Oct. 4, 1949. E. GRIP 2,483,459

CALCULATING MACHINE

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Fig. 1.

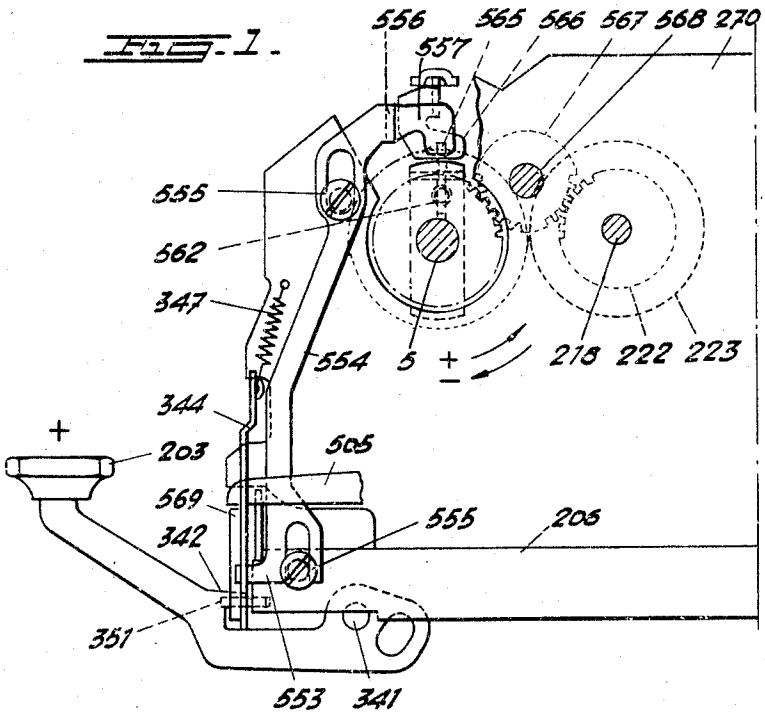


Fig. 3.

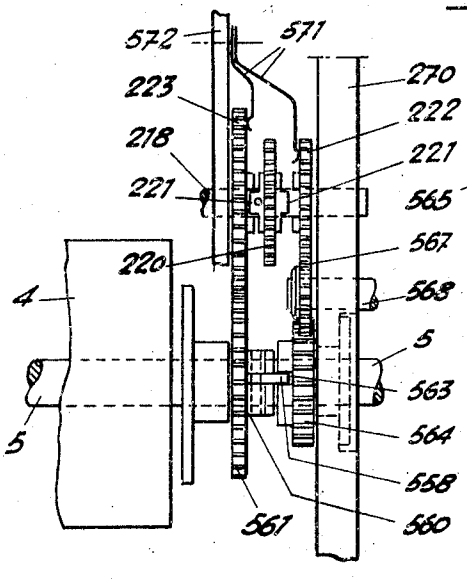
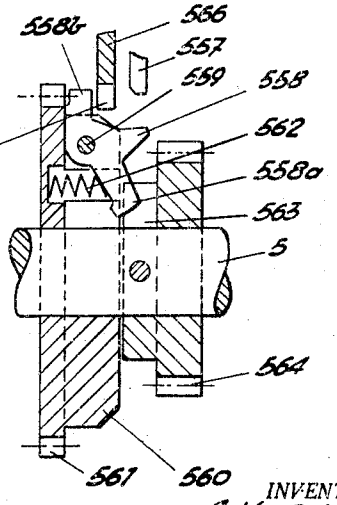


Fig. 5.



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CALCULATING MACHINE

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FIG. 3.

