Sept. 18, 1934. A. GORBATCHEWSKY 1,974,239

CALCULATING MACHINE

Filed May 26, 1930 2 Sheets-Sheet 1

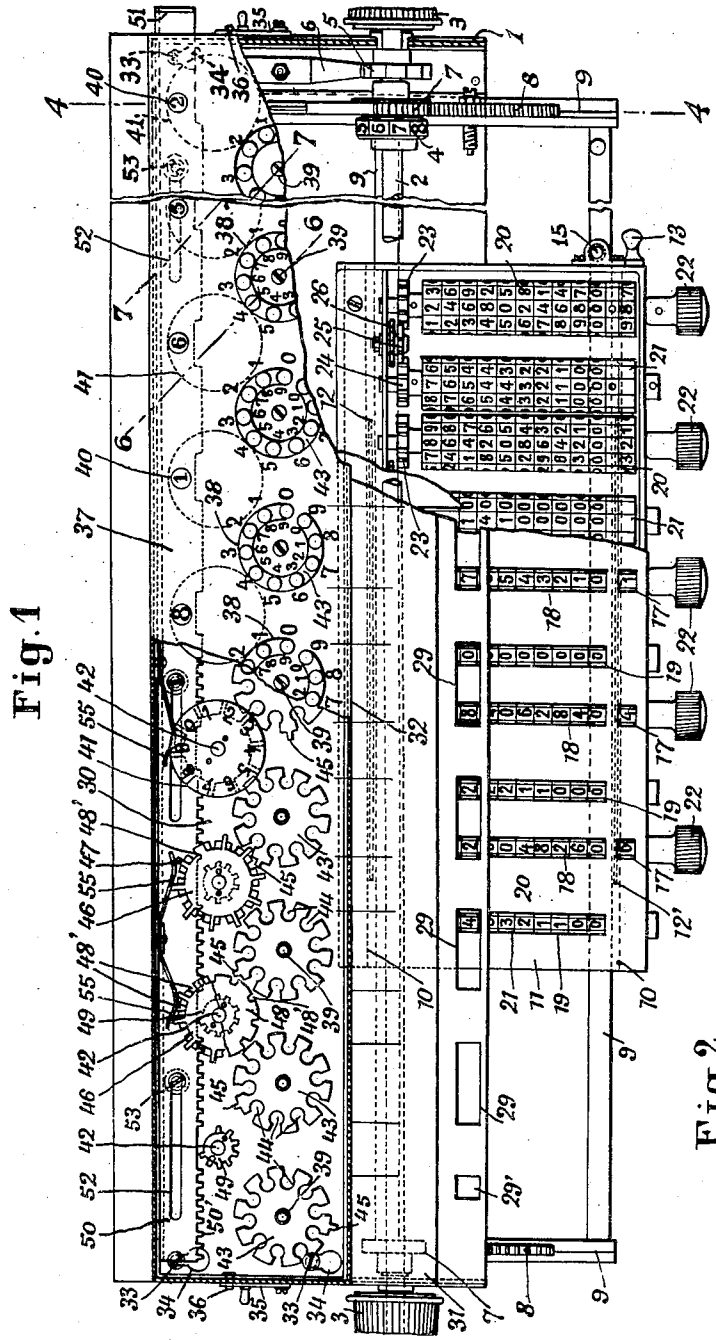


Fig. 1

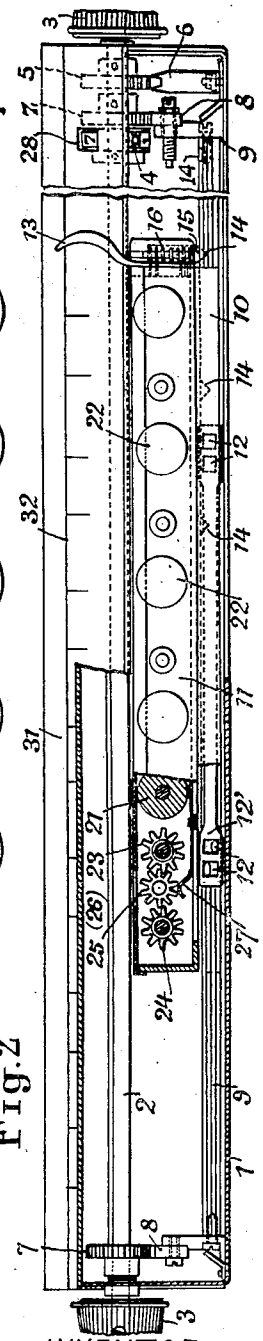


Fig. 2

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Fig. 3

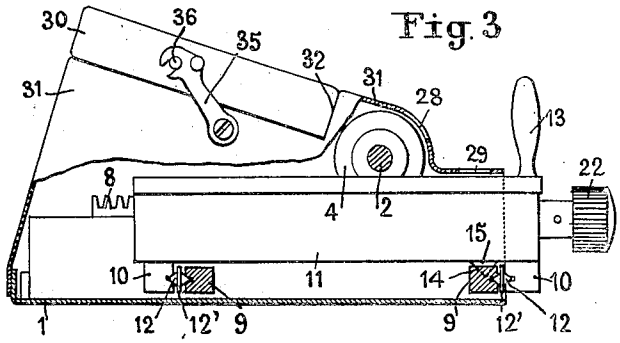
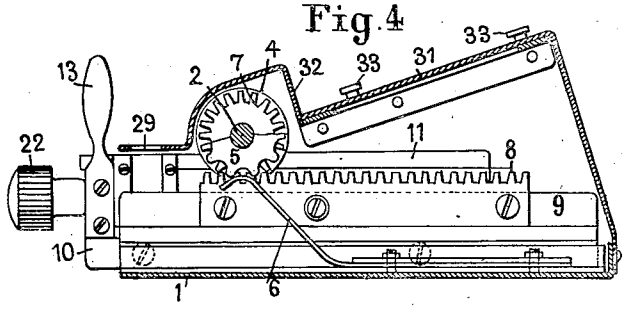


Fig. 4



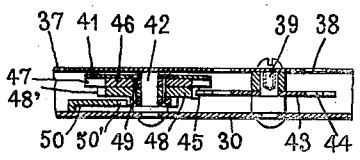


Fig. 6

Fig. 7

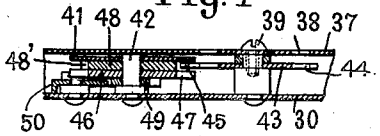


Fig. 5

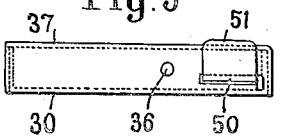
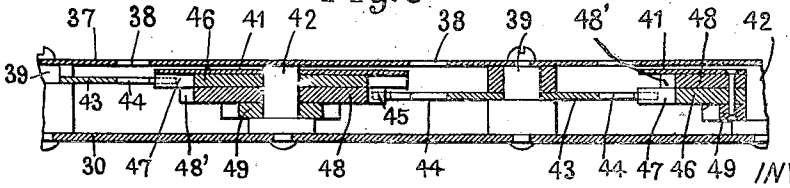


Fig. 8



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UNITED STATES PATENT OFFICE

1,974,239

CALCULATING MACHINE

Alexis Gorbatchewsky, Viroflay, France

Application May 26, 1930, Serial No. 455,777
In Czechoslovakia July 28, 1929

3 Claims. (Cl. 235—61)

This invention relates to a calculating machine which may be used as well for addition and subtraction as for multiplication and division.

My invention comprises the combination of two mechanisms which allow the machine to be used separately for addition and subtraction and for multiplication and division.

A preferred form of an embodiment of the machine according to my invention has been shown by way of example in the accompanying drawings in which:

Fig. 1 is a plan view, the cover having been removed,

Fig. 2 shows a front elevation of the machine in the part of the same more particularly devised for addition and subtraction, a part of the machine being shown in vertical section,

