J. F. ANDERSON.

ADDING AND SUBTRACTING MACHINE.

APPLICATION FILED OCT. 2, 1917.

**1,288,793.**

Patented Dec. 24, 1918.

2 SHEETS—SHEET 1.

Fig. 2.

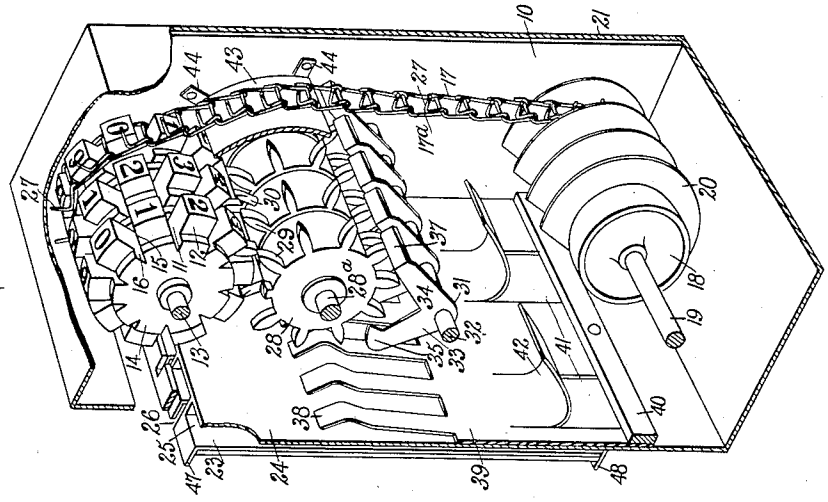
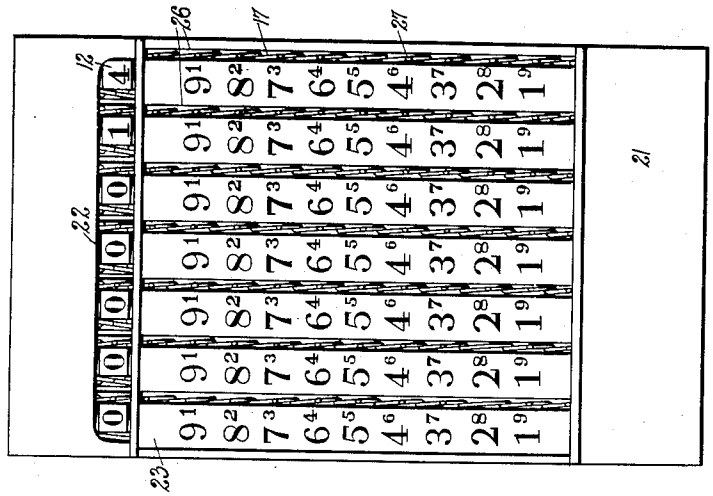


Fig. 1.



WITNESSES

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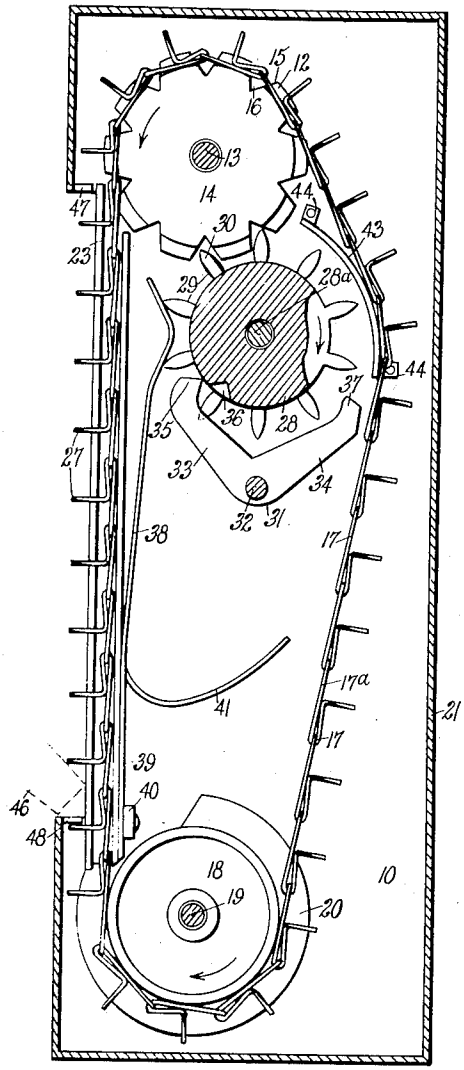
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2 SHEETS—SHEET 2.