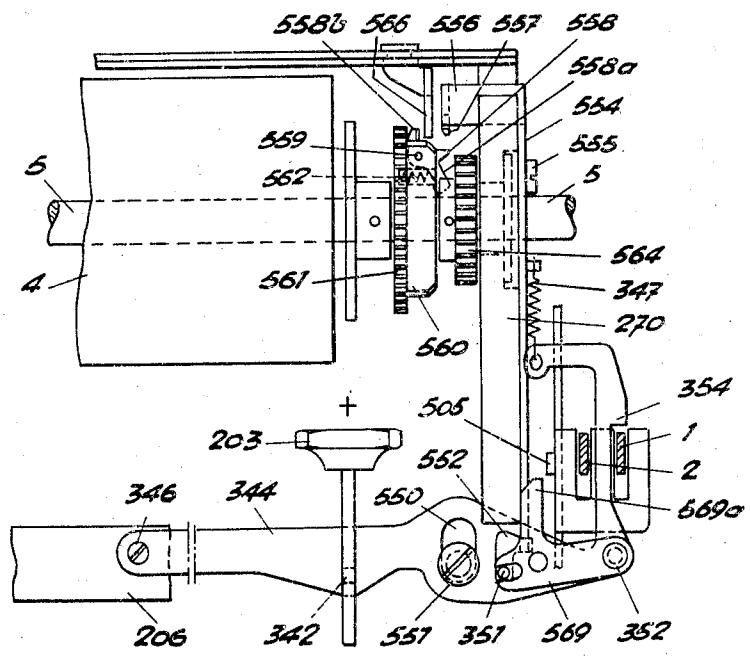
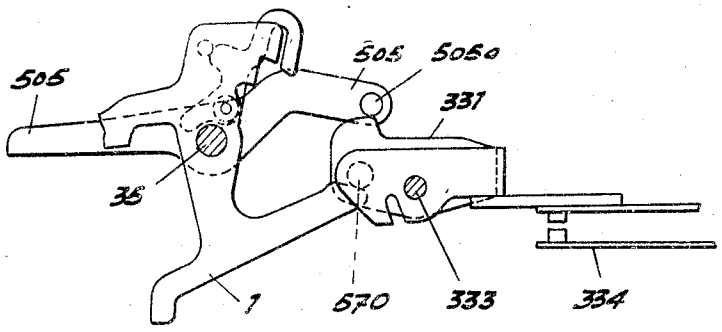


FIG. 4.



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CALCULATING MACHINE

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Fig. 6.

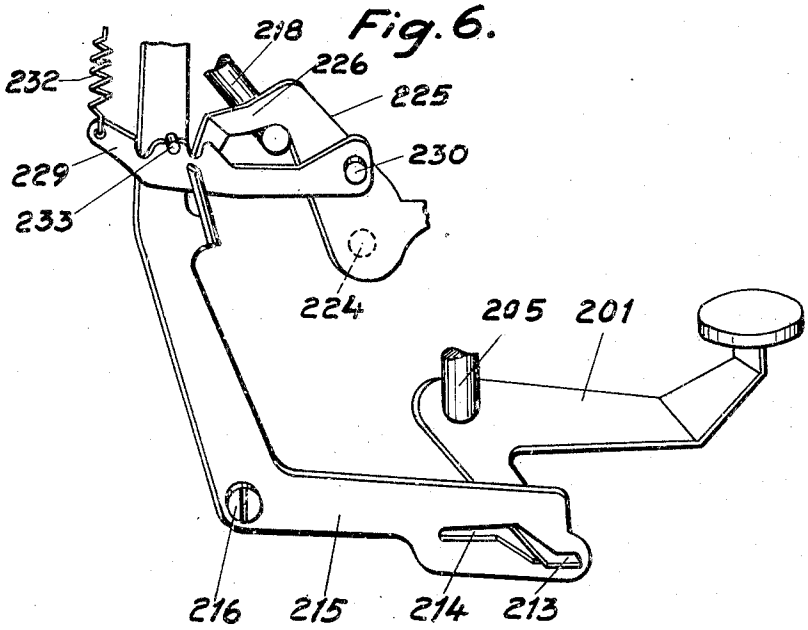


Fig. 7.

