June 17, 1930. A. E. VETHE 1,764,915

CALCULATING APPARATUS

Filed Sept. 10, 1928 2 Sheets-Sheet 1

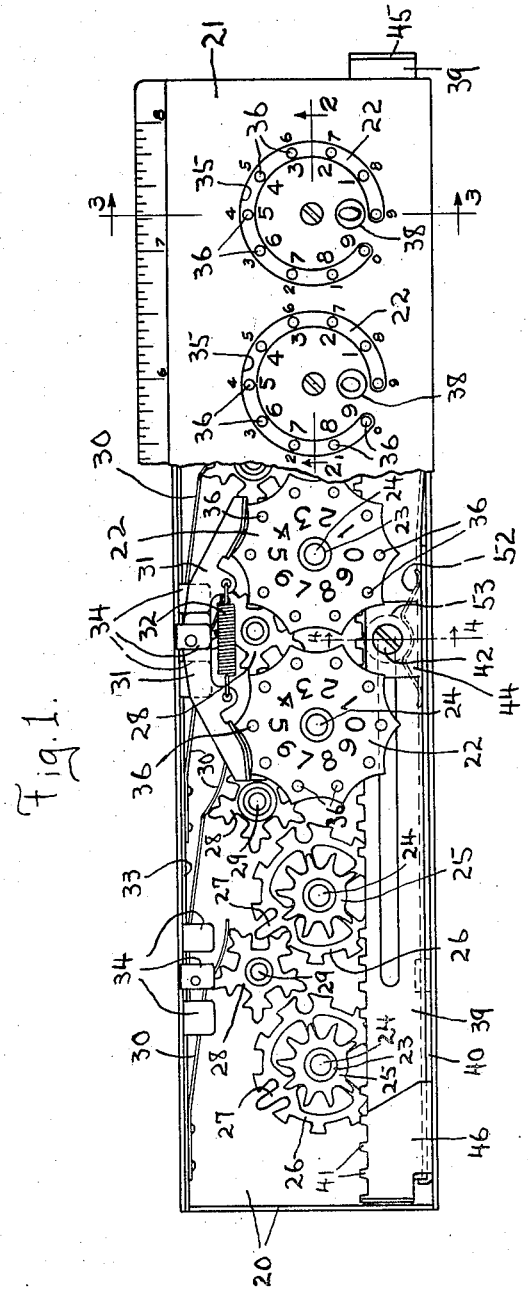


Fig. 1.

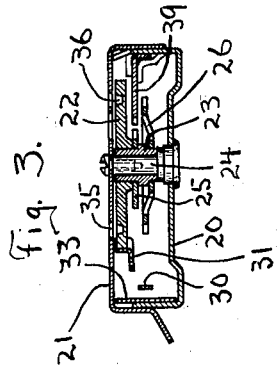


Fig. 3.

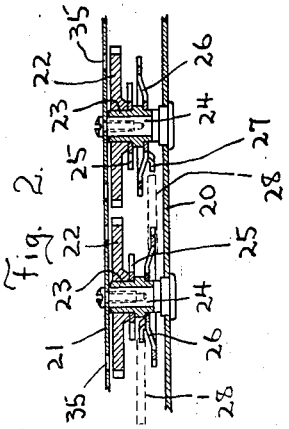


Fig. 2.

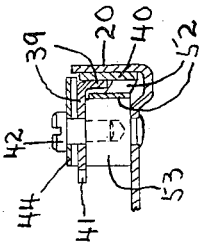


Fig. 4.

Inventor,
Anders E. Vethe,
By Fricke & DeBusk,
Attorneys.

June 17, 1930. A. E. VETHE 1,764,915

CALCULATING APPARATUS

Filed Sept. 10, 1928 2 Sheets-Sheet 2

Fig. 5.