Fig. 3.



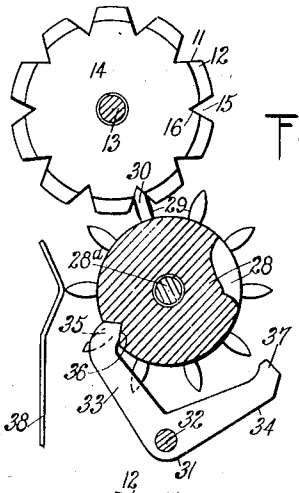




Fig. 4.

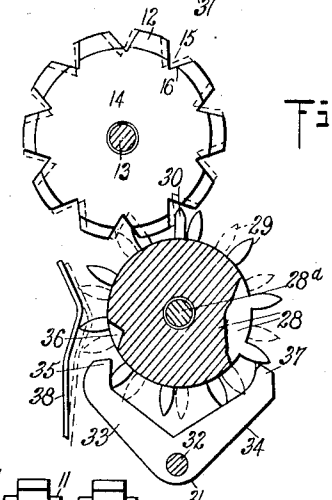



Fig. 5.

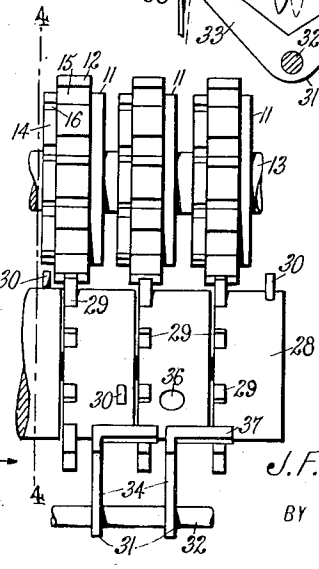
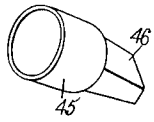



Fig. 6.

Fig. 7.




WITNESSES

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# UNITED STATES PATENT OFFICE.

JOHN F. ANDERSON, OF SEATTLE, WASHINGTON.

## ADDING AND SUBTRACTING MACHINE.

1,288,793. Specification of Letters Patent. Patented Dec. 24, 1918.

Application filed October 2, 1917. Serial No. 194,360.

*To all whom it may concern:*

Be it known that I, JOHN F. ANDERSON, a citizen of the United States, and a resident of Seattle, in the county of King and State of Washington, have invented a new and Improved Adding and Subtracting Machine, of which the following is a full, clear, and exact description.

My invention relates to calculating machines and more particularly relates to that type of machine having a series of number wheels and step transmission means for registering tens, hundreds, etc.

The invention more particularly relates to a calculating machine whereby the operations of adding and subtracting may be carried out without any change or adjustment of the number wheels or other parts and solely through the reverse movement of the operating means thereof.

Objects of the invention are to provide a machine of the indicated character in which the movement of one number wheel will be transmitted to the following wheel unfailingly without employing elements liable to become impaired or disarranged; and to provide controlling devices for the transmission means whereby the controlling devices of a given transmission wheel will limit the transfer movement imparted to a particular number wheel, and be operable by the preceding number wheel to unfailingly determine the extent of the transfer operation.

A further object of my invention is to provide pins or equivalent elements on the actuating chains or other actuating means and arranged to be directly engaged to move the actuating medium pertaining to any number wheel, thereby making for speed by facilitating the manual operation as compared with the operation of those actuating belts or the like having holes for the insertion of a pencil or like point.

The invention also has for an object to provide for resetting the number wheels or restoring them to zero entirely through the medium of the actuating means without the employment of adventitious resetting mechanism and in a manner that the resetting or restoring of the wheels may be accomplished with facility and despatch and without the necessity of exercising extreme care in the operation.

