T. BÄUERLE.

CALCULATING MACHINE.

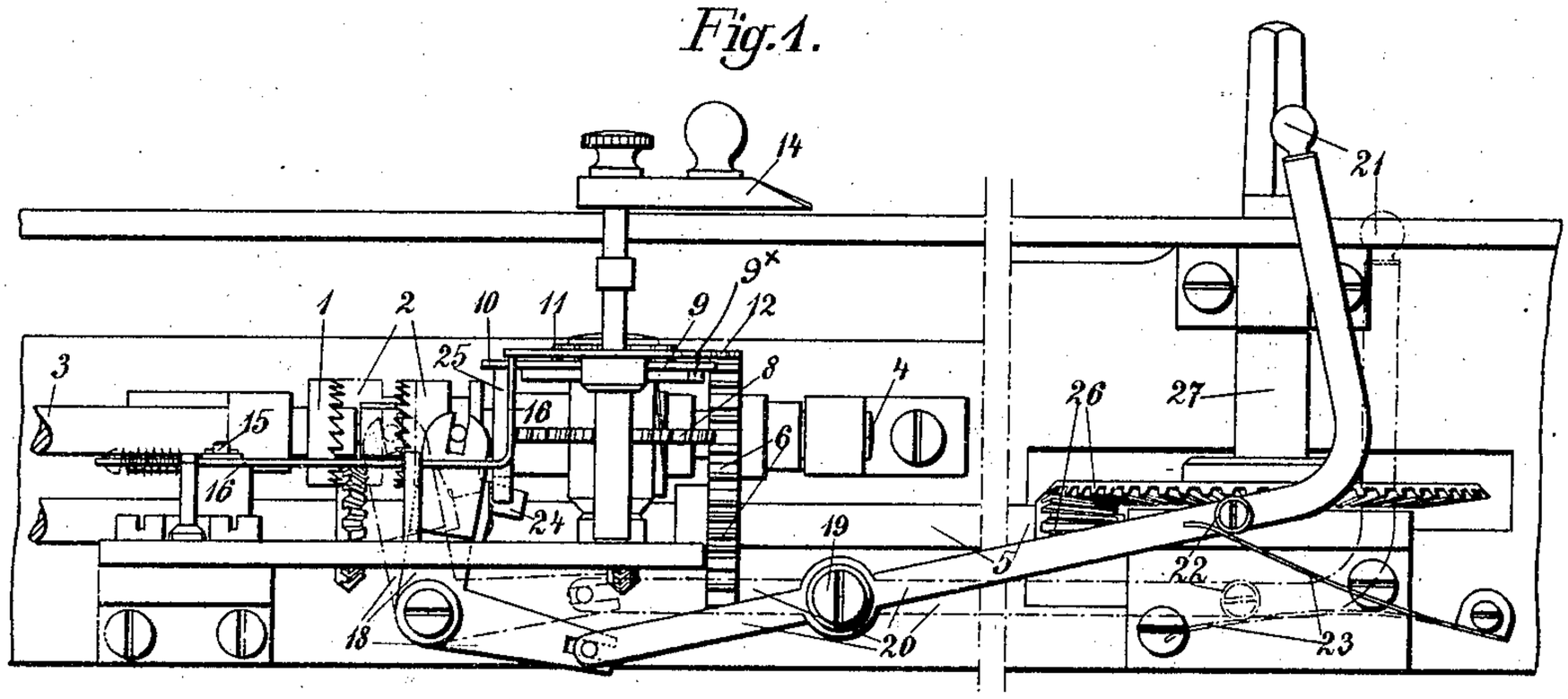
APPLICATION FILED FEB. 9, 1909.

967,489.

Patented Aug. 16, 1910.

3 SHEETS—SHEET 1.

Fig. 1.



