

Sept. 21, 1926.

1,600,766

L. L. LARSON

ADDING AND SUBTRACTING MACHINE

Filed July 9, 1925

2 Sheets-Sheet 1

Fig. 1

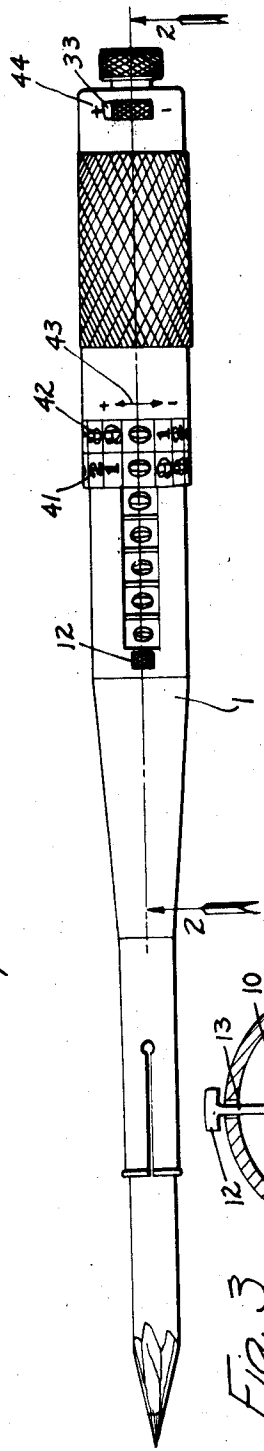


Fig. 2

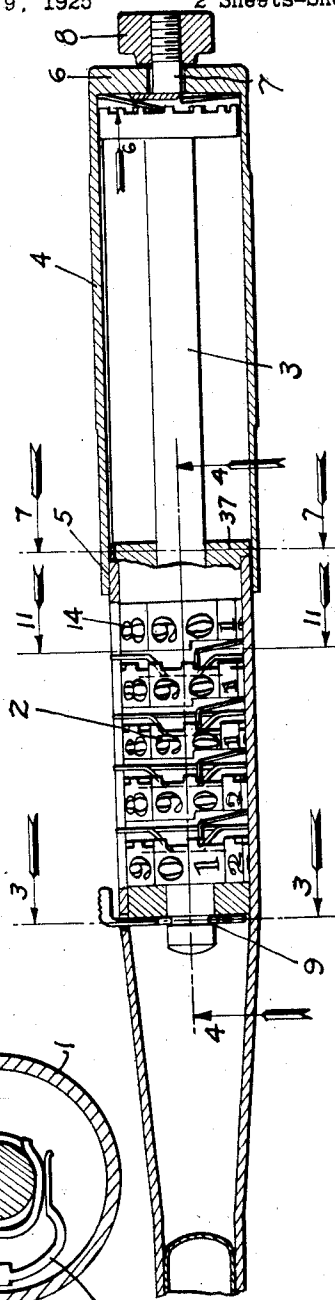
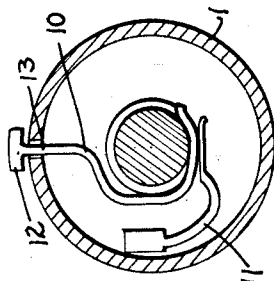