Reference is to be had to the accompanying drawings forming a part of this specification in which similar reference characters indicate corresponding parts in all the views, it being understood that the drawings are merely illustrative of one example of the invention.

Figure 1 is a face view of a calculating machine embodying my invention;

Fig. 2 is a fragmentary perspective view taken from the rear of the machine, parts being broken away and others in section;

Fig. 3 is a transverse vertical section of the machine;

Fig. 4 is a fragmentary transverse vertical section taken in a plane corresponding with the line 4—4, Fig. 6, and showing the number wheel and transmitting means and the controlling devices for the latter;

Fig. 5 is a view similar to Fig. 4 with the parts in different positions, the Figs. 4 and 5, being given for comparison with each other and with the parts as illustrated in Fig. 3;

Fig. 6 is a face view showing part of the series of number wheels, and transmitting mechanism associated therewith and controlling elements for the latter;

Fig. 7 is a perspective view of a thimble to be employed on the finger for operating the chains.

In its preferred form my invention is embodied in that style of machine in which spaced parallel index elements are employed together with endless operating means such as belts accessible adjacent to the index elements and arranged to turn the respective number wheels by a travel imparted to the said operating means, although it is to be understood that in all its phases the invention is not limited to machines having endless operating means for the number wheels.

In carrying out my invention in the illustrated form a frame 10 is provided in which, at the top, is arranged a series of number wheels designated generally by the numeral 11 and presenting at the periphery radially disposed number arms or teeth 12 having the digits produced on the faces thereof, the

said number wheels being loosely mounted on a fixed shaft 13 secured in the frame 10. In fixed relation to each number wheel 11 and usually integral therewith at a side thereof is an auxiliary wheel or disk 14. The teeth or arms 12 are separated by notches 15 and the notches of a wheel 11 are carried as at 16 laterally through the disk 14 of said number wheel, said disk terminating at the periphery adjacent to the bases of the arms 12.

In the preferred form the operating means comprises endless chains 17 each of which runs over a number wheel 11, the links of the chain being open to pass over the teeth or arms 12 for positively actuating the number wheel without loss of motion, said chains running also over drums or idler sheaves 18 on a transverse shaft 19 near the lower end of the frame 10, the several chains being separated by partitions 20 between the drums.

The frame is inclosed in a suitable casing 21 which is open at the front and at said front are fixed or produced on the frame 10 a series of parallel index plates 23. In the case 21 at the top an opening 22 is formed through which a number on an arm 12 on each number wheel 11 is visible, the plates 23 being in line with the faces of the number wheels appearing at the said opening 22. It will be observed from Fig. 1 that each index plate 23 bears digits 1 to 9 in two rows, the rows of numerals on a plate being reversed and to distinguish the rows of numerals on each face plate the numerals of one row are smaller than the other. The number wheels carry ten arms or teeth 12 bearing on the faces thereof 0 to 9. The larger numerals on each face plate run in regular order from the lower end of the plate to the upper end and are employed in adding, while the smaller numbers shown run in the reverse order from the top to the bottom and are used in subtracting. The index plates 23 constitute the face of the machine and at the back of the same is a backing plate 24 in the example shown which is spaced from the plates 23, thereby producing vertical passageways 25 through which the front runs of the chains 17 pass.

The several plates 23 are separated by slots 26 and I produce on the chains 17 outwardly projecting pins 27 which project sufficiently to extend from the front runs of the chains through the slots 26 beyond the index plates 23 as clearly shown in Fig. 3. In the preferred form of the chain which has practical advantages, the pin 27 of each link is formed integral with and constitutes the terminal of one side $17^a$ of the link, the chain being formed by the side arms of the chain of one link being bent about the cross bar at the opposite end of the next adjacent link.

