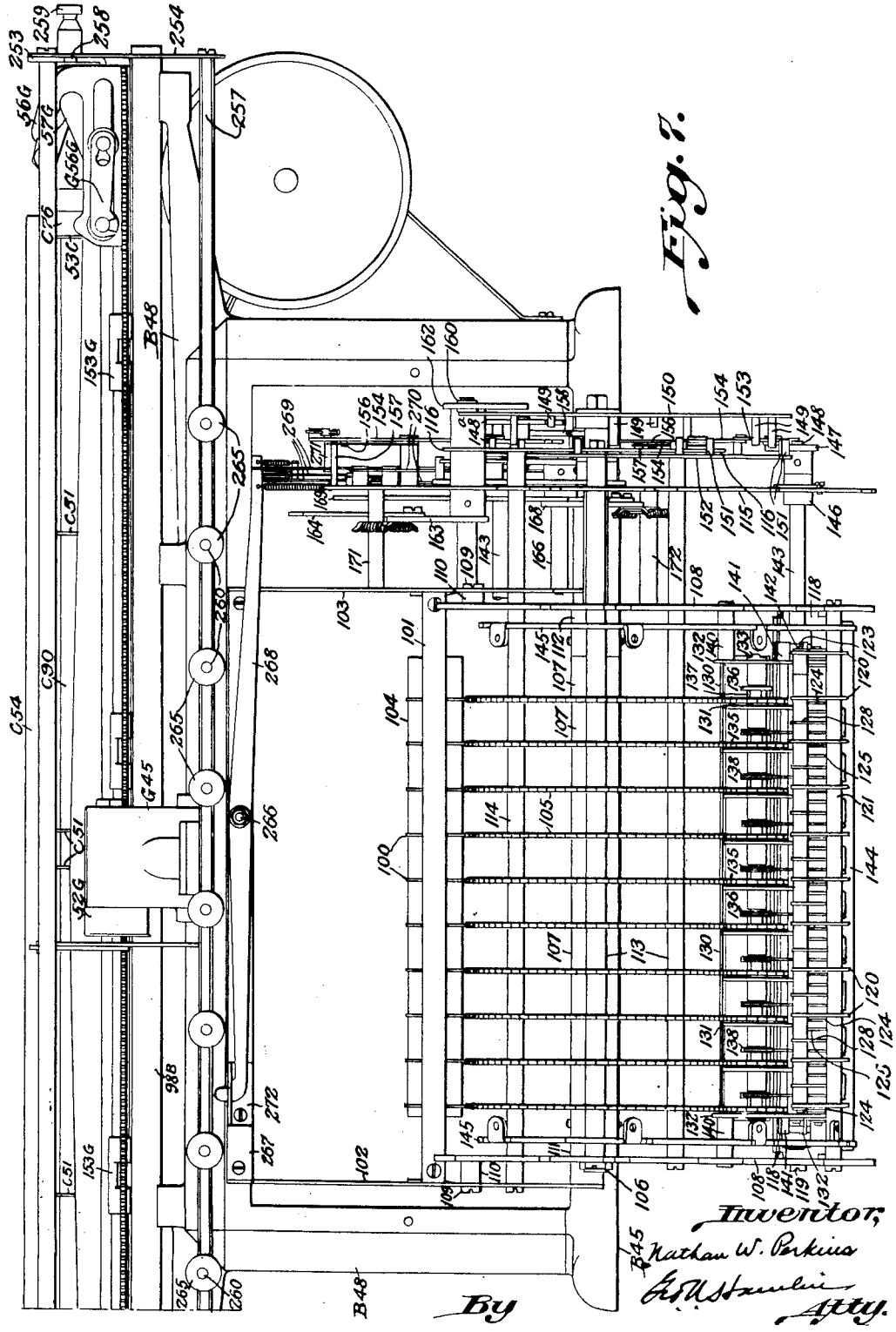


Fig. 7.

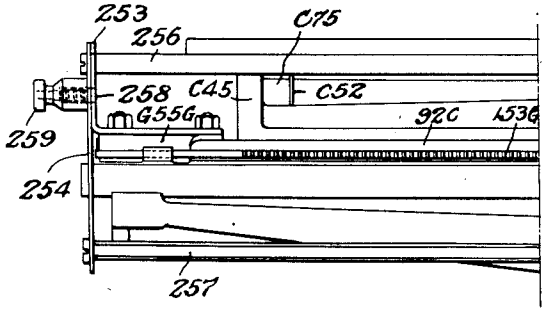
Inventor,
Nathan W. Perkins
By G. M. Hamlin Atty.

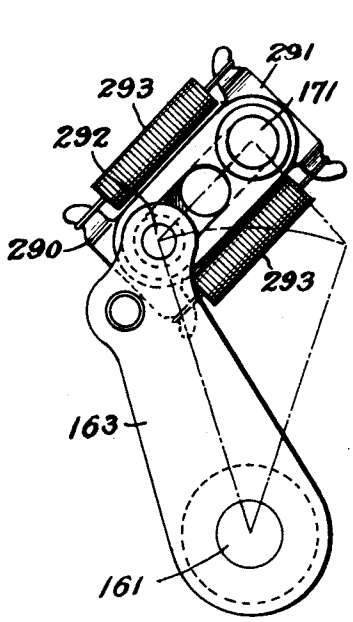
Aug. 30, 1932. N. W. PERKINS 1,874,709

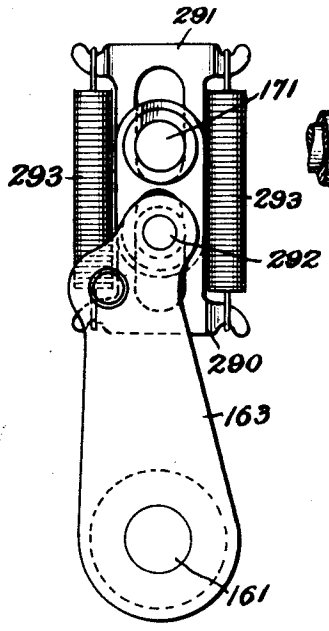
MULTIPLE ACCUMULATOR CALCULATING MACHINE

Filed April 17, 1930 14 Sheets-Sheet 11

Fig. 7a.







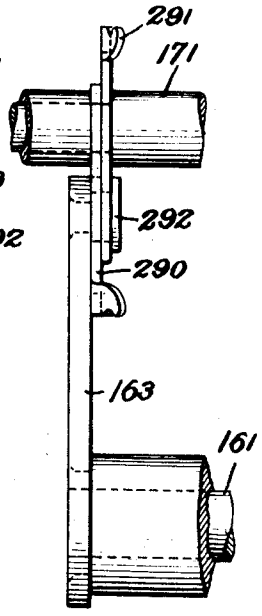


Fig. 12. Fig. 13. Fig. 14.

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Aug. 30, 1932. N. W. PERKINS 1,874,709

MULTIPLE ACCUMULATOR CALCULATING MACHINE

Filed April 17, 1930 14 Sheets-Sheet 12

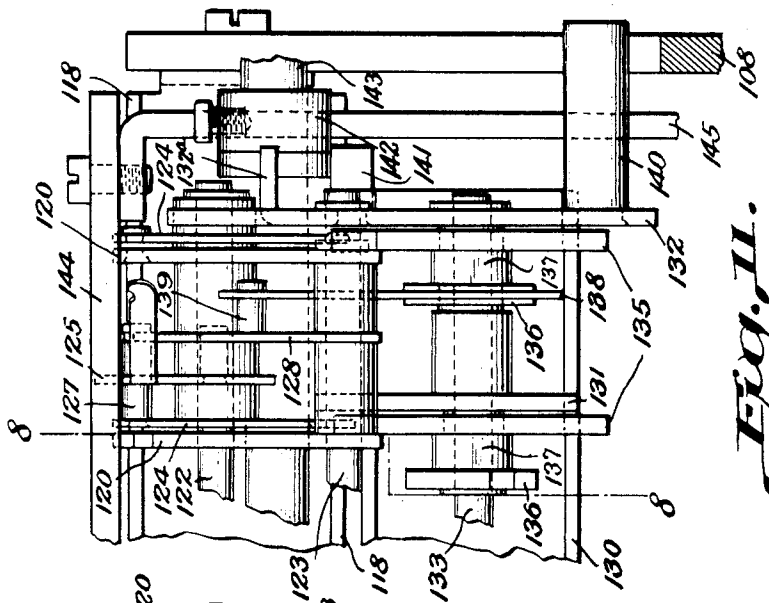


Fig. 11.

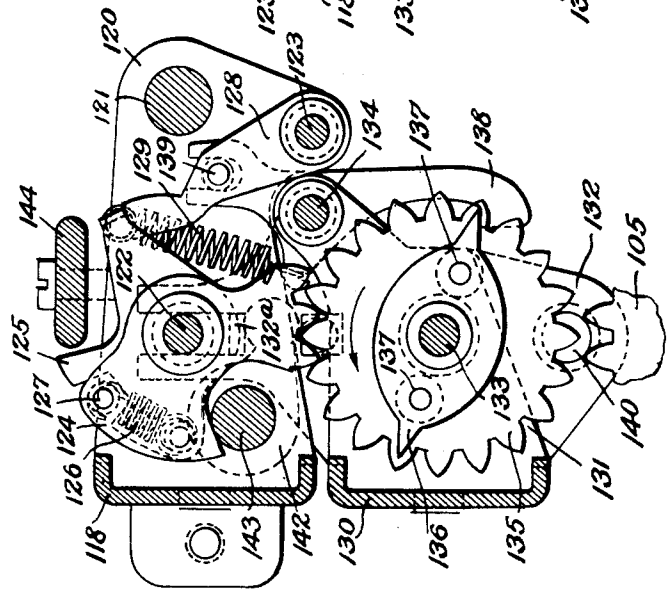


Fig. 8.

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MULTIPLE ACCUMULATOR CALCULATING MACHINE

Filed April 17, 1930 14 Sheets-Sheet 13

Fig. 15.