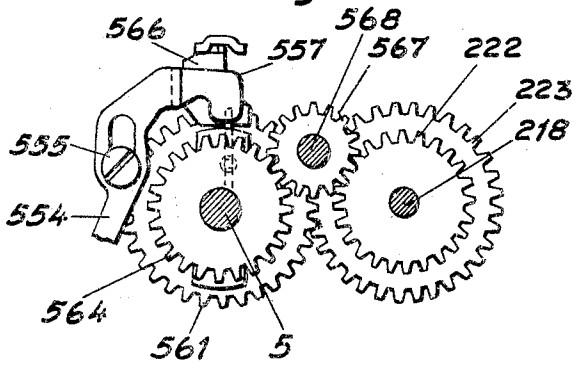
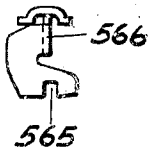


Fig. 8.



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Patented Oct. 4, 1949

2,483,459

UNITED STATES PATENT OFFICE

2,483,459

CALCULATING MACHINE

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Application May 6, 1944, Serial No. 534,453
In Sweden November 30, 1942

Section 1, Public Law 690, August 8, 1946
Patent expires November 30, 1962

1 Claim. (Cl. 235—79)

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For effecting operations of division in calculating machines, the dividend is first set into the actuator (such as a pin wheel rotor) and then the operator causes the actuator to effect one revolution to enter the dividend into the results register; that revolution is registered in the revolutions counter, on one or more numeral wheels. Thus, when the dividend is entered additively into the results register, that is by means of a positive revolution, the numeral "1" appears in the revolutions counter, but when the dividend is entered into the results register subtractively, that is, by negative revolution, one or more numerals "9" appear on the numeral wheels of the revolutions counter. It is, therefore, necessary to clear the revolutions counter, before the operation of division is continued with the divisor set in the actuator. This clearing operation necessitates an additional manipulation and may easily be forgotten, which results in errors of calculation.

It has been proposed to use special devices to render the revolutions counter inoperative, when the dividend is entered into the results register. Thus, it was proposed to use a mechanism, which is actuated manually, to displace the revolutions counter actuator (quotient tooth) laterally out of its operative position so that it does not act on the revolutions counter when the dividend is entered into the results register. Said construction suffers from serious drawbacks, because for each denomination the revolutions counter actuator must be able to assume two different positions laterally of each other, and especially in calculating machines having a stationary revolutions counter and a revolutions counter actuator movable laterally, such construction is very complicated and occupies much space.

The chief purpose of this invention is to eliminate the clearing operation of the revolutions counter generally necessary after the dividend has been entered into the results register in operations of division, in calculating machines capable of performing automatic division.

Another purpose of this invention is to disable the revolutions counter actuator automatically, when the machine is set to automatic division and then the dividend is entered into the results register.

Another purpose of this invention is to render operations of division simpler than heretofore. Thus, in accordance with this invention, one step of operation is eliminated and the attention of the operator may be concentrated on the chief operations. The same lever that sets the machine to automatic division simultaneously disables the revolutions counter actuator for simple addition operations; the dividend is always entered by means of a simple addition operation.

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Other purposes will be evident from the following specification and claim.

One embodiment of a device in accordance with the invention is illustrated in the annexed drawings.

Fig. 1 shows an end view of a device in accordance with this invention.

Fig. 2 shows a corresponding front view.

Fig. 3 shows a top view of the driving gears for the revolutions counter actuator.

Fig. 4 shows a side view of the motor-contact closing mechanism; and

Fig. 5 shows in section and on a larger scale, a detailed view of the coupling pawl mechanism.

Fig. 6 shows a perspective view of certain details controlled by the chief control lever of the machine.

Fig. 7 shows an end view of the upper parts of Fig. 1 the end wall being broken away to show the details in full.

Fig. 8 shows a side view of a detail.

In the drawings only those parts are shown which are necessary to illustrate the invention. When not otherwise expressly stated, in this specification the expressions "right," "left," "upwards," "downwards," "forward" and "backward" are used to designate those directions, as they appear to an operator, sitting at the keyboard of the machine.

The machine illustrated in the drawings is in its principal features constructed in accordance with U. S. Patent No. 2,398,286, granted April 9, 1946. The driving mechanism may be constructed in accordance with U. S. Patents No. 2,068,899 and 2,127,102, respectively. Some parts in the specification below and in the drawings carry the same reference characters as the corresponding parts in U. S. Patents Nos. 2,068,899, 2,127,102 and No. 2,398,286.