In order to cause one number wheel 11 upon a complete revolution thereof to move the following wheel one step, transmitting means is provided consisting of a second series of wheels 28 loosely mounted on a fixed shaft $28^a$ parallel with the shaft 13. Each wheel 28 presents a series of radial arms or teeth 29 corresponding in number and position with the notches 15 in the number wheels, and the arrangement is such that the transmission wheels 28 will be in constant mesh with the number wheels, one arm 29 entering its notch 15 before the other leaves its notch, so that the number wheels 28 are at all times subject to movements of the number wheels as distinguished from an arrangement requiring the transmitting wheels to be thrown into operative position in order to function or for varying the function. On each wheel 28 also, is a single transmitting tooth or arm 30 out of the plane of rotation of the teeth or arms 29, the teeth 29 of a wheel 28 being in the plane of one number wheel 11 to be actuated by the latter while the tooth 30 of the said wheel 28 is in the plane of the disk 14 of an adjacent number wheel 11 to actuate the latter and thereby move said adjacent number wheel one step upon a complete revolution of the preceding wheel 11. Associated with the transmission wheels 28 are controlling means therefor to thereby control the number wheels in mesh therewith for preventing the movement of a following number wheel more than one step by a preceding number wheel with each revolution of the latter. The said controlling means comprises a series of elements 31 of general bell-crank form loosely mounted on a fixed shaft 32 to rock back and forth thereon. Each element 31 presents arms 33, 34, the arm 33 terminating in an inwardly projecting tooth 35 adapted to dog into a depression or notch 36 formed in the periphery of the wheel 28 when the said notch is brought opposite the said tooth 35 through a rotation of a wheel 28. The opposite arm 34 terminates in a bar 37 disposed parallel with the shafts 32, $28^a$, and said bar serves to overbalance the opposite arm 33 of the element 31, whereby the tooth 35 of the arm 33 will be pressed against the periphery of the adjacent wheel 28 as said wheel rotates as shown in Fig. 3. It is to be understood that with the tooth 35 of a controlling element 31 riding on the periphery of the wheel 28 and out of its notch 36 said controlling element will be out of action, the bar 37 being clear of the teeth 29 of the adjacent wheel 28 that is controlled by said element, as shown in Fig. 3. Comparing the position of the element 31 in Figs. 4 and 5 with the position in Fig. 3, it will be seen that in Fig. 4 the wheel 28 has brought its notch 36 into position for the tooth 35 to be pressed into the notch

by the weight of the bar 37. At this time also, the transmission tooth 30 of the said wheel 28, Fig. 4, has engaged in the notch 16 of the following disk 14 for turning one step that number wheel 11 that is integral with said disk. With the tooth 35 in the notch 36 of a wheel 28 the further turning of the wheel to displace the tooth 35 offers some appreciable resistance because at that time the tooth 30 of said wheel 28 is engaging the next following number wheel; therefore, the tooth 30 will be displaced with sufficient force to result in the rocking of the element 31 to move the bar 37 thereof through an arc to throw said bar into the path of movement of the teeth 29 of the adjacent transmission wheel 28 to momentarily intercept one of said teeth 29 of said wheel 28 to arrest the movement thereof. Obviously, when a transmission wheel 28 is thus arrested by the bar 37, that number wheel 11 which has been moved one step and which is in mesh with the arrested transmission wheel 28 will also be arrested to partake only of the definite one step movement imparted thereto by the preceding number wheel and transmission wheel. The weight of the bar 37 will restore the element 31 from the position of Fig. 5 to that of Fig. 3 after a momentary swinging of said bar into the path of the teeth 29.

By employing the second series of wheels (28) to transmit the motion from one number wheel to the next following number wheel, and by employing the associated controlling elements 31, 37, the transmission is positively and unfailingly accomplished by means under reliable control and of a form involving the minimum possibility of impairment or disarrangement of the parts, and the result is accomplished through elements of simple form.

To exert friction on each wheel 28 so that the momentum thereof will not permit a movement except as the wheel is positively moved by a tooth 29 engaging its controlling number wheel 11, I provide spring brakes 38 in the form of a resilient finger for each wheel. The several resilient fingers 38 are shown as formed on the upper edge of a sheet metal plate 39 secured at its lower end by a cleat 40 or the like in the rear of the back plate 24, (see Fig. 2). The fingers 38 are each given a slight inward bend near their free ends to approximate a V-shape so that the finger will bear against two adjacent teeth 29 when the latter are presented thereto and at all times will bear on at least one tooth 29. To increase the resiliency of the plate 39 the same is formed with cut-outs 41 reducing its total mass as indicated in Fig. 2, the cut-outs being produced by slitting the plate and the material between the slits may be merely turned outward in the plane of the plate as indicated at 42 in Fig. 2. By forming the resilient fingers on the plate 39 the resiliency of the latter is also utilized and thereby the resiliency of individual fingers will not be limited to that inherent in a finger itself, the finger being subject also, to the resiliency inherent in the body of the plate, the described arrangement serving to give just the required yielding pressure on the wheels 28.