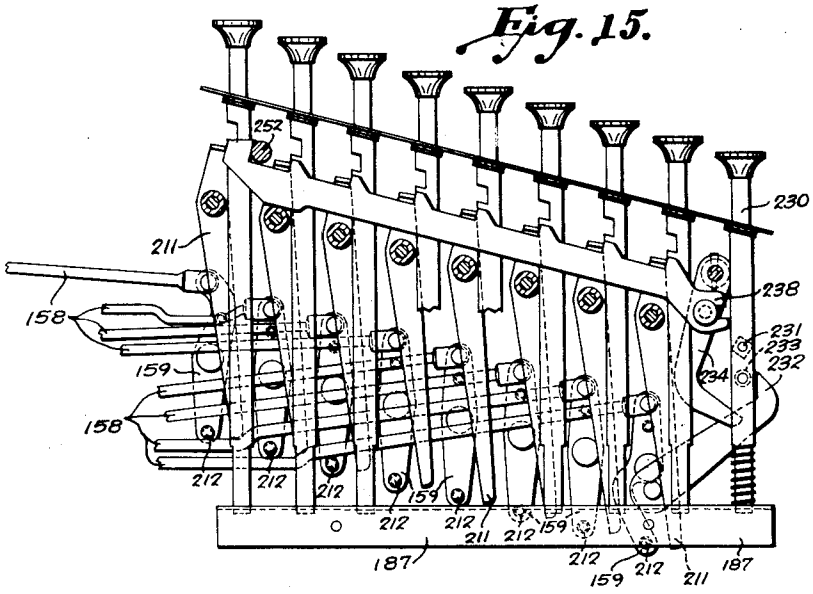


Fig. 16.

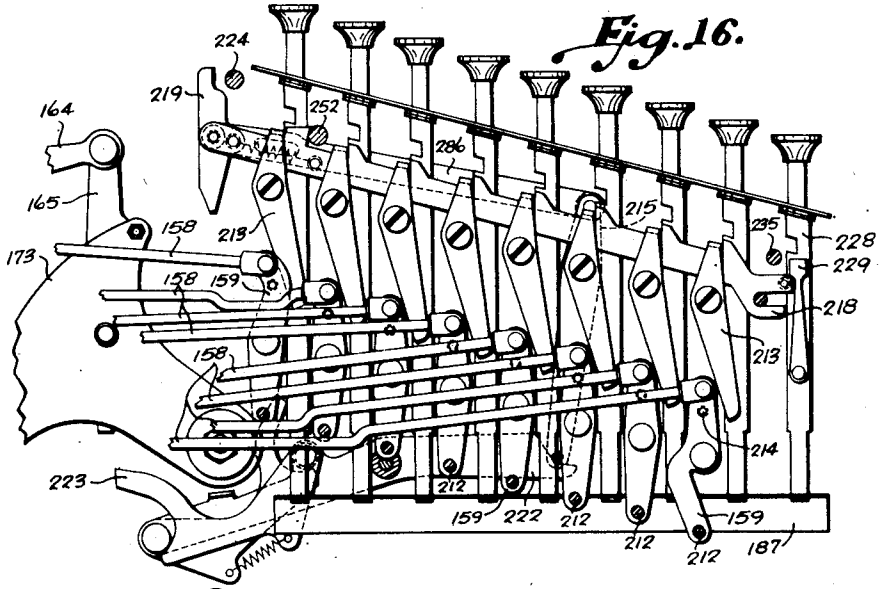
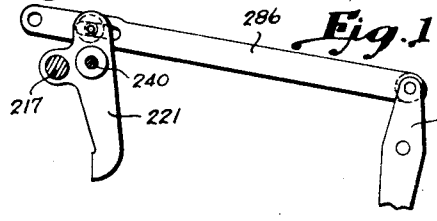


Fig. 17.



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MULTIPLE ACCUMULATOR CALCULATING MACHINE

Filed April 17, 1930 14 Sheets-Sheet 14

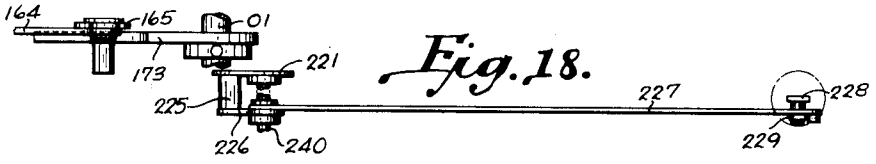


Fig. 18.

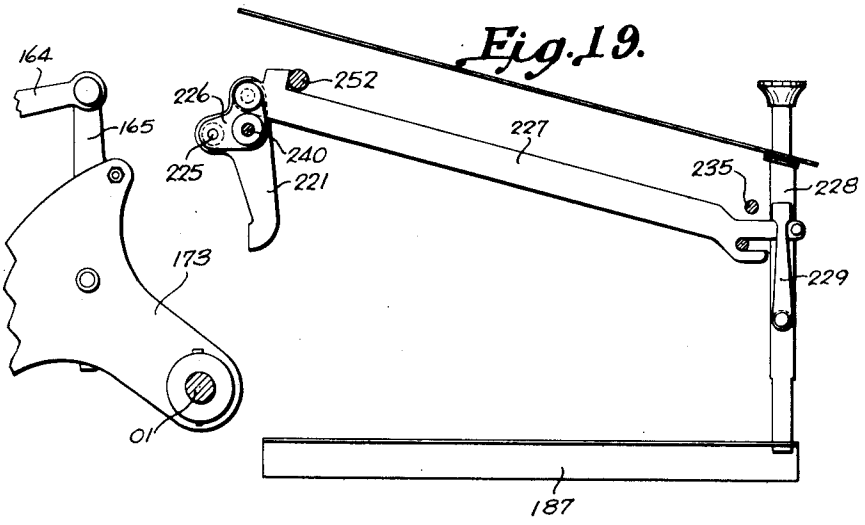


Fig. 19.

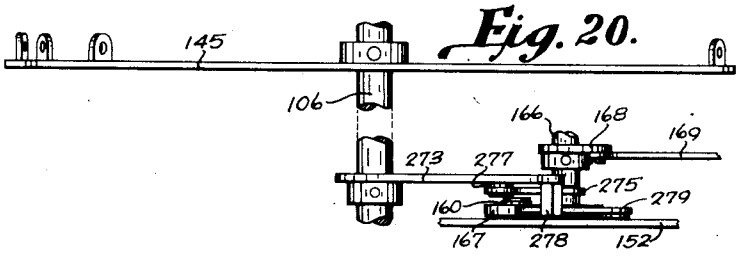


Fig. 20.

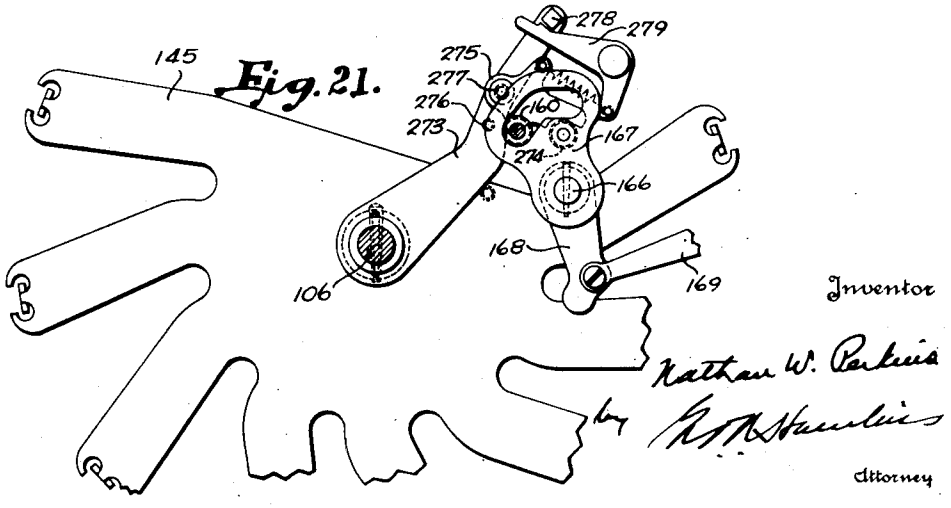


Fig. 21.

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Patented Aug. 30, 1932 1,874,709

UNITED STATES PATENT OFFICE

NATHAN W. PERKINS, OF EAST ORANGE, NEW JERSEY, ASSIGNOR TO ELLIS ADDING TYPEWRITER COMPANY, OF NEWARK, NEW JERSEY, A CORPORATION OF NEW JERSEY

MULTIPLE ACCUMULATOR CALCULATING MACHINE

Application filed April 17, 1930. Serial No. 445,051.

The "Ellis" adding machine, or adding or subtracting machine, as disclosed in patents to Halcolm Ellis, Nos. 1,197,276; 1,197,277; 1,197,278 dated September 5, 1916; No. 1,203,863 dated November 7, 1916; Bernau, No. 1,508,267 dated September 9, 1924; and No. 1,731,701 dated October 15, 1929, employs only two accumulators, together with mechanism whereby either or both of the accumulators may be utilized or cut out under the control of adding or subtracting keys, a non-add key, or, under control of the travelling carriage when the latter is in predetermined tabulated positions.

In an application of Emil J. Ens, Serial No. 323,124, filed December 1, 1928, for quadruplex accumulator calculating machines, disclosure is given, and claim is made to, two adding accumulators which are additional to the two accumulators disclosed in the foregoing Ellis and Bernau patents, together with improved controlling and selecting mechanism. The Ens machine provides four accumulators wherein addition may be performed in any one of the adding accumulators, addition or subtraction performed in the combined adding and subtracting accumulator, addition simultaneously performed in selected ones of the adding accumulators, and amounts transferred from one accumulator to another. However, in the Ens machine of Serial No. 323,124, all additive operations are solely controlled by the tabulated position of the carriage as all adding keys on the keyboard are dispensed with. In the Ens machine, subtracting and non-add functions are obtained by using subtraction and non-add keys, a total is taken from any accumulator by the use of a total-key therefor, and a sub-total is taken from any selected accumulator by the conjoint use of a single sub-total key and the total-key of the selected accumulator.