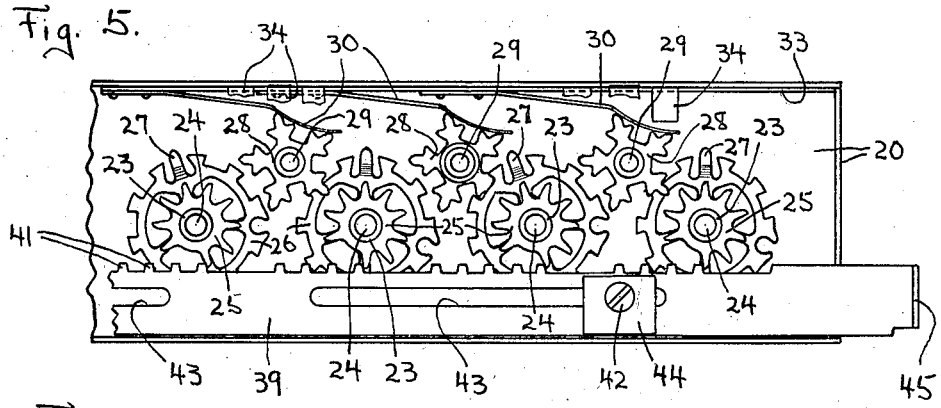


Fig. 7.

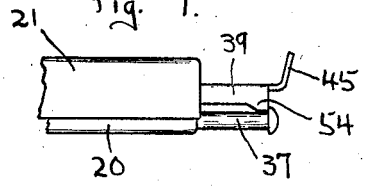


Fig. 6.

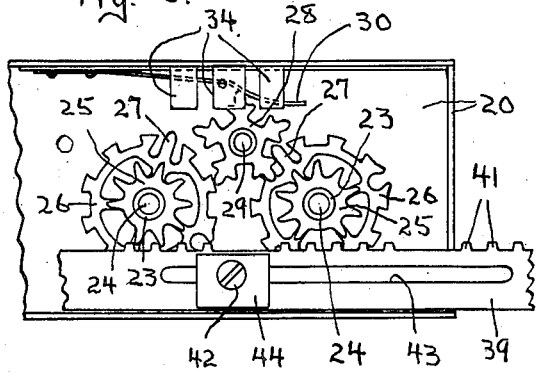


Fig. 8

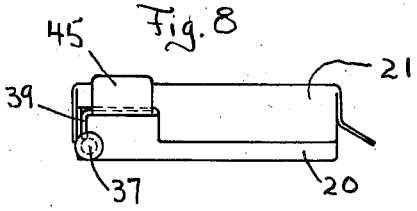


Fig. 9.

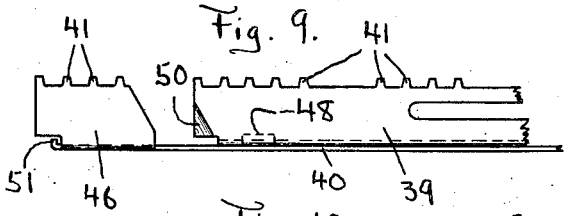


Fig. 12

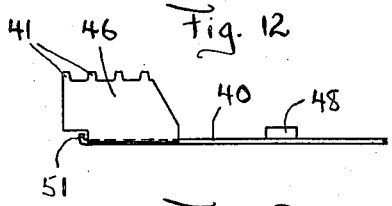


Fig. 10.

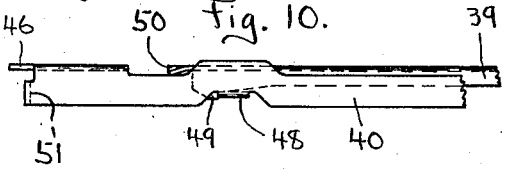


Fig. 13.

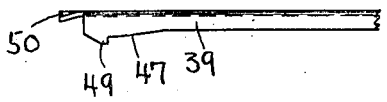
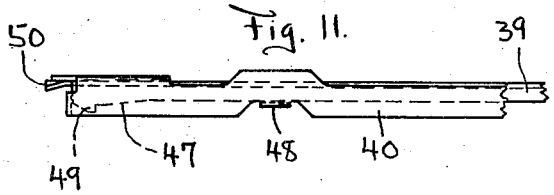


Fig. 11.



Inventor,—
Anders E. Vethe,
By Fricke & DeBusk
Attorneys.

Patented June 17, 1930 1,764,915

UNITED STATES PATENT OFFICE

ANDERS E. VETHE, OF CHICAGO, ILLINOIS

CALCULATING APPARATUS

Application filed September 10, 1928. Serial No. 304,921.