Fig. 3



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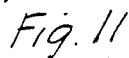
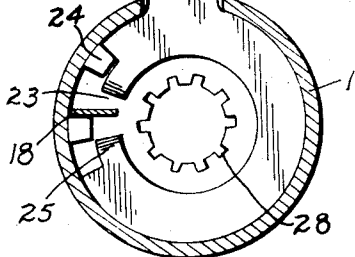
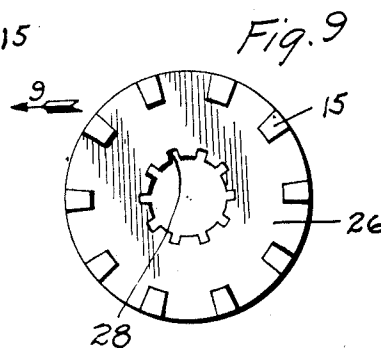
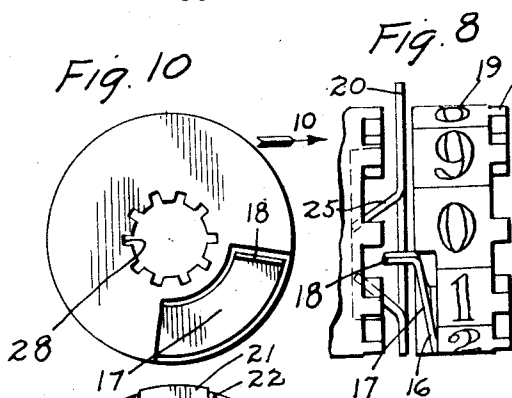
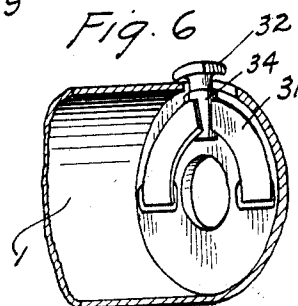
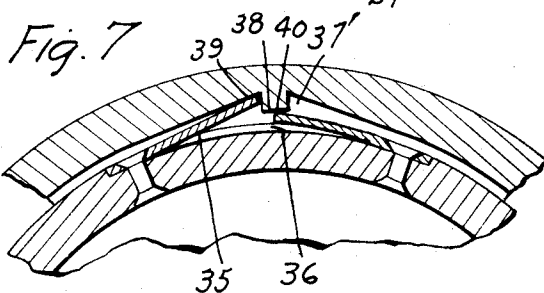
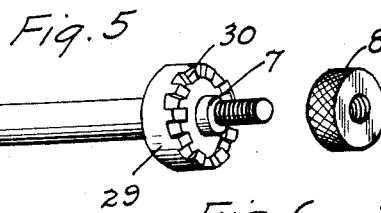
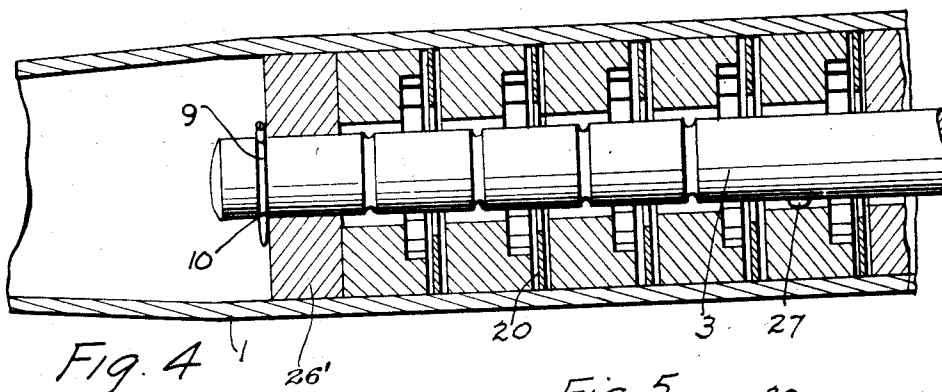
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ADDING AND SUBTRACTING MACHINE

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE.

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ADDING AND SUBTRACTING MACHINE.

Application filed July 9, 1925. Serial No. 42,472.

My invention is an adding and subtracting machine of the cylindrical type, having a series of indicating and registering discs operated by a rotating counting device. My invention is constructed in the form of a cylindrical article and may be made sufficiently small to be attached to the end of a pencil.

