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1,524,924

C. M. F. FRIDEN

CALCULATING MACHINE

Filed July 17, 1923

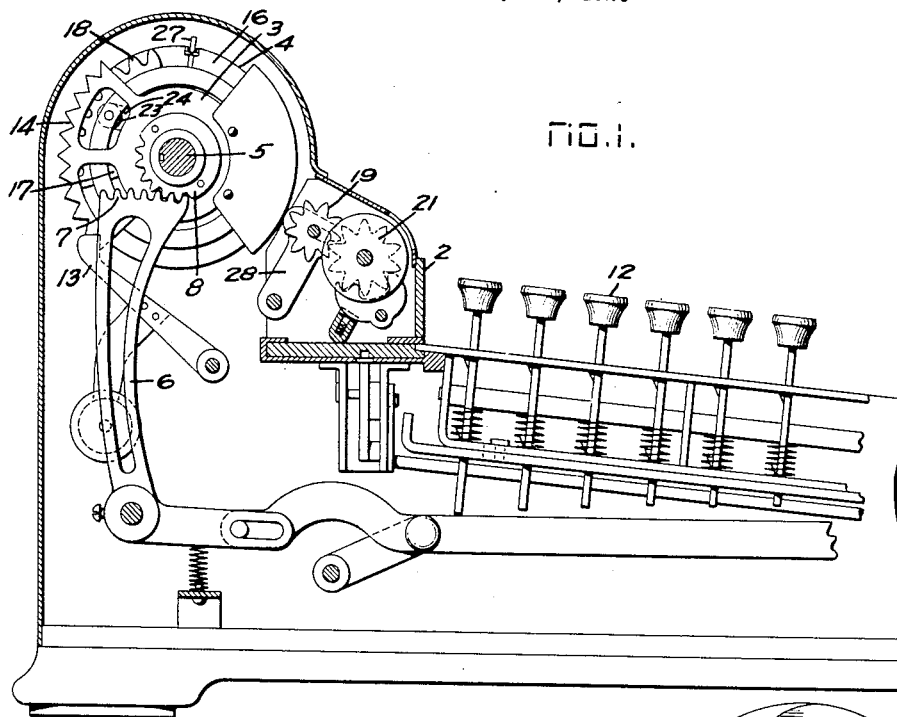


FIG. 1.

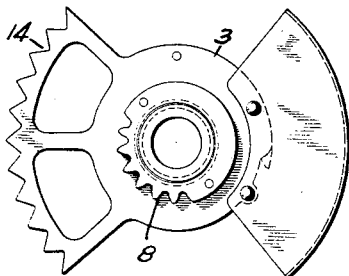


FIG. 2.

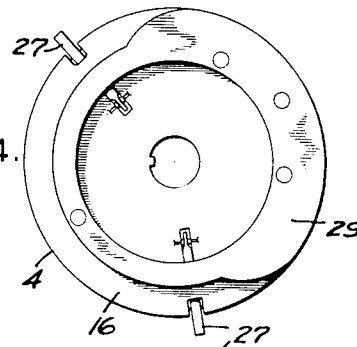


FIG. 4.

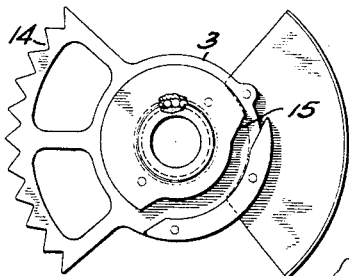


FIG. 3.

FIG. 5.

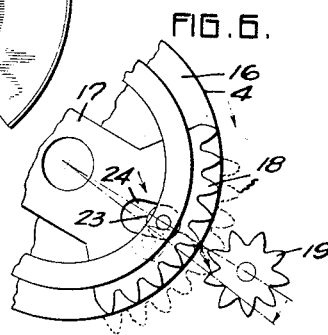
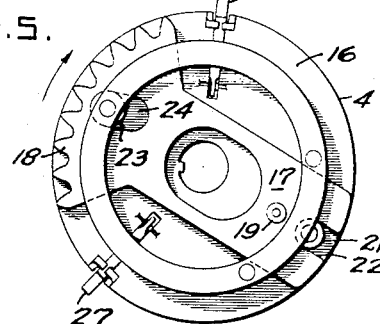


FIG. 6.

WITNESS
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UNITED STATES PATENT OFFICE.

CARL M. F. FRIDEN, OF PIEDMONT, CALIFORNIA.

CALCULATING MACHINE.

Application filed July 17, 1923. Serial No. 652,100.