The calculating machine illustrated in the annexed drawings is of the Odhner or pin-wheel type and has an actuator or pin wheel rotor 4 which is displaceably splined on the main shaft 5. For carrying out the operations of calculation this shaft together with the actuator 4 is rotated in either direction (+ direction or — direction, as indicated by the arrows in Fig. 1) under the control of a multiplication key or positive multi-revolutions key 1 and a division key or negative multi-revolutions key 2. Said keys start the actuator 4 in the positive or in

the negative direction of rotation respectively, that is, counter-clockwise and clockwise, respectively, in Fig. 1, for effecting one or more revolutions without clearing the rotor. In addition, the machine has an addition key 203 which when depressed causes the actuator 4 to effect one positive revolution and then to be cleared automatically. In analogy a subtraction key may be provided, as described in detail in U. S. Patent No. 2,393,286.

In addition, the machine also has the control lever 201 described in said last-mentioned patent for setting the machine to automatic division and to multiplication with automatic shift to the right and to the left, respectively. This lever is shown (at 201) in the patent just mentioned. It has a plurality of functions, but of those functions only that one is here concerned that at the setting of the control lever to automatic division said control lever displaces the shaft 218 of the revolutions counter actuator (quotient tooth) to the left in Fig. 3 (see Fig. 5 of the U. S. patent just mentioned) so that the toothed wheel 220 is coupled to the toothed wheel 223 by means of the left carrier or clutch 221. The operation of the lever 201 is illustrated in Fig. 6. The control lever 201 is pivoted on a stationary journal 205 secured to the machine frame. An arm 213 of the control lever 201 is movable in a cam slot 214 of a lever 215, which is rockable on a stationary pin 216. A pin 233 is secured to the lever 215 and a tension spring 232 urges an arm 229 against this pin. By means of a pin 230, the arm 229 is articulately connected with a lever 225 which is rockable on a stationary pin 224. This lever has a cam 226 engaging an annular or peripheral slot in the shaft 218.

When the lever 201 is set manually to its position for division (as shown in Fig. 1), the lever 215 is rocked counter-clockwise and by means of the arm 229 rocks the lever 225 counter-clockwise. This causes the cam 226 to displace the shaft 218 axially to its minus position (position for division), that is its extreme left position in Fig. 3, and consequently the toothed wheel 220 is coupled to the toothed wheel 223 by means of the left clutch 221. The toothed wheel 220 is secured to the shaft 218 and consequently causes that shaft to rotate if said wheel is rotated. But the toothed wheels 222, 223 are loosely journalled on the shaft 218 (the toothed wheel 220 drives the tens transfer rotor for the revolutions counter).

The addition key 203 is rotatably journalled on the shaft 341 and its projection or catch 342 engages the lever or rocking arm 344 which is rotatably journalled on a stationary pin 346. This pin may, for instance, be secured to the base plate 206 of the machine frame. A tension spring 347 pulls the lever 344 upwards and said lever has a projection or catch 354 which acts on the multiplication key 1, when the lever 344 is rocked downwards in Fig. 1 (clockwise in Fig. 2) by the addition key 203. For guiding purposes the lever 344 has a slot 550 cooperating with a stationary guiding pin 551. The lever 344 also has a recess 552, which encloses the projection 553 of the bar 554 so that said bar follows the motion of the arm 344 in the vertical direction. In this motion the bar 554 is guided by the studs or screws 555 entering guiding slots in said bar. In its upper end this bar has a part 556 bent out laterally and passing through a recess or hole in an end wall 270 of the machine frame. The flat and somewhat bevelled point 557 of that part 556 extends inwards above a coupling pawl 558.