My adding and subtracting machine comprises a cylindrical casing or holder with a series of rotatable registering and indicating discs having numerals thereon spaced apart by stationary cam plates having a slot therein. Each of the indicating discs of a lower order than the highest designation is provided with an actuating dog secured thereon to rotate a disc of a higher denomination one digit for each complete revolution of the lower denomination disc, that is for each ten digits of the lower disc.

The discs are rotated in succession by means of a sliding rod having a key therein to engage key-ways in the registering discs. This sliding rod is locked in the particular positions by means of a spring latch and has a ratchet on its opposite end which engages the base of a rotating sleeve.

This rotating or counting sleeve has a bearing at its open end on the cylindrical casing containing the registering discs and its other end rotatably mounted on the end of the sliding rod or as it may be designated, sliding shaft. Spring actuated dogs secured in the base of the sleeve actuate the sliding shaft to rotate the same either one way or the other to add or subtract in accordance with the positioning of a shifting lock having a finger grip on the exterior of the sleeve.

My invention will be more readily understood from the following description and drawings in which;

Figure 1 is a side elevation of my adding and subtracting machine, illustrating it in a small size attached to a pencil.

Fig. 2 is a longitudinal section on the line 2—2 of Fig. 1 in the direction of the arrows 2.

Fig. 3 is a transverse section of Fig. 2 in the direction of the arrows 3.

Fig. 4 is an enlarged section of the barrel of registering discs taken on the line 4—4 of Fig. 2.

Fig. 5 is a perspective detail of the slidable and rotatable actuating shaft, showing a ratchet on the end thereof.

Fig. 6 is a detail perspective of the end of the counting sleeve, showing the ratchet dogs with the shifting lock to throw either one or the other into engagement with the ratchet to utilize the device as an adding or subtracting machine, in the direction of the arrow 6 of Fig. 2.

Fig. 7 is an enlarged partial section across the series and sleeve as indicated by the line 7—7 of Fig. 2 in the direction of the arrows.

Fig. 8 is a side elevation of one of the indicating and registering discs, showing the mechanism for actuating a higher denomination disc from a lower denomination.

Fig. 9 is a face view of the ratchet end of one of the discs taken in the direction of the arrow 9 of Fig. 8.

Fig. 10 is a face view of the opposite side of a registering disc in the direction of the arrow 10, showing a counting pawl attached to the disc.

Fig. 11 is a transverse section of Fig. 2 on the line 11—11 in the direction of the arrows, indicating one of the cam plates situated between the discs.

The counting device comprises a substantially cylindrical casing 1 having a series 2 of registering discs mounted therein with a rotatable and sliding shaft 3 extending axially through all of the discs. A counting sleeve 4 is slidably mounted at its open end 5 on the casing and is supported at its outer end which may be designated the base 6, on the stem extension 7 of the shaft, thereby forming a bearing. A nut 8 screwed on to the end of the stem holds the device assembled and retains the sleeve and sliding shaft in adjusted position. The shaft is formed of a series of annular notches 9 which are engaged by a curved latch 10 actuated by a spring 11, secured to the casing and pressing the latch against the shaft. The latch is provided with a head 12 extending through an aperture 13 in the casing and may be depressed to disengage from the notches and allow sliding of the rod 3 by the sliding movement of the sleeve 4.

The series 2 containing the registering discs and immediately associated mechanism is substantially as follows, having reference particularly to Figs. 8 and 11:

There are five registering discs 14 shown which will allow a total of 99,999; and are all of substantially the same construction except the units disc and the highest de-

nomination. One of the intermediate discs is shown in Fig. 8 and has a series of square ratchet teeth 15 on the side adjacent a lower denomination disc. The units disc does not require these teeth and is hence smooth surfaced. A small recess 16 is formed on the opposite face of the disc and a counting pawl 17 of spring metal with a squared end 18 is secured in the recess. A series of indicating numerals 19 are formed on the face of the disc and number from zero to 9. The highest denomination disc does not require this recess or the counting pawl and is hence smooth on one face.