Fig. 3 is an end view of the machine viewed from the left part of Fig. 1,

Fig. 4 is a section on the line 4—4 of Fig. 1 showing a vertical section of the multiplying mechanism, the mechanism for addition and subtraction being not shown,

Fig. 5 is a detail of the mechanism for addition,

Fig. 6 shows a cross section along the line 6—6 (Fig. 1),

Fig. 7 is a cross section along the line 7—7 (Fig. 1),

Fig. 8 shows a longitudinal section of the mechanism for addition.

In a casing 1 is located a small shaft 2 which is provided with hand controlling hubs 3 arranged on both its left end and right end. Said shaft 2 carries a small drum 4, the periphery of which is provided with figures from 0 to 9. It is, however, possible to manufacture machines having a larger number of figures.

Arranged on the shaft 2 is a detent disc 5 provided with an elastic detent 6 which secures the shaft 2 in adjusted position.

Keyed on the shaft 2 are small tooth-wheels 7 which mesh with the teeth 8 forming a double rack carried by the frame 9 which is movable in a direction at right angles with the longitudinal axis of the machine. Frame 9 carries a movable slide 11 which is guided by means of longitudinal edges 10 with interposition of rolls 12 each comprising a circular rib 12', the slide 11 is provided with a hand lever 13 and it may be locked on the frame 9 by means of a bolt 15 provided with a spring 16 and which is forced into a recess 14 of the frame 9.