Said pawl is rotatably journalled on a pin 559 in a slot in the oblong hub 560 of a toothed wheel 561 running freely on the main shaft 5 and permanently engaging the toothed wheel 223. In addition to the projection extending into the path of the point 557 the coupling pawl 558 also has two projections or wings 558*a* and 558*b* and is under the action of a compression spring 562 tending to rock said pawl counter-clockwise in Figs. 2 and 5 so that the wing 558*a* enters a slot 563 in the hub of the toothed wheel 564 secured to the shaft 5 (by means of a pin or the like). In the position shown in the drawings, that is the stopping position or position of rest of the actuator 4, the projection 558*b* is just opposite a slot 565 in the stationary guide 566.

The toothed wheel 564 permanently meshes with the driving toothed wheel 567 which is secured is a shaft 568 and also drives the toothed wheel 222. The shaft 568 is driven via a driving mechanism (for instance of the type shown in U. S. Patents Nos. 2,068,899 and 2,127,102, respectively), in either direction of rotation, depending upon which of the control keys has been depressed. When the projection 558*a* engages the slot 563, the toothed wheel 567 also drives the toothed wheel 223 via the toothed wheel 561, and then the wheel 223 rotates in opposite direction to the wheel 222. According as the toothed wheel 220 then is coupled with the toothed wheel 222 or the toothed wheel 223, the shaft 218 of the revolutions counter actuator is caused to rotate in the same direction as the toothed wheel 222 (normal direction of rotation for addition, subtraction and multiplication) or as the toothed wheel 223 (normal direction of rotation for division), that is, in the same direction or in the opposite direction, respectively, as that of the pin wheel rotor 4.

On the lever 344 a pawl 569 is rockably journalled on the pin 352. One end of that pawl is fork-shaped and encloses a stationary pin 351 secured to the base plate 206. The recess 552 in the rocking lever 344 is so dimensioned that the pin 351 does not hinder the motion of the lever. The pawl 569 has an arm or a projection 569*a* extending upwards and so dimensioned that when the lever 344 is rocked clockwise (in Fig. 2) the projection 569*a* is rocked (also clockwise) inwards below the forward end of the locking arm 505. Said arm is journalled on the stationary shaft 35 and in its opposite end carries a pin 595*a*, Fig. 4, which engages a curve or a cam on a contact lever 331. Said contact lever is rockably journalled on the pin 333 and its back edge rests on the motor contacts 334. At its forward end the contact lever 331 engages the multiplication key 1, and in the embodiment shown this engagement is effected via the pin 570 secured to the contact lever.

On the end wall 572 springs 571 are secured which have the purpose of preventing the toothed wheels 222, 223 from being displaced axially, said springs passing the toothed wheels against the end walls 270 and 572.

The device described acts as follows:

The machine is set for division by setting the chief control lever 201 manually to its position of division. As is described in detail in the patent just mentioned, this sets the shaft 218 carrying the revolutions counter actuator (quotient tooth) to its extreme left position. The

dividend is now entered into the pin-wheel rotor **4**, for instance by means of numeral keys, and said rotor is now tabulated to its extreme left position in well-known manner. Then the operator depresses the addition key **203** to enter the dividend into the results register (not shown). When depressed, this key **203** acts on the rocking lever **344** which then pulls the bar **554** downwards, so that the point **557** of that bar is moved downwards in Figs. 2 and 5, and it swings the coupling pawl **558** clockwise against the action of the spring **562**. Thus, the projection **558***a* is moved out of engagement with the slot **563** and instead of it the projection **558***b* engages the slot **565** in the stationary guide **566**. The toothed wheel **561** is consequently now free from the driving toothed wheel **567** and is in addition locked in its position of rest (that is the stopping position or position of rest of the pin wheel rotor **4**). When the key **203** is depressed, it also depresses the multiplication key **1** via the projection **354** and said key **1** then closes the contacts **334** for the current to the electric motor, via the contact lever **331**. When the contact lever **331** is thus rocked clockwise in Fig. 1, it rocks the arm **505** counter-clockwise so that the front end of that arm visible in Fig. 2 is moved downwards. Simultaneously the pawl **569** has been rocked clockwise in Fig. 2, when the lever **344** follows the depressed key **203**. The front end of the locking arm **505** extending downwards then engages the oblique (bevelled) surface at the upper end of the projection **569***a* of the pawl **569** so that said pawl remains locked and consequently locks the key in its depressed position, when the operator releases the addition key **203**. Now the motor **4** performs one revolution in the + direction and then is cleared. This causes the dividend to be entered into the results register, but the revolutions counter is not actuated, because the shaft **218** of the revolutions counter actuator is disengaged from the driving mechanism.