My invention relates to calculating apparatus of the type comprising a series of rotary indicating dials or discs together with intermediate driving means or carrying means for giving each disc a single step of rotation for each movement of the indicating disc at its right past a critical point with respect to the indicia thereon. It is one of the objects of my invention to provide a new and improved form and arrangement of parts whereby the likelihood of overthrow movement of any of the discs may be cut down.

It is one of the objects of my invention to provide an improved form of clearance means or resetting means which is arranged to cooperate with the carrying means in a novel manner for preventing overthrow movement of the discs during the clearing operation. To this end, it is one of the objects of my invention to provide for actuation of the indicating discs in peculiarly timed relation to each other upon a resetting operation whereby when two adjacent indicating discs are in motion at the same time, they shall rotate non-synchronously with respect to the intermediate driving means.

It is one of the objects of my invention to provide an arrangement of this type in which the indicating discs are divided into two sets, the clearance movement of the discs of one set being started when the discs of the other set reach substantially the middle of a step of such movement, with alternate discs comprising one set and the remaining discs comprising the other set. It is one of the objects of my invention to provide an arrangement whereby, when two adjacent indicating discs are both being rotated to normal position by a resetting operation, the carrying wheel between said two indicating discs, if actuated slightly by an overthrow movement of the disc to its right at the end of the resetting movement of such disc to the right, is prevented from rotating to the next step position by reason of such engagement with the disc to the left as to prevent normal meshing.

It is another object of my invention to improve devices of this type in sundry details hereinafter pointed out. The preferred means by which I have accomplished my several objects are illustrated in the accompanying drawings and are hereinafter specifically described. That which I believe to be new and desire to cover by this application is set forth in the claims.

In the drawings,—

Fig. 1 is a top plan view of the preferred form of my improved apparatus, with the top plate broken away at the greater portion of its length, and with the indicating discs and certain cooperating parts removed at one end of the device;

Fig. 2 is a longitudinal section taken at line 2—2 of Fig. 1;

Fig. 3 is a cross section taken at line 3—3 of Fig. 1;

Fig. 4 is a cross section taken at line 4—4 of Fig. 1;

Fig. 5 is a view of a portion of my device with the top plate, the indicating discs and certain of the other parts removed for clearness of illustration, the resetting bar being drawn out for bringing the teeth of such bar into operative engagement with the teeth of the resetting gears of the indicating discs;

Fig. 6 is a view of a portion of the mechanism as shown in Fig. 5, but showing a changed position of the parts, the resetting gear and the parts connected therewith at the left being shown in an intermediate position after an uncompleted portion of a resetting operation, with the resetting gear and associated parts at the right in slightly overthrown position as a result of a just-completed resetting operation with respect to such parts, showing how the engagement of the intermediate driving means with the mechanism at the left prevents completion of the movement of the parts beyond normal position under the influence of such tendency to overthrow;

Fig. 7 is a side view of one end portion of my device, showing the engagement between the resetting bar and the stylus, whereby the stylus is partially withdrawn upon an operative stroke of the resetting bar;

Fig. 8 is an end view of the device as seen from the right in Fig. 7;

Fig. 9 is a top plan view of the end portions of the resetting bars in associated relationship separated from the remaining parts, with the bars at the limit of their longitudinal movement with respect to each other for an operative stroke;

Fig. 10 is a side view of the parts as shown in Fig. 9;

Fig. 11 is a view similar to Fig. 10, but showing a changed position of the parts, with the auxiliary resetting bar moved into raised offset position with respect to the main bar;

Fig. 12 is a top plan view of a portion of the auxiliary resetting bar; and

Fig. 13 is a side view of the end portion of the main resetting bar.

Referring to the several figures of the drawings, in which corresponding parts are indicated by the same reference characters, 20 indicates a casing formed preferably of sheet metal cut and pressed into shape, and 21 indicates the top plate portion also formed of sheet metal bent into shape to fit down over the casing member 20. At substantially the longitudinal center of the casing, there are mounted a series of indicating discs 22, each of which is rigidly mounted on a sleeve 23 rotatably mounted on a pin 24 rising from the bottom wall of the casing member 20. Each of said sleeves 23 is also provided with a resetting gear 25, a carrying gear 26, and a carrying arm 27, such carrying gears and carrying arms being adapted to engage intermediate driving gears 28 revolubly mounted on pins 29 rising from the bottom wall of the casing member 20.