To all whom it may concern:

Be it known that I, CARL M. F. FRIDEN, a subject of the King of Sweden, and a resident of Piedmont, county of Alameda and State of California, have invented a certain new and useful Calculating Machine, of which the following is a specification.

The invention relates to calculating machines of the type embodying a rotatable drum, upon which the values to be calculated are set up, rotation of the drum being effected by a handle which projects through the outside of the machine. The values adjusted on the drum are transmitted, on rotation of the crank handle, indirectly, by means of intermediate wheels, to the figure disc of the counting mechanism, which, for the purpose of making the direct action of the selected values on the intermediate wheels of the figure disc of highest value possible, is disposed in parallel displaceable relation to the value selecting mechanism axis.

The present invention is an improvement on the calculating machine disclosed in my copending application, Serial Number 539,422, filed February 27, 1922, to which reference is hereby made for the disclosure of the various elements of the calculating machine, not shown in this application.

An object of the invention is to provide a calculating machine of the class described in which the counting mechanism actuating means is arranged so that it is moved more quickly into and out of engagement with the counting mechanism.

Another object of the invention is to provide a calculating machine of the class described in which greater working limits are permissible without interfering with the accuracy and positive action of the machine.

The invention possesses other advantageous features, some of which, with the foregoing, will be set forth at length in the following description, where I shall outline in full that form of my invention which I have selected for illustration in the drawings accompanying and forming part of the present specification. In said drawings I have shown one embodiment of my invention, but it is to be understood that I do not limit myself to such form, since the invention, as set forth in the claims, may be embodied in a plurality of forms.

Referring to said drawings:

Fig. 1 is a cross section of a portion of

one type of calculating machine, to which my invention is applicable.

Fig. 2 is a side elevation of one side of the value selecting element. 60

Fig. 3 is a side elevation of the opposite side of the value selecting element.

Fig. 4 is a side elevation of one side of the actuating element.

Fig. 5 is a side elevation of the other side of the actuating element. 65

Fig. 6 is a detail showing in diagram, the movement of the counting mechanism actuating means.

In the calculating machine shown in my prior application above referred to, the counting mechanism actuating means, comprising an arcuate rack, is movable radially with respect to the rotatable element, on which the rack is carried. This rack is movable radially during rotation of the element so that any point on the rack moves in a spiral during its relative radial movement, the pitch of the spiral depending on the relative rates of rotation and radial movement. The radial movement is effected by cams and since it is desired that this radial movement occur abruptly, the cams must be made quite steep. The degree of inclination of the cam however is limited, by practical considerations, so that a tooth on the arcuate rack moves in a somewhat flat spiral during the radial movement of the rack. This necessitated small and accurate working limits in order that the teeth on the rack moved into mesh with the teeth on the toothed wheel of the counting mechanism. In accordance with the present invention these disadvantages are overcome by causing the racks to move outward in a steep spiral and this is accomplished by causing a backward movement of the rack with respect to the rotating element during the time that the rack is being moved outward or substantially radially with respect to said element. This backward movement may be equal to the forward movement so that a point on the arcuate rack actually moves radially with respect to the axis of the rotatable element during the rotation thereof. It is not essential however that this backward movement be equal to the forward movement and in the present construction, it is less, so that a point on the tooth moves in a steep spiral. The rotatable element is rotated in one direction to perform problems in addition and is moved in the opposite direction to perform problems 110

in subtraction. In the operation of addition the slide is moved forward or outward during the time that the arcuate rack is contiguous to the toothed wheel of the counting mechanism, and is moved forward at such time that the remaining number of teeth on the rack, which engage the toothed wheel of the counting mechanism, are equal to the value set up in the machine. In the subtracting operation the slide is moved to bring the rack into the path of the toothed wheel before the rack reaches the toothed wheel so that the rather long flat spiral developed by the tooth on the rack when it is projected during the subtracting operation is not effective, since the rack is entirely projected before it reaches the toothed wheel. In the subtracting operation the rack is withdrawn from the toothed wheel after it has moved the toothed wheel a distance corresponding to the value entered into the machine and this withdrawing operation occurs in a steep spiral so that there is no danger of overthrow in the toothed wheel. The arcuate rack therefore moves in a steep spiral when it is contiguous to the toothed wheel and moves in a flat spiral when it is out of contact or remote from the toothed wheel.