The present invention has for one of its objects to greatly increase the capacity of the Ellis machine, which is accomplished by the provision of means enabling several adding accumulators to be used in addition to the usual two accumulators disclosed in the foregoing patents and increasing, by several accumulators, the four-accumulator capacity of the machine of the Ens application aforesaid. While I do not limit the present invention to the provision of any given additional adding accumulators, eight additional straight adding accumulators are shown. Preferably, both of the usual accumulators of the Ellis machine are combined adding and subtracting accumulators but this need not be so unless the character of the work to be performed requires combined adding and subtracting accumulators, and it is to be understood that one or both of the two main accumulators may be straight adding accumulators and that the necessary changes may be made in the keyboard controlling mechanism.

Another object is to provide a multiple accumulator calculating machine wherein the control of any accumulator, either for additive or subtractive operation may be had either from the controlling keys of the keyboard, or, from the carriage, according to the tabulated position of the carriage, subject to the taking of a sub-total or a total from any given accumulator under the control of total and sub-total controlling keys on the keyboard.

A further object is to provide a multiple accumulator calculating machine having adding accumulators and one or more combined adding and subtracting accumulators, and improved means whereby addition may be performed in one or more of the adding accumulators while simultaneously adding into, or subtracting out of, one or more combined adding and subtracting accumulators, at a given operation of the machine.

Another object is to provide in a multiple accumulator calculating machine improved means whereby totals or sub-totals may be transferred from any given accumulator to one or more of the other accumulators on a single operation of the machine.

The one or two combined adding and subtracting accumulators usually provided on the Ellis machine may be of the construction and operation set forth in the patent to Perkins and Ens, No. 1,679,265, July 31, 1928, such construction being disclosed herein, but

it will be understood that other combined adding and subtracting accumulators may be used in lieu thereof as the main accumulators.

A further object is to provide an improved construction of adding accumulator for use in the group of auxiliary accumulators employed in the present improved machine.

An additional object is to provide, in a multiple accumulator calculating machine, a group of accumulators subject to both key and carriage control through improved means common to controlling keys and a carriage whereby either key or carriage control may be had without interference at any given time.

For a further object, the invention seeks to provide, in a multiple accumulator calculating machine, improved selective means under carriage control by which one or more of the accumulators may be arranged for operation.

Another object is the provision of a multiple accumulator calculating machine having an improved combination of main gears, operable by the key-controlled actuators or racks of the machine, and a plurality of independent accumulators, and controlling means for said accumulators, either key-operated, or carriage-operated, or both key-operated and carriage-operated, adapted for selective engagement with the main gears by improved means so that the amounts transferred to the gears by the actuators or racks may be entered in one or more of the said accumulators, or the amount standing on any accumulator or any number of accumulators may be obtained.

The invention has for a still further object the provision of a self-contained, unitary multiple accumulator which may be bodily attached to an "Ellis" machine, or to any other calculating machine of the same general class having racks, gears, or sectors adapted to shift distances corresponding to digits set up on a keyboard, to the end that the group or multiple accumulators may be individually or collectively used in connection with the regular accumulators and mechanisms of the Ellis, or other, machine for the accumulation and transfer of amounts.

Provision is made for the control of the accumulators by a controlling keyboard which comprises three rows of keys. The right hand row, that nearest the usual numeral keyboard of the machine, comprises the usual error and repeat key for use in connection with the numeral keyboard, and the controlling keys for the combined adding and subtracting accumulators such as for the performance of addition, subtraction, non-add, and the taking of totals and sub-totals. The middle row of controlling keys comprises keys representing totals for all of the group of adding accumulators embraced in the present invention and also a sub-total key therefor. The left hand row of controlling keys comprises keys for controlling the adding function of all of the straight adding accumulators embraced in the multiple accumulator group embodying the present invention, and this row also has an error key or release key for all of these adding controlling keys.

Among other features of the present invention, are novel spring-detent means, such as are used in connection with each of the accumulators and which detent means also appears in the application of Ens, Serial No. 323,124, filed December 1, 1928; improved mountings and operating devices for the adding accumulators of the multiple group or series; improved driving and controlling connections; starting bar interlocking means; interlocks between the total keys, preventing more than one being depressed at a given time; interlocks between the total keys and the starting bar, and other constructions and details appearing more fully hereinafter.

In the accompanying drawings and the following specification, only so much of the Ellis calculating machine is shown as will afford a clear understandig of the construction, operation, functions, and combination of the present improvements therewith, it being understood that the driving mechanism, numeral keyboard, tabulating and printing mechanisms, carriage and carriage control, racks, reducers, etc., disclosed in the Ellis, Bernau, Ens and Perkins patents and applications hereinbefore referred to, may be embodied in the machine.

In the accompanying drawings:

Figures 1 and 1ª comprise an elevation of the left or controlling side of the machine, the case being in section, showing the two left hand rows of controlling keys and parts for the group of adding accumulators;

Figs. 2 and 2ª comprise a longitudinal section on the line 2—2 of Figs. 3, 3ª, showing the remaining construction at the left side of the machine, including the row of controlling keys for the accumulators usually employed in the Ellis machine and showing the group of adding accumulators;

Figs. 3 and 3ª comprise a plan view of the mechanism at the controlling or left side of the machine, dotted lines representing the three rows of controlling keys, the case being in section;

Fig. 4 is a front elevation of the controlling keyboard, the base of the machine being in section and the deck broken away;

Fig. 4ª is a rear elevation of the controlling keyboard;

Fig. 5 is a plan view of the controlling keyboard, illustrating one set of designations which may be used on the key buttons;

Figs. 6 and 6ª comprise a longitudinal section through the rear of the machine, showing the usual accumulators of the Ellis machine

in Fig. 6ª and certain ones of the straight adding accumulators of the multiple group in Fig. 6;

Figs. 7 and 7ª comprise a rear elevation of the complete machine illustrating only one accumulator;

Fig. 8 is a detail vertical section on the line 8—8, Fig. 11 of one of the improved accumulators when in normal position;

Fig. 9 is a similar sectional view showing the accumulator in mesh with the large gear as in an adding operation;

Fig. 10 is a view like Fig. 8, showing the position of the parts just before the restoring bar starts to restore the sector actuator;

Fig. 11 is a fragmentary side view of the accumulator shown in Fig. 8;

Fig. 12 is a detail side view of one of the accumulator detents when in normal position;

Fig. 13 is a similar view showing the detent midway its travel;

Fig. 14 is a front view of the detent, the springs being omitted;

Fig. 15 is a detail side elevation of the adding keys and the release key and their connections which control the accumulators for addition;

Fig. 16 is a similar view of the total keys and the sub-total key and their connections to the accumulators whereby the accumulators may be controlled for totalizing;

Fig. 17 is a detail view of the link and lever for operating the total cam;

Fig. 18 is a plan view of the sub-total key and a part of the means for releasing the total keys on a sub-total operation;

Fig. 19 is a side elevation thereof;

Fig. 20 is a plan view of the mechanism for oscillating the shaft which controls the restoring bars for the auxiliary accumulators; and

Fig. 21 is a side elevation thereof.

The rear of the travelling carriage of the Ellis machine appears in Fig. 7 and the left hand end thereof in Fig. 1 but disclosure is not given of the rack at the front of the carriage which carries adjustably mounted stops for cooperation with the carriage controlled levers FF61, 4F64, 4F62, 4F61 and 4F63 appearing in Figs. 2 and 3. Reference is to be had to Ellis Patents Nos. 1,197,276 and 1,197,278, September 5, 1916, for a full disclosure of the manner in which the carriage and its stops at the front thereof, control the accumulators.

The carriage control of the adding accumulators of the group which have been combined with the Ellis machine according to the present invention and which accumulators appear in Figs. 1ª and 3ª, constitutes entirely independent carriage controlling means from the controlling means on the carriage for the levers FF61, 4F64, 4F62, 4F61, 4F63, as will hereinafter appear.

The control of the regular adding and subtracting accumulators used in the Ellis machine, such accumulators appearing at the left of Fig. 2 and in Fig. 6ª, may be accomplished through the keyboard of Fig. 5, independently of the control of the group of straight adding accumulators appearing in Fig. 1ª through keys of the keyboard shown in Fig. 5, and reference is to be had to Figs. 3 and 3ª for the general lay-out of the said controls.

The group of straight adding accumulators seen in Fig. 1ª, and the carriage and key controls therefor, may be built into the machine originally, or, added to an existing Ellis machine.

The base of the Ellis machine appears at B45; the shell or case is shown at B48.

Only so much of the front of the carriage C45 is shown in Fig. 1 as will afford a general disclosure thereof, the platen appearing at S92, the paper table at S150, and a part of the carriage frame at S52. The part 92C is supported by ball bearings 91C. As previously explained, the equipment at the front of the carriage is omitted and reference is to be had to prior patents enumerated, for the control of the levers FF61, 4F64, etc.

The improvements carried by the rear of the carriage C45 will be later described when reference is made to the automatic control, by the carriage, of the group of straight adding accumulators.

Adding and subtracting accumulators.— The construction and operation of the adding and subtracting accumulators seen at the left of Fig. 2 and in Fig. 6ª, are of the "Ellis" type and reference is to be had to the patents enumerated, the particular construction illustrated being substantially that disclosed in the patent to Perkins and Ens, No. 1,679,265, July 31, 1928, to which reference may be had for a disclosure of details. The accumulator gears or wheels are shown at N50, the double-pointed carrying cams appear at N56, adding and subtracting hooks are shown at 61N, 62N, N61 and N62 as carried by the shaft N103. The single cam plates N257 and 257N which are pivoted at N7, cooperate with the pins 311N carried by the toothed detents N52 and 52N. The pins 311N are connected by springs to the bail 73N.

The shift bars appear at N90 and 90N for the upper and lower accumulators. Other elements entering into the construction of these adding and substracting accumulators constituting the regular Ellis machine equipment, may be ascertained from the Perkins and Ens Patent No. 1,679,265.

In Fig. 6ª, disclosure is given of one of the usual adding racks or actuators R50 with which the wheels or gears N50 are adapted to cooperate in the usual "Ellis" construction.

The lower crank N65 carries a pin 177, Fig. 2, with which the lower subtracting operating latch N168 is adapted to latch or engage.