For holding the indicating discs 22 and the intermediate driving gears 28 normally in predetermined angular position as they are given a step by step rotary movement, and for assisting as may be required in the application of the rotary movements to such parts, I have provided flat springs 30 bearing at their free ends on the gears 28, and spring-pressed levers 31 bearing on the peripheries of the indicating discs 22. The arrangement is such that said gears and discs are normally held yieldingly in predetermined position by reason of a camming action of the spring means, serving to apply a pressure between two spaced bearing points in such manner as to have a tendency to center the spring means between such bearing points. The levers 31 are spring actuated by means of coiled springs 32 connecting said levers at suitable distances from the axes on opposite sides thereof. In the construction shown, the springs 30 and the levers 31 are all mounted on a removable bar 33, the levers 31 being carried and guided by lugs 34 formed with said bar 33.

As is shown at the right in Fig. 1, the top wall of the casing member 21 is provided with circular slots 35 extending almost completely about the axes of the several indicating discs 22, such slots being in position to provide access to a series of sockets 36 in the top faces of the indicating discs for rotation of said indicating discs by the use of a stylus 37 (see Fig. 7), the ends of the slots serving as stops for limiting the rotary movements of the indicating discs in either direction. A series of numerals 1 to 9 are provided adjacent to each of the slots inside of the slot for reference in connection with the use of the apparatus for performing an operation of addition, and a similar series of numerals 0 to 9 are provided outside of each of the slots in reverse order for use for subtraction. Each indicating disc also is provided with a series of numerals from 0 to 9 opposite the respective sockets 36, such numerals running in the same direction as that of the addition numerals above referred to.

It is believed to be unnecessary to describe the operation of the apparatus in detail except with respect to features forming some part of the present invention. With the parts assembled complete as shown at the right in Fig. 1, and with the several indicating discs all in their normal zero positions (with the zero of each of the indicating discs showing through a suitable sight opening 38), an operator turns the several indicating discs by inserting the stylus in the desired socket 36 and pressing the stylus around until it contacts with the end of the slot 35. When one of the indicating discs is rotated in either direction past the critical position (when the zero of the indicating disc is moved clockwise into the sight opening or is moved counter-clockwise out of the sight opening) the arm 27 of such indicating disc is brought into mesh with the intermediate driving gear 28 at its left so as to give such gear a single step movement, such intermediate driving gear serving at the same time to give the next adjacent indicating disc at the left also a corresponding single step movement.

For effecting this result whether the rotation is in one direction for addition or in the reverse direction for substraction, I have arranged the carrying gears 26 of adjacent indicating discs at different levels, with the intermediate driving gears at corresponding levels so that each intermediate driving gear serves to rotate the indicating disc at its left and so that each intermediate driving gear is itself driven only by the indicating disc at its right through the medium of the arm 27 carried by such indicating disc, each intermediate gear and

the carrying arm of the indicating disc to its left being normally out of mesh so that while the intermediate gear serves to drive the indicating disc to its left such indicating disc cannot in turn drive said intermediate gear. Such arrangement is not claimed herein, inasmuch as this subject-matter is claimed in my co-pending application Serial No. 87,120.

The means for clearing or resetting the indicating discs will now be described. Such means comprises a main resetting bar 39 and an auxiliary resetting bar 40, each in the form of an angle bar, said bars being provided with teeth 41 along their inner edges adapted to engage the resetting gears 25 upon longitudinal movement of the bars as hereinafter described for rotating such resetting gears and the indicating discs connected therewith to their normal zero positions. As is clearly shown in Fig. 1, each of the resetting gears 25 is mutilated, the arrangement being such that when the gears 25 stand in the position as shown in Fig. 1 the teeth 41 of the bars when moved longitudinally past said gears do not engage the gears. When the indicating discs are rotated one or more steps out of their normal zero positions, however, the gears 25 are brought to position (see Fig. 5) for engagement with said teeth 41 upon longitudinal movement of the bars. The bar 39 is slidably mounted in position in the casing by means of screws 42 passing through slots 43 in the bar, such screws being provided with spring plates 44 on their upper end portions for applying yielding downward pressure on the top face of the bar. Such bar 39 is provided at its outer end with an upturned handle portion 45.