A cam plate 20 is positioned between each disc and has a lug 21 extending through a slot 22 in the casing 1. These cam plates have a cutout section 23 so that they are not a continuous annulus and also have recesses 24 leaving cam ends 25 which extend into the groove 26 on the inner edges of the ratchet teeth. The squared end of 18 of the counting pawl is of sufficient width to extend across the cam and engage the teeth as indicated in Fig. 11. On each revolution of a disc of a lower denomination the squared end 18 of the counting pawl slips down one of the cam ends 25, engages one of the teeth 15 and moves the next higher denomination disc through one tenth of a turn until the end 18 rides up on the cam end 25 on the other side of the cut out section 23.

The discs are actuated to cause a rotation by the following mechanism, having reference particularly to Figs. 4 to 7:

As above described the sliding shaft 3 has a series of annular notches 9 and these are all spaced apart the distance between the centers of the discs as shown in Fig. 4, with the inner end supported by a partition 26' which forms a journal for the inner end of the shaft. A key 27 is fixedly secured to the shaft to engage keyways 28 cut on the inside periphery of the discs 14. A head 29 is secured on the outer end of the shaft and has a series of squared ratchet teeth 30. The extension 7 for the nut 8 is as described above.

The sleeve 4 has a pair of ratchet dogs 31 attached to the base 6 and is provided with a shifting lock 32 sliding in a slot 33 in the sleeve; the lock having a bar 34 to engage underneath one or other of the ratchet dogs 31. These dogs are for the purpose of utilizing the device for adding or subtracting by allowing a reverse direction of rotation. As will be seen from Fig. 2, the upper dog is pressed outwardly into engagement with the teeth, therefore the sleeve 4 may be rotated in the adding direction. When the sleeve is rotated it therefore forces the rotation of the shaft 3 by the dogs engaging the teeth 30.

A zero stop mechanism is particularly

shown in Figs. 2 and 7 and comprises a pair of spring arms 35 which are secured in a slot 36 in the stationary plug 37, which latter is rigidly secured in the end of the casing 4, the series of registering discs being confined between this plug and the partition 26. The inside surface of the sleeve is cut away forming a pair of longitudinal recesses 37', leaving a ridge 38 which is engaged on its side faces 39 by the ends of either one of the arms 35 and retains the other arm bent downwardly by contact with its face 40. These arms and the ridge 38 are so positioned as to stop the rotation of the sleeve at the zero position. The sleeve has a series of notations 41 and 42 numbered from naught to nine in two columns placed in reverse order and has an indicating double arrow 43 with the plus and minus sign to indicate which way to rotate the sleeve for adding or subtracting. There are also indicating plus and minus signs at each end of the slot 33 to show which way to shift the lock 32.

The operation of the device for adding is substantially as follows:

The discs are all set to indicate the zero through the slot 22. This is done by pressing the latch 10 to release the grooves or notches in the shaft 3 so that the sleeve 4 with the shaft may be moved lengthwise until the key 27 engages in the keyways 28 of the discs to be turned. Any individual disc may then be turned to zero; the discs forming the series have a sufficiently tight fit in the casing to prevent rotation unless positively moved and are pressed closely together by the spring action of the cam ends 25 of the cam plates 20 and also due to the pressure of the counting pawls 17.

When all the discs are set at zero the sleeve is rotated until the two zeros thereon are in alinement with the slot 22 being stopped at this position as above described by the arms 35 and the ridge 38. In this position with the units discs exposed the key 27 is in engagement with one of the keyways 28 of the units disc. If a column of figures are to be added running into from units to the ten thousands (for this particular adding machine), the units column is added up first by rotating the sleeve backward until a particular unit is indicated opposite the slot 22. It is then rotated in the direction of the plus sign and carries with it the units disc to the particular numeral. The sleeve is again reset for the next number in the units column and by continuous manipulation all the units are added up; and as above explained carry with it on each complete rotation of the units disc the tens disc and on each rotation of the tens disc the hundreds disc and so on.