Slide 11 is provided on its upper part with windows 17, 18 and 19, each window 17 corresponding with a pair of elongated windows 18—19. Small rolls or drums 20 are located under the windows 17 and 18, while the windows 19 allow figures carried on cylinder 21 to appear, the arrangement being such that the axes of the cylinders are at right angles with the controlling shaft 2.

The cylinders 20 are controlled from outside the casing 11 by means of knobs 22. The transfer of the tens on the cylinders provided with ten figures on their peripheries is effected by means of toothed-wheels 23—24—25. The control of discs or wheels 23 and 24 is made by means of disc 25 which is provided with a locking wheel 26 and a detent spring 27, such arrangement being devised for securing the several wheels in a definite position.

Windows 17 are to display the multiplicand and the figures showing such multiplicand may have a conveniently different colour. Another set of figures on the cylinders 20—21 show the result of the operation between multiplicand and multiplier. The registration of the figure of the multiplier upon the cylinder 4 is effected by means of knob 3 which, through the pinion 7 meshing with the rack 8 controls the position of the casing 11 in the direction perpendicular to the shaft 2.

The figure relative to the multiplier appears in an opening 28 while the result of the operation is visible in openings 29—29'. The openings 29 are arranged in such a manner as to be common for two adjacent cylinders 20—21 (Fig. 1).

The result obtained on the groups of cylinders is manually transferred to the device 30 for addition, which device is provided on the cover 31. The adding device is located in a recess 32 of the cover 31 and is locked in a convenient position by means of screws 33 which retain by means of key hole slots 34. Levers 35 are pivoted on cover 31 and engaged on knobs 36 of the adding device 30.

Such adding device is provided with a metallic cover 37 which has circular openings 38 which allow the corresponding discs to be rotated around axes 39. The edges of said openings 38 carry figures from 1 to 9. The cover 37 is pierced with openings 40 for the inspection of figures carried by discs 41, which discs carry numbers from 0 to 9. Such discs are pivoted on pins 42. The pivots 39 are parallel with pins 42: pivots 39 are carried by the upper part of casing 37 while pins 42 are solid with the bottom part of adding device 30.

Located under apertures 38 are flat discs 43 with recesses 44 and provided each with one tooth 45. The recesses 44 are for receiving the tip of the finger or an implement used in setting the discs. Said tooth 45 is symmetrically arranged on every flat disc 43 in order to be in position to mesh on both its sides. Each disc 43 pivoted on axis 39 is in mesh on the one hand with disc 46 having narrow teeth 47 and pivoted on pins 42; on the other hand said disc 43 is in mesh with disc 48 pivoted on the adjacent pin 42; said disc 48 is provided with notches 48' which receive the tooth 45.

Pins 42 receive dials 41 and discs 46 and 48 which are rotated together while pins 39 carry discs 43 which are arranged at a different height according to dial 48 being under or above disc 46.

The movement of dial 43, effected by the finger of the operator inserted in the opening 44 is transmitted to the disc which is located on the right of the same and pivoted on pin 42 while the transfer of tens is accomplished by means of the tooth 45 which is arranged so as to allow disc 43 to rotate backwards for eventually correcting the figures or for bringing the machine to initial position after a subtraction; the teeth simultaneously are in mesh with the discs located on the left hand side and rotating on pins 42.

The device is reset by means of teeth 50' of a rack 50 coacting with toother wheels 49 on the pins 42, by which not only disc 41, but also disc 43 bring their figures 0 under the corresponding window. Movement of the rack is effected by pressure applied to a lug 51 thereof, the rack being guided by means of slots 52 sliding upon pins 53. Wheels 49 are provided with teeth on a part only of their peripheries.

The operation is as follows:

The machine shown by the drawings has been devised for numbers of five figures, though it is possible to build machines receiving a larger number of figures. The number is registrated on the machine from right to left by means of knobs 22 so that such number may be read through windows 17. The knob 3 is afterwards rotated for making the multiplier appear through window 28 (Figs. 2 and 3); the result of the operation is visible through windows 29 and 29'.

As will be understood, each aperture 29 is for one order only, i. e., units, tens. Thus, for example, the 2, 2 shown in aperture 29 in Fig. 1 are each two hundreds and are to be added as $2+2=4$ which is 400 in this order. The slide 11 is brought to proper position by means of the hand lever 13 and in order to avoid having to add mentally the numbers on the drums 20 and 21 which appear in a common window 29, such numbers are transmitted in their normal order to the adding device 30.