The arrangement is such that during the sliding movement of the main bar 39 nine teeth 41 thereon are drawn past each of the gears 25 for giving such gears 9 steps of movement if necessary for bringing the gears to zero position, with the exception of the gear 25 farthest to the left in Fig. 1. Only five teeth 41 on said main bar are adapted to engage said gear 25 farthest to the left, and it is for the purpose of supplying this deficiency that the auxiliary bar 40 is provided. The auxiliary bar 40 comprises only a short horizontally arranged portion 46 having four teeth thereon as is best shown in Fig. 12, such horizontally disposed part 46 being normally carried above the horizontally arranged portion of the bar 39 in offset relation with respect thereto as is shown in Fig. 11 so as to be out of engagement with the gear 25 but being movable downwardly into alignment with the horizontally arranged portion of the bar 39 and into position to engage the gear 25 when the bar 39 is drawn toward the right.

For effecting this change in position of the parts, the bars 39 and 40 are arranged to have longitudinal movement with respect to each other, the arrangement being such that upon the initial portion of the outward movement of the bar 39 the bar 40 is left in its rearmost position. Upon continued outward movement of the bar 39 (toward the right in Fig. 1), the bar 39 moves out of engagement with the horizontally disposed part 46 of the bar 40 so as to permit downward movement of such bar 40 into the position shown in Fig. 10 at a level for subsequent operative engagement with the gear 25, the engagement of a diagonally disposed cam portion 47 of the bar 39 with a lug 48 carried by the bar 40 serving to insure such downward movement of the bar 40. Shortly thereafter, a lug 49 formed on the bar 39 engages the lug 48 for causing the two bars 39 and 40 to move longitudinally together.

Upon inward movement of the bar 39 with respect to the bar 40, a beveled corner portion 50 of the bar 39 engages the horizontally disposed portion 46 of the bar 40, serving by a camming action on the bottom face of said portion 46 to raise the bar 40 again into offset position with respect to the bar 39, the movement of the bar 39 longitudinally with respect to the bar 40 being limited by the engagement of the end of the bar 39 with a lug 51 carried by the bar 40.

For holding the bar 40 normally in stationary position upon the initial portion of the movement of the bar 39 in either direction, a flat spring 52 is provided, engaging at its middle portion a lug 53 rising from the bottom wall of the casing, and engaging at its ends the inner face of the bar 40, as is best shown in Figs. 1 and 4. This spring serves by friction to resist the movement of the bar 40 as desired.

Upon the initial portion of the outward movement of the bar 39, the five teeth 41 on its end portion move along the path opposite the gear 25 farthest to the left in Fig. 1 for engaging such gear. After said five teeth 41 have passed said gear 25 and the bar 39 has moved downwardly as above described into the position shown in Fig. 10, upon the continued outward movement of the bar 39 the bar 40 moves therewith, serving to bring the teeth 41 on said bar 40 into engagement with said gear 25. By this expedient, I have provided nine teeth adapted to act in turn upon said gear 25, such nine teeth being arranged in spaced relation for proper meshing with said gear but occupying normally only the space of five such teeth. I have thus provided against the necessity for lengthening the casing at the left for accommodating a considerably longer resetting bar as would otherwise be necessary.

As is shown in Fig. 5, the teeth 41 are arranged in groups of four or five teeth, with the spacing between the individual teeth of each group the same in every instance but with the several groups of teeth arranged in differentially spaced relation as compared with the spacing of the axes of the gears 25. In the construction shown, the spacing between the several groups of teeth is such that when the bar 39 is first drawn toward the right in Fig. 5 for an operative stroke the leading teeth of the second and fourth groups from the right engage the teeth of the respective gears 25 earlier than the leading teeth of the first and third groups engage the teeth of the gears 25 adjacent thereto. By the time when the leading teeth of said first and third groups first engage the adjacent gears 25 in the position as shown in said Fig. 5, the leading teeth of said second and fourth groups have moved their respective gears 25 to substantially the middle of the first step movement, as is also shown in said Fig. 5. It is thus clear that the intermediate driving gears 28 cannot be rotated in synchronism with both of the two adjacent carrying gears 26 while such carrying gears are being rotated by the resetting mechanism. If such intermediate driving gear were rotated in step with the rotation of the carrying gear at one side it would necessarily be half a step out of normal meshing relationship with the carrying gear at the opposite side.