The subtracting detent levers N169 and

169N are of modified form over the disclosures of the corresponding detent levers of the Bernau Patent No. 1,731,701, to enable their forward ends to be operated by pin N25D carried by the restoring lever D67 (Fig. 2). The overdraft shafts N6, patents to Bernau, Nos. 1,508,267 and 1,731,701, are connected by a link 179.

Supplemental frame construction for adding accumulators.—Referring to Figs. 1, 1ª, 2ª, 6, 6ª, 7, the group of straight adding accumulators is supported from the main frame by carrying plates 102, 103, attached to the side frames N45, 45N, which mount the adding and subtracting accumulators previously described. These plates 102, 103 are braced against the base B45.

A slotted plate 104, carried by bar 101, serves as a guide for the supplemental racks 100, there being one of these supplemental racks 100 attached to each of the usual racks R50 in any suitable manner, as by studs, rivets or screws for the purpose of making the supplemental racks unitary with the racks R50 and to constitute racks 100 as rearward extensions of racks R50 so that movement will be imparted to each rack 100 exactly as though it were integral with the rack R50 to which it is connected, thus enabling all movements of racks R50 to be utilized in connection with the improved multiple accumulator construction hereinafter described.

Two plates 108, Figs. 2ª, 6, 7, are fastened by screws 109 and posts 110 to the plates 102 and 103. Two rods 113 secured to the right hand plate 108, and a rod 114, pass through these plates and are extended at the left and have secured thereto the plates 115 and 116, Figs. 1ª, 3ª, 6. The plate 115 is also carried by posts 117 in the side frames N45 and 45N of the adding and subtracting accumulators. Plates 102 and 103 carry at their tops the bar 267.

The plates 108 have mountings 111 and 112 for a shaft 106. Carried by the shaft 106 are the large gears 105, Figs. 6, 7, corresponding in number to the auxiliary or extension racks 100, said large gears constantly meshing with the respective extension racks so that every movement of a given rack or actuator is communicated to the corresponding gear 105. The rods 113 and 114 pass through the spaces between the spokes of the gears 105, permitting turning of each gear a distance sufficient to permit proper actuation of the respective auxiliary adding accumulators of which two appear in Fig. 6 and whose construction is disclosed in Figs. 8, 9, 10, 11.

Auxiliary adding accumulators.—Referring to Figs. 1ª, 6, illustration is given, by way of example, of eight auxiliary adding accumulators, additional to the adding and subtracting accumulators appearing in Figs. 2 and 6ª but it will be understood that a greater or lesser number of the auxiliary accumulators may be used, according to the work the machine is intended to carry on and the particular use to which it is put. Similarly, while combined adding and subtracting accumulators are shown in Figs. 2 and 6ª, one of these regular Ellis type accumulators may be an adding and subtracting accumulator and the other a straight adding accumulator, or, if the machine is to be used where subtracting operations are not necessary, both of these accumulators may be straight adding accumulators.

The auxiliary accumulators, however, are preferably straight adding accumulators.

Referring to Figs. 2ª, 6, 7, 8, 9, 10, 11, shallow channel pieces 118 are fastened by screws 119 to the plates 108, these channel pieces extending across the group of large gears 105. Fastened to the channel pieces 118 are brackets 120 through whose ends extend rods 121 which are attached to the plates 108. Carried by the brackets 120 are rods 122 and 123.

Sectors or detents 124 are rockably mounted on the rod 122. Sector actuators 125, connected by springs 126 to the sectors or detents 124, are also rockably mounted on the rod 122. Each sector actuator 125 has a notch through which projects the pin 127 carried by the sector 124.

Rockably mounted upon the rod 123 are latches 128 which, when latched, hold or lock the sector actuators 125 in normal position against the action of springs 129 cooperating therewith.

Referring to Figs. 2, 6, 7, 11, there are shallow channel strips 130 carried by intermediate brackets 131 and end brackets 132 forming a rigid structure carrying rods 133 and 134. The brackets 132 at one end of the structure are forked over the rod 122 and at the other end thereof are provided with pins 140 (Fig. 11) which are guided in radial slots in the plates 108.

Accumulator gears 135 are mounted on rod 133 and carry double-pointed trip cams 136 which are fastened thereto by rivets 137 so that the gears and trips are unitary. Trip pawls 138, which are rockably mounted on the rod 134, are provided at one end with heads or points adapted to engage the trip cams 136 and prevent rotation of said cams and the accumulator wheels 135 in one direction but said trip pawls 138 are adapted to be pushed back by the points of the trip cams 136 when the accumulator wheels are moving in the opposite direction, that is, in the direction indicated by the arrow in Figs. 8 and 9.

The other ends of the trip pawls 138 are provided with forks which receive a pin 139 carried by the latch 128 on the next higher order of accumulator wheel 135, the purpose being to release the sector actuator 125 of the next higher order of the accumulator when

one of the points of the trip cam 136 pushes back and passes the trip pawl 138 of a lower order, thereby effecting carrying.

Suitable hubs and collars are provided to space the previously described parts.

The springs 129 connect the sector actuators 125 to the trip pawls 138, thus actuating both of said pieces.

Controlling connections for the auxiliary accumulators.—Referring to Figs. 2ª, 6, 8, 9, 10, 11, there are lugs 132ª and pins 141 which project laterally and outwardly from the brackets 132. Between the lugs and the pins are the ends of two short levers 142, said levers being mounted on the shafts 143 for the respective accumulators, said shafts 143 passing through the brackets 120, Figs. 3ª, 7, 8, 9, 10, 11.

Fastened to the central shaft 106 are two restoring plates 145, Figs. 2ª, 6, 7, to which restoring bars 144 for the respective auxiliary accumulators are fastened so that when said restoring plates turn, the restoring bars 144 for all of the accumulators will be shifted.

As previously explained, any or all of the accumulator gears 135 are adapted to be made to mesh with the large or main gear 105 or with their respective carrying sectors 124. The right hand end sectors 124 are fastened to the right hand end brackets 120 to prevent these particular sectors from turning. The restoring plates 145 have slots 145ª, Fig. 6, to permit the free passage of rods 113 so that there will be no interference therewith.

Referring to Figs. 1ª, 3ª, 7, the shafts 143 have bearings 146 which are held by screws in the slots 115ª in the plate 115. The left hand ends of shafts 143 have cranks 147 to carry pivoted pawls 148 provided with slots at their ends.

There are two spaced incomplete or partial discs 150, 152 which are carried by shaft 106 and are respectively provided with pins 149 and 151. When a latch pawl 148 is moved in one direction, its slot will latch over pin 149 and when moved in the opposite direction, its remaining slot will latch over pin 151. The two upper front latching pawls 148ª are made double, Figs. 1ª, 3ª, the two parts being connected, and the space between these pawls permitting the passage of one of the wire links 158.

The latch pawls 148, 148ª are independently operated by the following means. For each pawl 148, there is a lever 154, some of which are pivotally mounted on plate 115 and others on plate 116, Figs. 1ª, 7. The respective levers 154 are connected by links 153 to the latches 148. Each lever 154 is held in a neutral position by a hairpin spring 155 having its coil encircling the pivot of the lever and its ends bearing against the opposite sides of the pins 156 carried by said levers and pins 157 on the plates 115 and 116. This arrangement prevents the latches 148 from normally engaging either of the pins 149, 151.

Sectional, adjustable, turnbuckle wire links or connections 158 are pivoted at one end to the levers 154 and at their forward ends, they are pivotally connected to the upper ends of levers 159 carried by the controlling keyboard section of the machine, Figs. 1, 1ª, 4, 4ª.

The sectional, adjustable construction of links 158, enables any desired adjustment to be obtained to prevent normal engagement of the pawls 148 with pins 149, 151.

Driving connections for auxiliary accumulators.—The incomplete or partial discs 150, 152 are adapted to turn freely on shaft 106 and each of these discs carries a cam roll 160, Figs. 1ª, 3ª, 7. A shaft 161 which is journalled in the plates 103 and 115, Figs. 1ª, 3ª, has secured thereto a cam 162 whose slot cooperates with the cam roll 160. The shaft 161 has fast thereon an arm 163, Figs. 1ª, 3ª, 12, 13, 14 which is connected by a link 164 to the upper end of a pivoted flying lever 165. A shaft 166 which is journalled in the plates 103 and 115, carries a cam 167 and an arm 168, Figs. 1ª, 3ª. There is a cam roll 160 carried by the other partial disc 152. The arm 168 is connected by a link 169 to the upper end of another pivoted flying lever 170.

The cams 162 and 167, in conjunction with the respective rolls 160 on the partial discs 150 and 152, provide means whereby the said partial discs may be operated by the means shortly to be described.

Referring to Figs. 12, 13, 14, in connection with Figs. 1ª, 3ª, 7, there is shown an improved accumulator detent for the arms 163, 168 which have been referred to, said accumulator detent being used in connection with said arms to hold the cams 162 and 167, and hence the partial discs 150, 152, in the position to which they have been shifted, until such position is changed.

Accumulator detent.—Referring to Figs. 12, 13, 14, the construction illustrated, is substantially that disclosed in the application of Emil J. Ens, Serial No. 323,124, filed December 1, 1928. There are two slotted slides or plates 290, 291 which are drawn toward each other by contractile coil springs 293 whose ends are engaged with horns on said slides or plates. One of the slides or plates 290 is mounted on the rod 171 (in the other instance on the rod 172), the rod 171 being carried by the plates 103 and 115; and the rod 172 being carried by the plates 108 and 115. The remaining slide 291 is pivoted at 292 to the arm 163 in one instance and to the arm 168 in the other instance. The slots receive the connections 171, 292, as shown in Figs. 12, 13, 14 so that the respective plates slide in relation to each other against the contractile action of the springs 293 when the arm 163 is shifted. The springs hold the arm 163 in the two limits of its play, thereby holding the partial discs 150, 152 where set.

Driving means for auxiliary accumulators.—The means for operating the driving connections for the auxiliary accumulators is operated by the main shaft O1 of the machine, following the practice in the Ellis machine. A driving plate 173, Figs. 1 and 3, secured to shaft O1, carries flying levers 165 and 170 pivotally mounted thereon, said levers being respectively pivoted to the driving links 164 and 169.