In order to render the device clearer, lines 54 are arranged upon the cover 31. The position of the device is secured in the first two instances by means of the springs 6 and 27 while in the second instance, slide 11 is secured by means of bolt 15 which enters the recess 14. The result of dials 43 is afterwards transmitted from right to left of the adding device 30; the result appears through windows 40. The multiplication and addition may afterwards be continued or resumed as above described.

In order that the underlying feature of the invention may be easily understood it will at first be shown by way of example by making the following product

$$358\times23$$

I commence by making the partial product of 358×3 which may be written

$$(300+50+8)\times3$$

This partial product is obtained on a special device comprising the first windows 29 from the right (Fig. 1) the product $8\times3=24$ comprises two figures, the figure of the units 4 which will be seen in the first window 29 from the right, the figure of the tens which will be seen in the second of said windows 29. The product $5\times3=15$ comprises a figure of the units 5 which will be seen in the second window, and a figure of the tens 1 which will be seen in the third window. It is obvious that the two figures 5 and 2, seen in the second window, are both figures of the tens.

Now the machine is constructed in such a manner that the second window is situated opposite the device of the adding mechanism corresponding to the tens, say opposite the second (from the right) of the totalizing wheel 39. The numbers 2 and 5 are added successively on the said wheel. The numbers appearing in the third window are added on the third wheel and so on. In order to obtain the product 358 by 2 which is the figure of the tens in the multiplier, the first window 29 must be previously brought in front of the second of the wheels 39, the second window 29 in front of the third wheel and so on.

The figures of the new partial products appearing in the windows are again added by means of the totalizing wheels.

In order to perform division I proceed as follows: I actuate the wheels 38 in such a way that the figures of the dividend appear in the windows 40, the first figure from the left of said dividend appearing say in the second window from the left, the second figure in the third window and so on, I then rotate the drums 22 so as to let the figures of the divisor appear in the windows 17, I then actuate the knob 3 in order to let appear in the windows 29 the greatest number smaller than the dividend; the figure appearing then in the window 28 is the first figure of the quotient.

I substract now the number appearing in the windows 29 from the dividend, after I move the slide 11 towards the right and repeat the same operation until the division is entirely performed.

Said device may be used for subtraction by rotating dials 43 backwards and using the figures located inside the slot 38. The result appears anew through window 40.

The machine may be used for addition, subtraction, multiplication, either simultaneously or separately. Should the device be used only for addition, the adding device 30 could be removed by disengaging levers 35.

The distances apart of axes 39 and 42 are equal. Consequently the transfer may be effected very precisely and without the aid of springs which have only to secure the device in position. Discs 46 are held against accidental displacement by means of springs 55; the latter are arranged in a position to engage with teeth 47 of discs 46.

The construction of the device as well as the arrangements shown in the drawings could be varied or modified without departing from the scope of the invention.

What I claim is:

1. A calculating machine for effecting the multiplication of two numbers of several figures and other elementary operations, comprising an adding mechanism having totalizing wheels one

for each unit row arranged in line and equidistant, a mechanism for multiplying one number of several figures by a number of one figure having means for causing groups of two figures to appear together with line positions and the same equidistance as the wheels of the adding device, the two figures in the same unit row of the successive products of each figure of the multiplicand by the figure of the multiplier, and connecting means between the adding mechanism and the multiplying mechanism adapted for displacing the multiplying mechanism relative to the adding mechanism for bringing the positions of the groups of two figures successively in front of the various totalizing wheels.

2. A calculating machine including, in combination, a multiplying mechanism comprising several pairs of juxtaposed calculating cylinders, a connection between the cylinders of each pair, a knob with figures 0 to 9 for the control of the said connection on the two cylinders of one pair, the figures of the successive products by 0 to 9 of the figures from 0 to 9 being so arranged that when the said control knob is in the position corresponding to a figure of the multiplicand, the products by 0 to 9 of this figure of the multiplicand appear on the upper generatrices of the two cylinders, the figure of single units on the right cylinder and the figure of tens on the left cylinder.

3. A calculating machine according to claim 1, characterized in that said multiplying mechanism comprises a fixed frame supporting the adding mechanism, a cover in the said frame, windows on the said cover one for each unit row and arranged in front of the totalizing wheels of the adding mechanism, a slide with pairs of calculating cylinders therein movable in one direction with respect to said windows, means for displacing said slide in a second direction, and means for indicating the position of said slide in its movement in the second direction.

ALEXIS GORBATCHEWSKY.