It is to be observed that during the entire operation of addition and the subsequent clearing of the rotor **4**, the contact lever **331** in is well-known manner kept in its operative position (as described in U. S. Patent No. 2,398,286), and consequently the contact **334** remains closed. Via the locking arm **505** and the pawl **569** and the lever **344** the addition key is thus kept locked in its depressed position so that it cannot return before the operation of addition is finished. This is important for avoiding errors, because it prevents the operator from bringing the disengaged toothed wheel **561** out of position by means of repeated depressions of the addition key; as long as that key is kept depressed and locked in its depressed position, also the toothed wheel **561** is locked by the pawl **558**.

When the operation of addition is finished, the addition key **203** returns to its position of rest. It is to be observed that the oblique surface of the arm **569***a* of the pawl **569** is so shaped that the key **203** is not locked at the return motion.

When the addition key **203** returns to its original position, the point **557** is lifted off from the pawl **558** which is now rocked counter-clockwise by the spring **562**, so that the projection **558***b* is disengaged from the guide **566** and simultaneously the projection **558***a* enters the slot **563**.

If the division key **2** or the multiplication key **1** is depressed, the bar **554** and consequently also the pawl **558** are not actuated. After the divisor has been entered into the rotor **4**, the operation

of division can, therefore, be finished in well-known manner, the shaft **218** being driven from the toothed wheel **567** via the toothed wheel **564** and the pawl **558** and the toothed wheels **561**,**223** so that the revolutions counter actuator operates in the usual manner on the revolutions counter.

It is to be observed that, if desired, numerals may be entered into the revolutions counter by means of the multiplication and division keys **1**,**2** before the beginning of the operation of division. During such entering operation the rotor **4** remains cleared.

When the chief control lever (**201**) is set in either of its positions for multiplication, the shaft **218** is in its right position so that the toothed wheel **220** is coupled with the toothed wheel **222** and consequently the driving wheel **567** drives the shaft **218** and the shaft **5** in the same direction of rotation.

Addition is normally effected with said chief control lever in either of its positions of multiplication, and then the number of items of addition is automatically registered in the revolutions counter which in some cases is important.

What I claim is:

In a calculating machine adapted to divide by repeated alternative addition and subtraction having an accumulator, a revolutions counter, a differential actuator, a revolutions counter actuator, and a plurality of operation control keys, in combination, drive means for said counter actuator comprising a shaft driven in synchronism with the differential actuator, an axially adjustable counter actuator shaft reversibly operable with respect to said differential actuator, a first gear train operable by said synchronously driven shaft, said gear train terminating in a first gear loosely mounted on said counter actuator shaft, a second gear train operable by said synchronously driven shaft terminating in a second gear loosely mounted on said counter actuator shaft, said second gear operating oppositely to said first gear, a coupling member fixed to said counter actuator shaft and engageable with either said first or second gear by axial adjustment of said counter actuator shaft, a disconnectable coupling pawl in said second gear train, and means controlled by one of the plurality of operation control keys for disconnecting said pawl, whereby when said coupling member is engaged with said second gear and said pawl is disconnected by operation of said control key said synchronously driven shaft will be ineffective to drive said counter actuator shaft.

ERIK GRIP.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,381,898	Andersson	June 21, 1921
2,088,974	Pott	Aug. 3, 1937
2,227,785	Kottman	Jan. 7, 1941
2,252,621	Eichler	Aug. 12, 1941
2,310,280	Friden	Feb. 9, 1943
2,366,345	Machado	Jan. 2, 1945
2,382,661	Pott	Aug. 14, 1945

FOREIGN PATENTS

Number	Country	Date
551,311	Great Britain	Feb. 17, 1943