The flying lever 165 is adapted to contact with a square stud 174, said stud rigidly connecting the driving plate 173 with the usual driving plate D50, Fig. 3, which is carried by shaft O1 and is a well-known feature of the Ellis machine as shown by Ellis Patents Nos. 1,197,276; 1,197,278; 1,203,863, whereby plates 173 and D50 move as a unit. The square stud 174 by its engagement with the flying lever 165, insures the return of said lever to normal position.

There are two square pins 175 and 176, Figs. 1 and 3, carried by driving plate 173, which are adapted to contact with the flying lever 170 to effect the shifting of the link 169, the cam 167, Fig. 1[a] and the partial disc 152 during the last part of the stroke of the main shaft O1 in both directions. By reference to the preceding description, it will be seen how, on each stroke of the main shaft O1 when the machine is put through its cycle of operations, the link 169 operates the mechanisms appearing in Fig. 1[a] so that if the proper keys have been set or the carriage brought to the proper tabulated position, as will now be described, accumulation may be effected in one or more of the auxiliary accumulators, but the link 164, cam 162 and partial disc move only when taking a total.

Controlling keyboard.—Referring to Figs. 1, 2, 3, 4, 4[a], 5, the row of keys to the right of Fig. 4, being in the row nearest to the numeral keyboard (not shown), contains the error key K61 and repeat key K62 for the numeral keyboard and also the controlling keys K63, K64, K65, K66, K67, K68, K69 for the adding and subtracting accumulators comprising the regular equipment of the Ellis machine except that both accumulators may be made to subtract, and which are shown at the left of Fig. 2 and also in Fig. 6[a].

The central or middle row of keys 228, etc. includes the sub-total key 228 and eight total keys for the eight auxiliary accumulators, or, as many total keys as there are auxiliary accumulators.

The left hand row of controlling keys 230, etc. includes the release key (230) and as many adding keys as there are auxiliary accumulators.

The latches and pins of the row of keys K61, K62, etc., are mounted on the left side frame B47 of the machine; those of the middle row 228, etc. are carried by a plate 180, Figs. 4, 4[a], and those for the left hand row 230, etc. are mounted on a plate 181.

The plates 180, 181 are attached to the base B45 by bars 182 which also space said plates; screws 183 fastening down the bars 182.

The plates 180, 181 are attached by bars 184, Figs. 1, 3, to the keyboard plate or deck 186 by screws 185. The key stems are guided at the top by the plate 186 and at the bottom by perforated angle pieces 187, Figs. 2, 4, attached to plates 180, 181.

The key stems have means to engage the angle member 187 to limit their downward movement, and they are elevated by springs *b*, only one of which is shown in Figs. 1 and 2.

The release of the numeral keys (not shown) by the error key K61, is accomplished substantially as set forth in Ellis Patent 1,197,276, there being a horizontally arranged push link 57K pivoted to the error key K61 by stud K29. The push link 57K is adapted to shift the slide bar L51, seen at the right of Fig. 2. Reference may be had to Fig. 51 of Ellis Patent No. 1,197,276 for further details of this particular part of the Ellis machine.

The numeral error key K61 carries a piece 72K, appearing at the right of Figs. 2 and 4, and at the upper right hand part of Fig. 3. The piece 72K in conjunction with the arm M52 carried by shaft M4, as seen in said figures, serves to interlock the starting bar (not shown) and the error key K61 to prevent both of them being depressed at the same time. Reference may be had to patent to Bernau, No. 1,731,701, Figs. 15, 16, 17 for a complete showing of the interlocking of the starting bar by the shaft M4.

The repeat key K62, when depressed, is latched down by latch L155, Fig. 2, which effects the raising of the numeral key release hook L63 by means of the repeat key bar L61, Fig. 2, which action will be clearly understood by reference to Ellis Patent No. 1,197,276.

The total key K63 for the upper adding and subtracting accumulator appearing at the left of Fig. 2 and in Fig. 6[a] will, when depressed, enable its latch L56 to depress the total cam arm 58L by the engagement of the pin 22L therewith, said total cam arm 58L then depressing the subtracting cam lever 60L which carries the total pawls 61L to position these pawls in the path of the lower end of the flying lever D53, causing lever D53 to move the upper regular accumulator, seen at the left of Fig. 2 at the beginning of the stroke of shaft O1 in either direction, all of which will appear more fully on reference to the Ellis Patent No. 1,197,276.

Inasmuch as the repeat key K62 has a bar L61, Fig. 2, carrying pin 25L extending under the total cam arm 58L, when said arm 58L is depressed, the repeat key bar is also depressed, which brings its rear end into the path of travel of the roller 40D which, ordi-

narily, would bring about the automatic release of the repeat key K62 when taking this total. If the subtracting key K64 for the upper accumulator be in latched down position, the depression of the total key K63 will release this subtracting key because the pin 187 carried by the stem of key K63, will engage lever 188 and cause said lever by its contact with pin 189 of lever 190 to effect the release.

The depression of the subtracting key K64 for the upper accumulator results in the latch 191 locking down said key and said latch 191 causes the pin 189 to swing the subtracting lever 190, thus shifting the pin 192 on the lower end of said lever into engagement with the subtracting cam lever 60L, depressing said cam lever in the same manner as it will be depressed by the action of the total key K63 but without depressing the total cam arm 58L or the repeat key bar L61. Therefore, if the repeat key K62 happens to be down, it will not be released at this time. Nevertheless, the subtracting set link N64L carrying the pin NL26, is moved so that the upper accumulator of the Ellis machine will be conditioned for subtraction.

The depression of the adding key K65 for the upper accumulator places said accumulator in condition for addition. Reference is to be had to the Ellis Patents Nos. 1,197,276; 1,197,278; and 1,203,863 for detailed explanation of the foregoing actions.

The lower adding and subtracting accumulator is subject to the control of the total key K66, and the subtracting key K67. The parts L60, L1, 203, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, correspond in operation and function to the parts L56, 22L, 187, 188, 189, 190, 191, 192, 58L, 60L, 61L, N64L and NL26, respectively.

The non-add key K69 operates in the manner set forth in the Ellis Patent No. 1,197,276 to which reference may be had.

The sub-total key K68 functions in the manner described in the application of Emil J. Ens, Serial No. 323,124, quadruplex accumulator calculating machine.

In the present machine, there is no adding key for the lower adding and subtracting accumulator, said accumulator being subject only to control by the carriage when the latter is in its different tabulated positions, according to requirements. Therefore, a carriage controlled lever 4F64 may be employed, together with its train of mechanism, as shown in the aforesaid Ens application Serial No. 323,124, quadruplex accumulator calculating machine, to permit the transfer of the total from the upper accumulator to the lower accumulator by utilizing the tabulated position of the carriage, should the nature of the work require this function to be performed.

The total key stems K63 and K66 are adapted to be locked when an overdraft occurs in either of the adding and subtracting accumulators, this being accomplished by overdraft locks N68L, Fig. 2, operated by links N66L and N69L jointed together, the latter being pivoted to the crank or arm N68 and operated, and released, as set forth in the patents to Bernau, Nos. 1,508,267 and 1,731,701, the purpose being to prevent depression of the keys K63 and K66 when an overdraft occurs.

A symbol printer such as set forth and described in the application of Emil J. Ens, Serial No. 323,124 may be provided, the vernier cam slide or bar thereof being extended so that it may be actuated by the non-add key K69 and the cams of said bar altered to provide for the printing of symbols corresponding to the controlling keys for the adding and subtracting accumulators comprised in the right hand series shown in Fig. 5, except for the sub-total key. The cam bar 4—52, link 4—59, crank arm 4—58 and shaft 4—1 of this mechanism appear in Fig. 2.

The automatic release of the controlling keys in the right hand series K61, K62, etc., Figs. 1 and 3, on the machine going through its cycle of operations, is accomplished by means such as set forth in Ellis Patent No. 1,197,276, one releasing bar L66, Fig. 2, carrying pawl L67 and having projections to engage with the front of each of the key latches except that for the repeat key K62, the other bar L65 being connected to the sub-total release lever L68 which operates bar L66 when the insert piece K68′, Fig. 2, is pushed between the pins in the said bars L65, L66 by the depression of the sub-total key K68. Reference is to be had to the application of Ens, Serial No. 323,124, for the details of this construction.

The adding keys of the series 230, etc. for the group of adding accumulators, Figs. 1, 3, 5, are each adapted to be locked in depressed position by a latch 211 whose bent-over end will enter a notch in the key stem when the key is depressed. The lower end of the latch 211 is adapted to contact with a pin 212 carried by the lower end of lever 159, Fig. 1.

In the middle row of keys, Figs. 1, 3, 4, 4^a, each total key is locked in depressed position by latch 213 whose bent upper end is adapted to engage a notch in the key stem when the key is depressed, the lower end of the latch 213 contacting with a pin 214 projecting from the upper end of the lever 159.

Upon the right side of the plate 180, Figs. 1, 3, 4, 4^a, is pivoted a lever 215 which carries a pin 216 at its lower end. The upper end of the lever 215 is connected by a link 286 to a post 217 in the total key release bar

218, said post 217 carrying a total release pawl 219, Fig. 4a.

The link 286 is supported near its rear end by a stud 220 on the sub-total release lever 221, Figs. 3, 4a. The total pawl 219 is adapted to contact at its upper end with a pin 224 carried by plate 180, said pin corresponding in position with the pin NL20 on the left side frame B47.

The sub-total release lever 221 is also mounted on the right side of the plate 180 and has an arm projecting rearwardly and connected at 225 to a bell crank 226, the other end of the bell crank being connected by a stud to the sub-total release bar 227. The lever 221 and bell crank 226 are fastened to the shaft 240, Fig. 1. The forward end of cam lever 222 contacts with pin 216 and the rear end of this lever carries total pawls 223, Fig. 1.

Referring to Figs. 1, 3, 4, the sub-total key 228 of the middle row, Fig. 5, carries an insert pawl 229 which is, by the depression of said key, inserted between pins projecting from the total and sub-total key release bars 218, 227 at the forward ends thereof. If desired, the key 228 may have a latch to hold it down, such latch not being illustrated.