In Figure 1 I have shown one form of calculating machine in which my invention may be embodied. The details of the calculating machine however are not essential, and they are shown merely to illustrate one type of machine in which my invention may be employed. This machine is what is usually known as the rotary type of machine and key operated means are provided for introducing the values into the machine. The calculating element comprises a drum formed of a plurality of calculating units which are operatively associated with a counting mechanism which is arranged on a carriage 2. A calculating unit comprises a selecting element 3 and an actuating element 4. The actuating element is secured to the shaft 5, so that it rotates therewith and the selecting element is rotatably mounted on the shaft so that it may be moved with respect to the shaft and so that the shaft may be rotated without producing movement of the selecting element. In the construction shown in Figure 1 the selecting element 3 is positioned by the bell-crank lever 6 which is provided on its end with a rack 7 engaging a gear 8, secured to the selecting element. The bell-crank lever 6 is operatively connected with keys 12 so that upon depression of a key the selecting element is rotated through an arc corresponding to the value indicated on the key. The selecting element is held in its adjusted position by means of a pawl 13 which engages a rack 14 formed on the selecting element. The selecting element is provided on one face with a cam 15

which determines the value to be transferred by the actuating mechanism to the counting mechanism.

Contiguous to the selecting element is the actuating element 4 which comprises a disc or wheel carrying a substantially radially movable slide 17 which is provided on its end with an arcuate rack 18 which, when projected, is adapted to engage the toothed intermediate wheel 19 of the counting mechanism 21 and cause movement of the counting mechanism. The slide 17 is provided with a pin or roller 19 which contacts with the cam 15 on the selecting element, so that as the actuating element is rotated, the slide 17 is projected from and retracted to the disc 16 during the rotation of the actuating element. The point at which the slide is projected and retracted depends upon the position of the cam 15 on the selecting element. The slide 17 is guided at its rear end by a roller 21 which is disposed in a slot 22 in the slide and is guided at its forward end, adjacent the arcuate rack 18 by a roller 23 engaging in a slot 24 in the slide. In the application hereinbefore referred to the slide was moved radially with respect to the actuating disc and since this radial movement occurred during the rotation of the disc, the teeth of the rack 18 moved in a spiral path. In accordance with the present invention I incline the slot 24 in a direction which is opposed to the rotational direction of the actuating element during the operation of addition so that as the actuating element is rotated, the rack is projected therefrom in a direction opposed to the direction of rotation. This causes the teeth to move outward to their full extent for a very small angular movement of the teeth, so that they more readily move into engagement with the toothed wheel 19. Due to this construction the cam 15 may be made less steep than is necessary in the construction shown in the prior application, thereby producing less wear on the cam and making the machine more easily operative. The direction of movement of the teeth of the rack 18 with respect to the axis of the shaft 5 is controlled by the inclination of the slot 24 and this slot may be inclined to such an extent to produce actual radial movement of the teeth with respect to the axis.

The actuating disc 16 is also provided with transversely movable pins carrying pins 27 for actuating the counting mechanism. The calculating machine is also provided with transfer levers 28 for actuating the pins 27 and the actuating disc 16 is provided on its opposite sides with a cam 29 for returning the transfer levers to inoperative position.

I claim:

1. In a calculating machine, a counting mechanism including a toothed wheel, a ro-

tatable element, a toothed slide carried by the rotatable element and adapted to co-operate with said toothed wheel, means operative during rotation of said element for projecting the slide from said element so that the teeth thereon co-operate with the toothed wheel and means for causing the toothed end of the slide to move sidewise in the plane of the rotatable element with respect to the rotatable element as it is being projected.

2. In a calculating machine, a counting mechanism including a toothed wheel, a rotatable element, a slide carried by the rotatable element, an arcuate rack on the slide adapted to co-operate with the toothed wheel and means operative during the rotation of said element for moving said slide to move the rack outwardly from said element and in a direction with respect to the element which is opposed to the direction of rotation of said element.

3. In a calculating machine, a counting mechanism including a toothed wheel, a

rotatable element, a slide carried by the rotatable element, an arcuate rack on the slide adapted to co-operate with the toothed wheel, means operative during rotation of said element for moving said slide and means co-operating with the slide to cause the rack to move, with respect to the rotatable element in a direction opposed to the direction of rotation of the rotatable element.

4. In a calculating machine, a counting mechanism including a toothed wheel, a rotatable element, a slide disposed radially on said element, an arcuate rack on the slide adapted to co-operate with the toothed wheel, said slide being provided with a slot inclined to the radius of the element, means on the element engaging in said slot and means operative during the rotation of the element for moving the slide into co-operative relation with the toothed wheel.

In testimony whereof, I have hereunto set my hand.

CARL M. F. FRIDEN.