The effect of this differential arrangement under certain circumstances is illustrated in Fig. 6. With the units and tens indicating discs being brought to zero position by the resetting mechanism and with the tens indicating disc still in motion at an intermediate stage of the resetting operation at the time when the units indicating disc comes to its zero position, any slight overthrow movement of the units disc would bring the arm 27 thereof into forcible contact with the teeth of the intermediate gear 28 as shown in Fig. 6, serving possibly to give such intermediate driving gear a slight rotary movement out of normal position. By reason of the differential arrangement of the teeth 41 as above described, such slight rotary movement of the intermediate driving gear 28 would serve to bring another tooth of said intermediate gear into abnormal engagement with the end of one of the teeth of the carrying gear 26 of the tens indicating disc, such abnormal engagement serving effectively to stop the rotary movement of the intermediate driving gear before it has proceeded very far, the springs 30 and 32 serving thereafter promptly to return the parts to normal position.

As will be appreciated from an inspection of Figs 7, the stylus 37 is slidably mounted in a suitable opening in the casing, having preferably such fit in the opening as to cause it to be held lightly by friction therein. Upon an outward stroke of the resetting bar 39, a lug 54 carried by the bar 39 engages the head of said stylus and moves the stylus outwardly in its opening for ready removal therefrom for use.

While I prefer to employ the form of mechanism as illustrated in my drawings and as above described, it is to be understood that my invention is not limited to such form except so far as the claims are so limited by the prior art.

I claim:

1. A calculating mechanism comprising in combination two indicating discs rotatably mounted in spaced relation to each other, intermediate driving means for driving the indicating disc at the left by power from the indicating disc at the right, and resetting means adapted upon an operative stroke to act first upon one of said indicating discs and then when said indicating disc has been given a partial step movement to act upon the other disc.

2. A calculating mechanism comprising in combination two indicating discs rotatably mounted in spaced relation to each other, intermediate driving means for driving the indicating disc at the left by power from the indicating disc at the right, and resetting means adapted by an operative stroke to bring both of said discs to zero position, being adapted upon such resetting operation to rotate said discs out of timed relation to each other with respect to said intermediate driving means.

3. A calculating mechanism comprising in combination two indicating discs rotatably mounted in spaced relation to each other, intermediate driving means for driving the indicating disc at the left by power from the indicating disc at the right, resetting gears carried by the said indicating discs, and a resetting bar adapted by engagement with said gears upon an operative stroke to bring both of said discs to zero position, being adapted upon such resetting operation to rotate the disc at the right in such timed relation to the disc at the left that in case said disc at the right should continue its rotation by an overthrow movement said intermediate driving means would be brought into non-meshing engagement with the resetting gear of the disc at the left.

4. A calculating mechanism comprising in combination two indicating discs rotatably mounted in spaced relation to each other, intermediate driving means for driving the indicating disc at the left by power from the indicating disc at the right, resetting gears carried by said indicating discs respectively, and a resetting bar slidably mounted in position adjacent to said gears

and provided with a plurality of sets of teeth for engaging the gears, said resetting gears and bar having a differential arrangement with respect to each other whereby the rotation of one gear starts when the other gear is at substantially the middle of its first step of rotation.

5. A calculating mechanism comprising in combination two indicating discs rotatably mounted in spaced relation to each other, intermediate driving means for driving the indicating disc at the left by power from the indicating disc at the right, resetting gears carried by said indicating discs respectively, and a resetting bar slidably mounted in position adjacent to said gears and provided with a plurality of sets of teeth for engaging the gears, said teeth being differentially positioned with respect to said gears whereby the rotation of one gear starts when the other gear is at substantially the middle of its first step of rotation.

6. A calculating mechanism comprising in combination two indicating discs rotatably mounted in spaced relation to each other, intermediate driving means for driving the indicating disc at the left by power from the indicating disc at the right, resetting gears carried by said indicating discs respectively, and a resetting bar slidably mounted in position adjacent to said gears and provided with a plurality of sets of teeth for engaging the gears, the distance from the operative face of the leading tooth adapted to engage one gear to the operative face of the leading tooth adapted to engage the other gear being made to differ from the distance between centers of the indicating discs by approximately one-half of the distance between the operative faces of teeth of the same set.

ANDERS E. VETHE.