The release or error key 230 of the left hand row of keys, Fig. 5, is provided with a square stud 231, Fig. 1, projecting toward the right and adapted to co-operate with an arm 232 upon the extended end of the shaft M4, previously referred to, to interlock the error key 230 with the starting bar, not shown, so that the error key and the starting bar may not both be depressed at the same time. Reference has previously been made to the Bernau Patent No. 1,731,701, Figs. 15, 16, 17 for a disclosure of the shaft 4 and the starting bar.

The error key 230 also carries a pin 233, Figs. 1 and 4, which is adapted to contact with the release key lever 234 secured to shaft 235. A short arm 236, Fig. 4, is also secured to shaft 235, and there is a grooved rod 237 which is attached to said arms, Fig. 4. The grooves in the rod 237 support the forward ends of the total release bars L66 and 218, Figs. 3, 4, and also the sub-total release bars L65 and 227, and the adding release bar 238. These bars, when moved rearwardly, will release the latch from any depressed controlling key. The release bars being forked over the rod 237, they may be moved independently by the automatic action of the machine as it goes through its cycle of operations.

Referring to Figs. 1, 2, 3, each total key for the adding and the adding and subtracting accumulators is provided with a pin K12. Pivotally mounted on the side frame B47 are three operating key locks L50, Fig. 1, and a front operating key lock 239. Reference is to be had to Ellis Patent No. 1,197,276, Fig. 47 thereof, for a more detailed disclosure of the key locks L50.

Depending from the shaft 240 is an arm 241 which is in the same plane as that of the total key locks, Figs. 1, 3, 4a, for the group of straight adding accumulators, said arm 241 being connected by a link 242 to an arm 243 which is attached to a sleeve 244, Figs. 2 and 4, and on the other end of the sleeve is fastened an arm 245 whose upper end is off-set to pass by or around the repeat key latch L155 and to contact with the front of a pin 246 in the total key lock from the starting bar L154L, Figs. 2, 3, 4.

When any one of the total keys is depressed, its pin K12 swings the aforesaid parts so that they are in the path of the pins in the other total key stems and thus prevent the depression of any other total key. This mechanism at the same time causes the total key lock from starting bar L154L to be swung into its raised position, during which movement the depression of the starting bar is prevented. The aforesaid mechanism prevents the starting bar from being depressed unless all of the total keys are either in raised or in depressed position and prevents more than one total key being depressed at a given time.

The shaft L1 and handle lock lever 150L, Fig. 2, co-operates with the key release bar to bring about unlocking of the starting bar in substantially the manner disclosed in the Ellis and Bernau patents, there being a rod 247 which connects the lock lever 150L to an arm 248 which is fastened to a shaft 249, Fig. 4a, extending between plates 180 and 181 and to which shaft 249 is fastened to another arm 250 similar to the arm 248. The arms 248 and 250 are connected at their lower ends by a rod 251, and their upper ends carry pins 252 which perform the same function as performed by the pin 15L for their row of keys.

Carriage control of adding and subtracting accumulators.—Referring to Figs. 2, 3, the hanging bar levers 4F61, 4F62, 4F63, and 4F64 are constructed and arranged substantially the same as in the quadruplex accumulator calculating machine application of Ens, Serial No. 323,124 and in addition thereto, there is a non-add hanging bar lever FF61. However, certain of the connections for these hanging bar levers and their functions, are changed in the present construction.

The hanging bar levers 4F63 and 4F62 are connected by the hanging bars 204 and 205, Fig. 2, to the controlling latches D60 and D61 for the adding and subtracting accumulators which are seen at the left of Fig. 2. The hanging bar levers 4F61 and 4F64 have yielding spring connections to their hanging bars 206 and 207 and by them are connected to two levers 208 which are lo-

cated one behind the other, Figs. 2 and 3, to which are attached links 209 and 210 which are connected to subtracting levers 195 and 190 so that the said levers 195 and 190 may be operated from the adjustable stops on the carriage, independently of the operation by the keys previously described. The purpose of the spring connection is to permit the restoration of the subtracting levers 195 and 190 while the hanging bar levers are still held down by a stop. The non-add hanging bar lever FF61 is connected to a non-add stop 265D whose functions are the same as that of the non-add latch L58.

Carriage control of auxiliary adding accumulators.—As previously stated, the control by the carriage effected through the levers 4F61, 4F62, 4F63, 4F64, FF61, Figs. 2 and 3, is entirely independent of the control of the auxiliary adding accumulators by the controlling means whose description follows.

Referring to Figs. 1, 1ª, 3ª, 7, brackets 253 are carried by the traveling carriage and from these brackets depend two arms 254 which are pivoted at 255 and are connected by rods 256 and 257 fastened thereto, the upper rod 256 resting in notches in the brackets and there being a spring pin 258, Fig. 7, having a manipulating knob 259 so that the arms are locked down in the operative position shown in Fig. 1, or, in the raised position, over the top of the brackets 253 to permit removal of the carriage from the machine, when desired.

The lower rod 257 has a flat rear face, Fig. 7, and carries as many contact stops as may be required for the particular uses to which the machine is subject. Each contact stop, as best seen in Fig. 1ª, comprises a body 260 having a head provided with a round hole through which the rod 257 passes, a collar 261 which presses against the flat rear face of rod 257, a washer 262, a series of spacing collars 263, one or more contact washers 264, and a thumb nut 265 which clamps the aforesaid parts together. By slightly loosening the thumb nut 265, the entire stop may be shifted lengthwise on the rod 257 to any desired position where the stop may be desired for use as representing a certain tabulated position of the carriage.

A series of contact levers 268, one for each of the eight (more or less) adding accumulators, are pivoted on a stud 266 on bar 267 which bar is carried by the plates 102 and 103. Viewing Fig. 7, the left hand ends of these control levers 268 pass through slots in a bracket 272 supported by the bar 267 and, still viewing Fig. 7, the right hand ends of the levers 268 are connected by springs to links 269, see also Fig. 1ª.

Pivoted to plate 115, Figs. 1ª and 7, are bell crank levers 270, corresponding in number to the levers 268 and connected by links 269 to said levers 268 through the medium of the springs. The other arms of the bell crank levers 270 are adapted to contact with pins 271 in the wire links 158 which, it will be remembered, extend forwardly to the controlling keyboard, as previously described. The bell cranks 270 and the pins 271 are so located that the contact lever 268 nearest the front of the machine, will act on the wire link 158 that is connected to the arm 159 nearest the front, and so on, in regular order from front to rear.

It will be seen that means is thus provided common to the controlling keys and to the travelling carriage (at the rear thereof) entirely distinct from the control exercised by the levers 4F61, 4F62, 4F63, 4F64, FF61 at the front of the carriage, whereby the straight adding accumulators may be manually arranged for addition by key operation or automatically thus arranged by the tabulated position of the carriage.

General operation.—The depression of an adding key in the left row of the series 230, etc., Figs. 1, 3, 5, permits its latch 211 to lock the key in depressed position and the lower end of the said latch to contact with the pin 212, carried by arm 159 which, through the connections 158, 154 and 153, causes the latching of pawl 148 over the pin 151 in the partial disc 152.

It will be remembered that the partial disc 152 shifts at the proper time for causing the accumulator connected to it to add, that is, the crank shaft 143, in the given instance, is moved near the end of the forward stroke of the operating means of the machine so that the accumulator gears 135 of the given accumulator are meshed with the gears 105, Figs. 6, 8, 9, 10, 11, and remain in mesh during the first part of the return stroke of the machine until the racks 100 and the gears 105 have returned to their normal position. When the end of the return stroke of the operating means of the machine is approached, the given crank shaft 143 is moved in the opposite direction, thereby disengaging the accumulator gears 135 of the particular selected accumulator from the large gears 105 and placing them in mesh with the sector 124. During the time the gears are in mesh with each other, the large gears 105 turn the accumulator gears 135 in the direction of the arrow, Fig. 8, a distance equal to the number of teeth that the gear 105 and the rack 100, Fig. 6, have moved from normal position, as determined by the particular numeral key depressed in the corresponding row of numeral keys, not shown.

If a point of the trip cam 136 carried by the gear 135 passes the point of the trip pawl 138, it moves said pawl outwardly and this causes the pin 139 to move latch 128 to effect the release of the sector actuator 125 of the next gear to the left, which moves until stopped by contact with the restoring bar 144 without moving the sectors 124. The

parts then assume the position shown in Fig. 9.

After the gears 134 are disengaged from the gears 105 and move into mesh with the sectors 124, the storing bar 144 moves out of engagement with sector actuator 125 and sector 124 moves under the influence of spring 129, a distance of one tooth until stopped by contact with the shaft 143. This action results in turning the adjacent gear representing the next higher order a distance of one tooth in an adding operation to what it may have been moved by its gear 105; should this result in the point of its trip 136 passing the point of the pawl 138, the same result of turning the next succeeding gear to the left would follow.

When the gears 135 are again moved out of mesh with the sectors 124, the restoring bar 144 moves back and re-latches the sector actuator with latch 128 and then drops back to its normal intermediate position shown in Fig. 8.

In Fig. 10, the parts are shown in the position they will occupy just before the restoring bar 144 has started to restore the sector actuator 125. Referring to Figs. 2[a], 6, 11, the several restoring bars 144 for the group of adding accumulators are fastened to the restoring plates 145, all of which plates are fastened to shaft 106 as is also the restoring arm 273; the system is moved by the roll 274 carried by cam 167, Figs. 2[a], 3, 6, 11, 20, 21, said roll acting on the restoring pawl 275 pivoted on stud 277 carried by the arm 273.

The arm 273 carries a pin 276 which arrests the swinging of the restoring pawl 275, after which the pawl disengages from the roll 274. To enable the stud 277 and the pin 276 to be adjusted, they may be made eccentric and adjustable and fastened by nuts. After the pawl 275 disengages from the roll 274, the arm 273 is arrested by the pin 278 carried on the end thereof by the latching against the restoring detent 279, Fig. 1[a], release therefrom being effected by the engagement of the cam 167 with the opposite end of the detent.