After the tens column has been added up in a similar manner followed by the hun-

dreds and so on, to the capacity of the machine, each lower denomination disc on indicating ten rotating the disc next higher will thus complete the addition. The sleeve 4 is then moved back in a straight line to its starting, that is the extreme right hand position and the numbers shown by the indicating discs give the total.

In utilizing the device for subtracting, the number from which subtraction is to be made is indicated on the discs by rotating each disc to its proper position and then proceeding as if for adding, only utilizing the sleeve in the reverse direction of rotation as indicated by the minus sign and after moving the shifting lock 32. One number may thus be subtracted from another or a succession of numbers may be subtracted one after the other looking at the indication each time or a column of figures may be subtracted from the primary number by proceeding in the same manner as in adding. An inspection of the discs after all the numbers have been recorded will give the result of the subtraction.

My invention may be considerably changed in size and may be constructed to add a much higher product. Moreover, very thin discs with merely a sufficient width to insert the numbers may be made so as to form a compact device which may readily fit in a person's vest pocket. It is also apparent that my device may be utilized for counting reciprocating movements by having some means for reciprocating the sleeve in a partial rotation periodically and by the removal of the arms 35, may be used as a revolution counter.

My machine may readily be changed into a simple selective computing machine or computing indicator by removing the counting pawls 17 so that the rotation of one disc does not cause the rotation of another or else they may be removed in groups so as to allow additions or subtractions of units and tens or even hundreds. In this manner the rod 3 may be moved lengthwise to engage any particular disc and rotate it to give an indication. Therefore, by having a sufficiently long series my device may be made into a computer useful for keeping the scores of various games having opposing sides and keeping the score of opposite sides entirely separate. For a device of this character some of the discs would not require the ratchet teeth 15 nor the cam plate 20.

Having described my invention, what I claim is:

1. An adding and subtracting machine, comprising in combination a casing, a series

of rotatable indicating discs mounted therein, a sleeve rotatable and slidable on the casing, a shaft having an operative connection with the sleeve to rotate the discs successively and means to change the operative connection between the sleeve and the shaft to indicate addition or subtraction in accordance with the direction of rotation of the sleeve.

2. An adding and subtracting machine as claimed in claim 1, having a ratchet and dog connection between the sleeve and the shaft and means to reverse the position of the dogs.

3. A computing machine comprising in combination a cylindrical casing, a partition positioned therein, a plug closing the open end, a longitudinal slot in one face, a series of rotatable indicating and registering discs mounted in the casing, a rotatable shaft slidable through the discs and having bearings in the partition and plug, a sleeve rotatable and slidable on the outside of the casing and having an operative connection with the shaft, and means to control the rotation of the shaft by the sleeve and to rotate the discs in a desired order by the shaft to give a computation on the discs visible through the slot in the casing.

4. A computing machine as claimed in claim 3, having in addition a ratchet on the end of the shaft, a pair of ratchet dogs secured to the base of the sleeve and a sliding shift lock extending through an opening in the sleeve adapted to shift the dogs alternately into and out of engagement with the ratchet.

5. A computing machine as claimed in claim 3, having in addition a pair of spring arms of resilient material mounted in the outside face of the casing and operative to engage a longitudinal ridge in the sleeve and to cause a zero indication.

6. In a computing machine having a cylindrical casing, a stationary plug held therein, a plurality of registering discs rotatably mounted in the casing adjacent the stationary plug, a rotatable and slidable sleeve on the outside of the casing, having a longitudinal ridge with longitudinal recesses on each side of the ridge, a pair of spring arms mounted on the periphery of the plug, the end of one of the spring arms being adapted to engage the ridge while the end of the other arm is depressed by the ridge into close position with the plug.

In testimony whereof I have signed my name to this specification.

LEVI L. LARSON.