The numeral 43 indicates a curved guard shield adjacent to the wheels 28 over which shield the chains 17 run to thereby clear the said wheels 28 and the angular controlling elements 31. The guard shield 43 is suitably secured, there being shown lugs 44 thereon riveted or otherwise fastened to the frame 10 at the sides of the machine.

In practice I prefer to provide a thimble such as illustrated in Fig. 7 and indicated in Fig. 3 to be placed on the finger of the operator for engagement with a pin 27. The said thimble is provided at the front end with a pin-engaging projection 46 preferably of oblong form and of a size to be readily accommodated between adjacent pins 27. The projection 46 of the thimble 45 in the operation of the chain upward and downward is arrested by upper and lower stops 47, 48 here shown as in the form of flanges presenting slots for the passage of the fingers 27. The arrangement is such as to prevent excess travel being given to the chain since the projection 46 will be interposed between adjacent pins and the striking of said projection against a flange 47 or 48 will arrest the movement of the following pin 27. Thus, the provision of the pins 27 on the chains not only facilitates the engagement of the chain by the operator but coöperates with the projection 46 or other manual operating means employed, to thus insure the definite desired movement of the chain for a given operation of a number wheel.

In the operation of adding it is necessary only for the operator to engage the pin 27 opposite the adding index digit corresponding with the number to be added and the chain is then actuated in a downward direction to bring the selected pin to the lower flange 48 at which time the operator's finger or the stop projection 46, when the thimble 45 is employed, will be arrested by the flange 48 to arrest the chain in the proper position. The chain will have imparted a corresponding movement to the corresponding number wheel 11 through an arc sufficient to bring the selected number to the opening 22. Similarly, for subtraction, no other operation is necessary than to impart a reverse movement to a chain 17 by moving the pin opposite the selected digit to the upper flange 47. It will be seen therefore that the operations of both adding and subtracting are performed

simply by imparting a movement to the actuating chain in the proper direction, the subtracting operations being performed without any adjustment or re-arrangement of the parts and without any other means than that employed in performing the operations of adding.

The controlling elements 31 with their teeth 35 have a function also contributing to the resetting operation. To reset it is necessary only to move the chain a sufficient distance to bring the zero or naught to the opening 22 at which time the tooth 35 will have engaged its notch 36, and the resistance offered to a further movement, as above referred to when the tooth is in its notch, will be apparent to the operator, for which reason the operator will not need to observe with care the resetting movement imparted to the chain, but will be made aware of the restored position of the number wheel by the said resistance offered upon the zero position being reached.

I wish to state in conclusion that although the illustrated example constitutes a practical embodiment of my invention, I do not limit myself strictly to the mechanical details herein illustrated, since manifestly the same can be considerably varied without departure from the spirit of the invention as defined in the appended claim.

Having thus described my invention, I claim as new, and desire to secure by Letters Patent:

A calculating machine including a series of number wheels, a series of transmission wheels, an annular series of teeth on each transmission wheel adapted to be engaged by a number wheel, a transmission tooth on each transmission wheel adapted upon a given movement of the latter to move the next number wheel one step, a rockable controlling element for each transmission wheel and presenting two arms disposed respectively at opposite sides of a transmission wheel, one of the arms of the controlling element of a given transmission wheel having an inwardly projecting tooth thereon normally riding freely on the preceding transmission wheel, and the transmission wheels having each a depression positioned to receive the tooth of the adjacent controlling element of a following transmission wheel, when a transmission tooth is engaging a following number wheel, a member on the opposite arm of each controlling element rockable with said element momentarily into the path of movement of the teeth of the controlled adjacent transmission wheel when the tooth on the element carrying said bar leaves the depression of said preceding transmission wheel.

JOHN F. ANDERSON.