A spring 280, Fig. 1[a], which connects the restoring pawl 275 and the restoring detent 279, holds the former against the roll 274 to latch the latter on the pin 278 and also to return the arm 273 and connected parts after having been moved.

When controlling addition in the adding and subtracting accumulators by the position of the travelling carriage, that position is determined by stops located on the tabulating bar at the front of the carriage, as previously explained. These stops may or may not have points adapted to contact with the hanging bar levers controlling the operation of the subtracting accumulators. The contact stops 260 are set upon the bar 257 at the back of the carriage so that the selected contact washer 264 will depress the selected contact lever 268 at the given time and connect the selected adding accumulator of the group shown in Fig. 1[a] to the partial disc through its link 269, bell crank 270, pin 271, wire link 158, arm 154, link 153, and latch 148.

The depression of the total key in the center row of the series 228, etc., permits its latch 213 to lock the key in depressed position and the lower end of said latch to contact with the pin 214, carried by arm 159, which through the connections 158, 154, and 153, causes the latching of the pawl 148, over the pin 149, in the partial disc 150, and, through the connections 218, 217, 286, 215, and 216, to move the total cam arm 222, so that the ends of the pawls 223, are placed in the path of the lower end of the flying lever 165, so that when the machine is operated the parts 165, 164, 163, 162 and 150 will be moved at the beginning of the stroke in either direction as will a crank 147, which has been connected by these parts as above-noted.

What I claim is:

1. In a multiple accumulator calculating machine, the combination with actuators whose extent of movement is determined by the number set up on the machine, of main gears positively shifted by said actuators during each movement of the actuators, independent accumulators having gears adapted to be directly meshed with, or disengaged from, said main gears, and means whereby the respective accumulators may be selectively arranged for individual or joint direct engagement with the main gears.

2. In a multiple accumulator calculating machine, the combination with toothed actuators whose extent of movement is determined by the number set up on the machine, of main gears with whose teeth the teeth of the actuators constantly engage, whereby the main gears are positively shifted by said toothed actuators during each movement of the actuators, independent accumulators having gears adapted to be directly meshed with, or disengaged from, the teeth of said main gears, and means whereby the respective accumulators may be selectively arranged for individual or joint direct engagement with the main gears.

3. In a multiple accumulator calculating machine, the combination with actuators whose extent of movement is determined by the number set up on the machine, of main gears positively shifted by said actuators during each movement of the actuators, independent auxiliary accumulators having gears adapted to be directly meshed with, or disengaged from, said main gears, means whereby the respective auxiliary accumulators may be selectively arranged for individual or joint direct engagement with the main gears, and a main totalizing accumulator, additional to the aforesaid auxiliary ac-

cumulators, which is adapted for selective engagement with said actuators for joint use with one or more of the aforesaid auxiliary accumulators for the purpose of accumulation simultaneously therewith, or, the transfer to the main accumulator of an accumulation standing on any auxiliary accumulator.

4. In a mulitple accumulator calculating machine, the combination with actuators whose extent of movement is determined by the number set up on the machine, of main gears positively shifted by said actuators during each movement of the actuators, independent auxiliary adding accumulators having gears adapted to be directly meshed with, or disengaged from, said main gears, a main adding and subtracting totalizing accumulator adapted for selective engagement with the said actuators for joint use with one or more of the aforesaid accumulators, means for engaging the main adding and subtracting accumulator with the actuators for joint use with such one or ones of the auxiliary accumulators as may be desired, for the purpose of addition or subtraction simultaneously therewith, or, the transfer to the main adding and subtracting accumulator of an accumulation standing on any auxiliary accumulator, and means whereby the respective auxiliary accumulators may be selectively arranged for individual or joint direct engagement with the main gears independently of the cooperation of the main adding and subtracting accumulator with said actuators.

5. In a multiple accumulator calculating machine, the combination with actuators whose extent of movement is determined by the number set up on the machine, of main gears positively shifted by said actuators during each movement of the actuators, independent accumulators having gears adapted to be directly meshed with, or disengaged from, said main gears, a traveling carriage, and means controlled by the carriage for automatically selecting one or more of the accumulators by the tabulated positions of the carriage for adaptation for direct meshing with the main gears.

6. In a multiple accumulator calculating machine, the combination with actuators whose extent of movement is determined by the number set up on the machine, of main gears positively shifted by said actuators during each movement of the actuators, independent accumulators having gears adapted to be directly meshed with, or disengaged from, said main gears, accumulator-setting-means for selecting one or more of the respective accumulators for adaptation for direct meshing with the main gears, controlling keys for the respective accumulators, a traveling carriage, and operative connections common to the keys and carriage whereby the accumulator-setting-means may be manually operated by the keys, or, automatically operated by the carriage according to the tabulated position of said carriage without interference regardless of the position of the carriage.

7. In a calculating machine, the combination with a plurality of independent groups of accumulators, and actuators which may selectively or jointly operate the respective accumulators of the said groups, of a traveling carriage and independent selecting means automatically operated by the carriage when in its different tabulated positions for determining whether one or more of the accumulators of one group, or one or more of those of another group, or one or more of all of the groups will be operated by said actuators.

8. In a calculating machine, the combination with a plurality of independent groups of accumulators, and actuators which may selectively or jointly operate the respective accumulators of the said groups, of a traveling carriage, independent selecting means for determining whether one or more of the accumulators of one group, or one or more of those of another group, or one or more of all of the groups will be operated by said actuators, and independent series of settable means carried by the traveling carriage adapted for independent co-operation with said independent selecting means and by which automatic selection by carriage position may be made as between the accumulators of a given group or between the groups of accumulators, or, selected accumulators of the respective groups may be jointly utilized by the actuators.

9. In a calculating machine, the combination with a combined adding and subtracting accumulator, of a plurality of adding accumulators, actuators which may selectively or jointly operate the respective accumulators aforesaid, means whereby the adding accumulators may be selectively conditioned for individual or joint co-operation with said actuators, and means whereby the adding and subtracting accumulator may be conditioned for direct engagement with said actuators independently of, or jointly with the co-operation of one or more of the adding accumulators with said actuators, including means whereby addition may be performed in one or more of the adding accumulators alone, or while simultaneously adding the amount into, or subtracting the amount out of, the adding and subtracting accumulator on a given operation of the machine.

10. In a calculating machine, the combination with a combined adding and subtracting accumulator, of a plurality of adding accumulators, actuators which may selectively or jointly operate the respective accumulators aforesaid, means whereby the adding accumulators may be selectively conditioned for individual or joint co-operation with said actuators, means whereby the adding and

subtracting accumulator may be conditioned for direct engagement with said actuators independently of, or jointly with, the co-operation of one or more of the adding accumulators with the actuators, including means whereby addition may be performed in one or more of the adding accumulators alone, or while simultaneously adding the amount into, or subtracting the amount out of, the adding and subtracting accumulator on a given operation of the machine, means whereby totals and subtotals may be taken from any of the adding accumulators or the adding and subtracting accumulator, and means whereby the adding and subtracting accumulator may be utilized for subtraction independently of the utilization of the adding accumulators.

11. A self-contained unitary multiple-accumulator auxiliary attachment for a calculating machine, embodying an auxiliary frame adapted to be attached to the main frame of the calculating machine, a plurality of auxiliary accumulators carried by the auxiliary frame, main gears carried by the auxiliary frame, main-gear-actuators carried by the auxiliary frame and adapted to be coupled to the actuators of the calculating machine, and auxiliary accumulator shifting means carried by said auxiliary frame, whereby the auxiliary accumulators may be selectively conditioned for operation by said main gears, and selecting means for determining the utilization of the auxiliary accumulators.

12. The combination with a calculating machine having a main frame and provided with main accumulators, main actuators for said accumulators, a numeral keyboard controlling the actuators, and means controlling the engagement of the accumulators with the actuators, of a self-contained unitary multiple-accumulator attachment for said calculating machine embodying an auxiliary frame adapted to be attached to the main frame of the calculating machine, a plurality of auxiliary accumulators carried by the auxiliary frame, main gears carried by the auxiliary frame, main-gear-actuators carried by the auxiliary frame and coupled to the aforesaid main actuators, auxiliary accumulator shifting means carried by said auxiliary frame, whereby the auxiliary accumulators may be selectively conditioned for operation by said main gears, a traveling carriage mounted on the calculating machine, and independent selecting means carried by said carriage, one of said selecting means being adapted to control the selection of the main accumulators for co-operation with the main actuators, the other of said selecting means being adapted to control the selection of the auxiliary accumulators for co-operation with the auxiliary actuators.

13. In a multiple-accumulator calculating machine, the combination with a numeral keyboard, operating means for putting the machine through its cycle, and actuators, of main gears directly engaged with said actuators for turning as the actuators advance and retreat, a group of independent auxiliary accumulators having gears adapted for independent or joint direct engagement with the main gears, independent means whereby any accumulator may be selected for adaptation for direct engagement with said main gears, and means common to a plurality of said accumulators and operated by said operating means for causing direct engagement of the gears of a selected accumulator or a plurality of selected accumulators, as the case may be, with said main gears for the purpose of individual or joint accumulation therein.

14. In a multiple-accumulator calculating machine, the combination with a numeral keyboard, operating means for putting the machine through its cycle, and actuators, of main gears directly engaged with said actuators for turning as the actuators advance and retreat, a group of independent accumulators having gears adapted for independent or joint direct engagement with the main gears, independent means whereby any accumulator may be selected for adaptation for direct engagement with said main gears, a shiftable member operated by said operating means and adapted for co-operation with any or all of the independent selecting means aforesaid which may have been operated to adapt an accumulator for utilization, whereby the movement of said shiftable member will cause direct engagement of the gears of any previously selected accumulator or plurality of selected accumulators, as the case may be, with the main gears for the purpose of individual or joint accumulation therein when the operating means puts the machine through its cycle.

15. In a multiple accumulator calculating machine, the combination with a numeral keyboard, operating means for putting the machine through its cycle, and actuators, of main gears directly engaged with said actuators for turning as the actuators advance and retreat, a plurality of independent accumulators having gears adapted for independent or joint direct engagement with the main gears, independently operable means for selecting the different accumulators for adaptation for use, each of such means including a latch pawl, and a shiftable member operated by said operating means and engageable by such of the latch pawls as have been set by the respective independent selecting means aforesaid, whereby the movement of said shiftable member will cause direct engagement with the main gears of the gears of those of the accumulators whose latch pawls have previously been set when the machine goes through its

cycle, thereby to operate the selected accumulator or accumulators.

16. In a multiple-accumulator calculating machine, the combination with a numeral keyboard, operating means for putting the machine through its cycle, and actuators, of main gears directly engaged with said actuators for turning as the actuators advance and retreat, a group of independent accumulators having gears adapted for independent or joint direct engagement with the main gears and each being provided with its own carrying means additional to its own gears, independent means whereby any accumulator may be selected for adaptation for direct engagement with said main gears, means common to a plurality of said accumulators and operated by said operating means for causing direct engagement of the gears of a selected accumulator or a plurality of selected accumulators, as the case may be, with said main gears for the purpose of individual or joint accumulation therein, restoring devices for the carrying means of the respective accumulators, a shiftable mounting carrying all of the restoring devices, and means for actuating said shiftable mounting by the operating means, whereby the respective carrying means of all of the accumulators are simultaneously restored.

17. In a multiple accumulator calculating machine, the combination with a traveling carriage, of two groups of accumulators, actuators common to all of the accumulators of the respective groups, a numeral keyboard, connections whereby an amount set up on the keyboard may be transmitted to the actuators and, through them, to any or all accumulators selected for operation by said actuators, operating means for putting the machine through its cycle, means at the front of the carriage for automatically selecting for use by the actuators the desired accumulator or accumulators of one group, and means at the rear of the carriage for automatically selecting for use by the actuators the desired accumulator or accumulators of the other group by the tabulated position of the carriage.

18. In a multiple accumulator calculating machine, the combination with a traveling carriage, of two groups of accumulators, actuators common to all of the accumulators of the respective groups, a numeral keyboard, connections whereby an amount set up on the keyboard may be transmitted to the actuators and, through them, to any or all accumulators selected for operation by said actuators, operating means for putting the machine through its cycle, means at the front of the carriage for automatically selecting for use by the actuators the desired accumulator or accumulators of one group, means at the rear of the carriage for automatically selecting for use by the actuators the desired accumulator or accumulators of the other group by the tabulated position of the carriage, and independent sets of keys whereby the aforesaid selection of accumulators from the respective groups may be had irrespective of the automatic selecting action effected by the carriage.

19. In a multiple accumulator calculating machine, the combination of a traveling carriage, a bar carried thereby, and a plurality of multiple stops each of which is adjustable along said bar and adapted to be secured where adjusted, each of said stops comprising a group of independent contact members mounted on the same axis and adapted to be independently turned on a common axis to render them effective or ineffective, together with independent means for each multiple stop common to the group of contact members of said stop for clamping the entire group of said contact stops in their effective or ineffective positions and for securing the entire stop on the bar wherever adjusted thereon, a plurality of accumulators, stationarily arranged on the machine in respect to the travel of the carriage, actuators for said accumulators, and independent means on the machine for conditioning the respective accumulators for co-operation with the actuators, said last-named means being subject to selective operation by the contact members of the stops according to the setting of said contact members.

20. In a calculating machine, a retaining detent for holding an accumulator in its inoperative position comprising a pair of bodily shiftable slides movable in respect to each other, and contractile coil springs connecting the slides to each other adapted to draw them together.

21. In a calculating machine, a retaining detent for holding an accumulator in its inoperative position, comprising a pair of bodily shiftably relatively movable overlapping slotted slides, guiding means in the slots of said slides, and contractile coil springs connecting the slides to each other adapted to draw them together.

22. In a multiple accumulator for a calculating machine, the combination with toothed actuators adapted to be shifted according to the amount set up on the machine, of accumulator gears, shiftable carriers for said accumulator gears whereby they may be moved into or out of mesh with the toothed actuator, accumulator carrying sectors or detents with which said accumulator gears normally engage, spring-actuated sector actuators adapted to co-operate with said carrying sectors or detents, trip pawls adapted to be tripped by the accumulator gears, latches adapted to hold said sector actuators in normal position, said trip pawls serving to release the latches from the sector actuators, thereby to enable the sector actuators

to shift the carrying sectors or detents when the trip pawls are operated by the accumulator gears, and restoring means for the sector actuators effecting the re-latching thereof.

23. In a multiple accumulator for a calculating machine, the combination with main gears adapted to be turned according to the amount set up on the machine, a plurality of independent carriers which are independently shiftable, and independent accumulators carried by the respective carriers, said accumulators having gears, means whereby the respective carriers are normally positioned so that the accumulator gears are disengaged from the main gears, means for selecting the respective carriers so that they may be conditioned for shifting, operating means for the machine, and means common to all of said independent carriers, controlled by said operating means for collectively shifting any or all of the carriers of the accumulators which have been previously selected for use when the machine is put through its cycle, thereby to engage the gears of the selected accumulator or accumulators with the main gears for the purpose of effecting turning of the accumulator gears by the main gears.

24. In a multiple accumulator for a calculating machine, the combination with main gears adapted to be turned according to the amount set up on the machine, a plurality of accumulators each comprising a shiftable carrier, and accumulator gears carried thereby, means whereby the respective carriers are normally positioned so that the accumulator gears are disengaged from the main gears, means for selecting the respective carriers so that they may be conditioned for shifting, operating means for the machine, means controlled by said operating means for collectively shifting any or all of the carriers of the accumulators which have been selected as aforesaid when the machine is put through its cycle, thereby to engage the gears of the selected accumulator or accumulators with the main gears, and independent carrying means for the respective accumulators which is normally engaged with the accumulator gears and from which the accumulator gears disengage when the carrier therefor is shifted as aforesaid.

25. In a multiple accumulator for a calculating machine, the combination with main gears adapted to be turned according to the amount set up on the machine, a plurality of accumulators each comprising a shiftable carrier, and accumulator gears carried thereby, means whereby the respective carriers are normally positioned so that the accumulator gears are disengaged from the main gears, means for selecting the respective carriers so that they may be conditioned for shifting, operating means for the machine, means controlled by said operating means for collectively shifting any or all of the carriers of the accumulators which have been selected as aforesaid when the machine is put through its cycle, thereby to engage the gears of the selected accumulator or accumulators with the main gears, independent carrying means for the respective accumulators which is normally engaged with the accumulator gears and from which the accumulator gears disengage when the carrier therefor is shifted as aforesaid, and restoring means common to all of the carrying means of the respective accumulators, by which all of the carrying means are collectively restored, said restoring means being operated by the operating means of the machine.

26. In a multiple accumulator calculating machine, the combination with a plurality of independent accumulators, of independent total keys for controlling the taking of totals from the respective accumulators, a starting bar, and means preventing operation of the starting bar when any total key is only partly set.

27. In a calculating machine, a retaining detent for holding an accumulator in its inoperative position, comprising a pair of alined slotted slides, a stationary member, an accumulator-operating-member received in the slots in the sides, and equalizing contractile coil springs connecting the slides together.

28. In a multiple accumulator for a calculating machine, the combination with rockable main gears adapted to be turned according to the amount set up on the machine, of a plurality of independent carriers which are independently shiftable in relation to the rockable main gears, independent accumulators carried by the respective carriers, said accumulators having gears which are shiftable into and out of direct mesh with the rockable main gears, a rockable shifter, independent couplings for the respective carriers subject to selection or joint connection to the rockable shifter, and operating means for the machine adapted to rock the shifter, thereby to cause the couplings which have been operated to mesh the gears of the selected accumulators with the rockable main gears to condition the selected accumulators for individual or joint operation by the rockable main gears.

29. In a multiple accumulator for a calculating machine, the combination with rockable main gears adapted to be turned according to the amount set up on the machine, of a plurality of independent carriers which are independently shiftable in relation to the rockable main gears, independent accumulators carried by the respective carriers, said accumulators having gears which are shiftable into and out of direct mesh with the rockable main gears, carrying means for each accumulator, additional to its own

gears, independent restoring devices for the carrying means of each accumulator, a rockable mounting carrying all of the aforesaid restoring devices, a rockable shifter, independent couplings for the respective carriers subject to selective or joint connection to the rockable shifter, and operating means for the machine adapted to rock the shifter, thereby to cause the couplings which have been operated to mesh the gears of the selected accumulators with the rockable main gears to condition the selected accumulators for individual or joint operation by the rockable main gears, said operating means also rocking the rockable mounting for the restoring devices for the purpose of restoring all of the carrying means of all of the accumulators aforesaid.

30. In a multiple accumulator for a calculating machine, the combination with main gears adapted to be turned according to the amount set up on the machine, of a plurality of accumulators having gears adapted to directly mesh with the main gears, each accumulator having its own carrying means self-contained therewith and independent of the main gears, means for independently or collectively shifting the accumulators to cause their gears to engage with, or disengage from, the main gears, a keyboard, actuators for the main gears which are under the control of the keyboard and are independent of the carrying means for the respective accumulators, and operating means for the machine, said operating means being adapted for shifting the actuators and for shifting the respective accumulators into, and out of, engagement with the main gears.

31. In a multiple accumulator calculating machine, the combination with a numeral keyboard, operating means for putting the machine through its cycle, and actuators controlled by the numeral keyboard, of a plurality of shiftably mounted independent accumulators, each of which has its own carrying means self-contained therewith, said accumulators, when set for operation, being adapted for independent or joint cooperation with the actuators for accumulation in such of said accumulators as may be selected for use, selecting means by which one or more of the accumulators may be selected for use in connection with said acutators, rockably mounted means, common to all of said accumulators, controlled by said operating means, latching pawls combined with the respective accumulators and subject to control by the selecting means aforesaid which independently couple the shiftably mounted accumulators to the aforesaid means common to all of said accumulators so that said operating means will cause such of the accumulators as have been selected to be picked up and shifted for co-operation with the actuators when the machine is put through its cycle of operation by said operating means.

In testimony whereof I affix my signature.

NATHAN W. PERKINS.