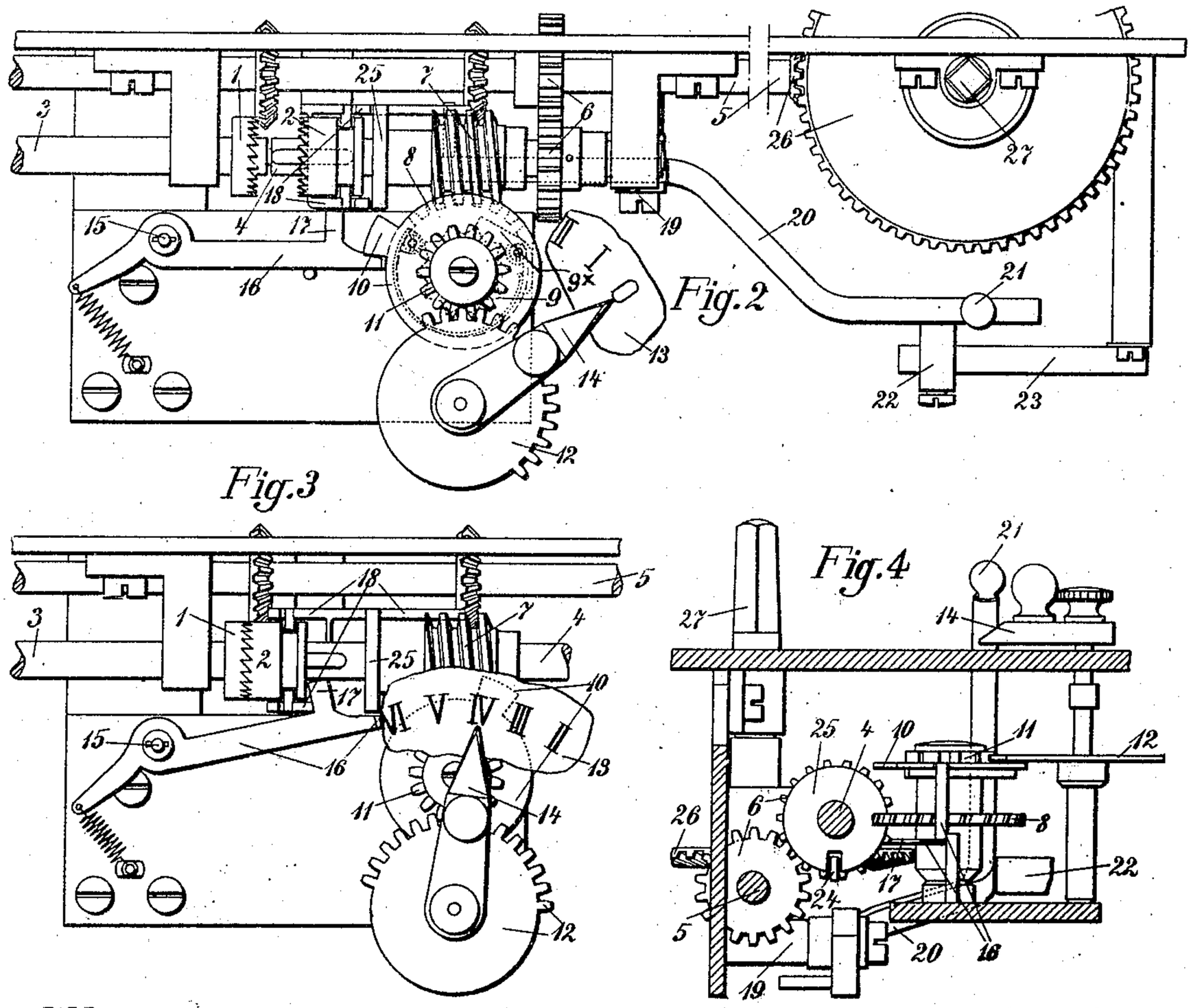


Fig. 2

Fig. 3

Fig. 4

Witnesses

S. Brashears

Annie Cooper

Inventor

Tobias Bäuerle

by Paul & Schilling

his Attorney

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3 SHEETS—SHEET 2.

Fig. 5

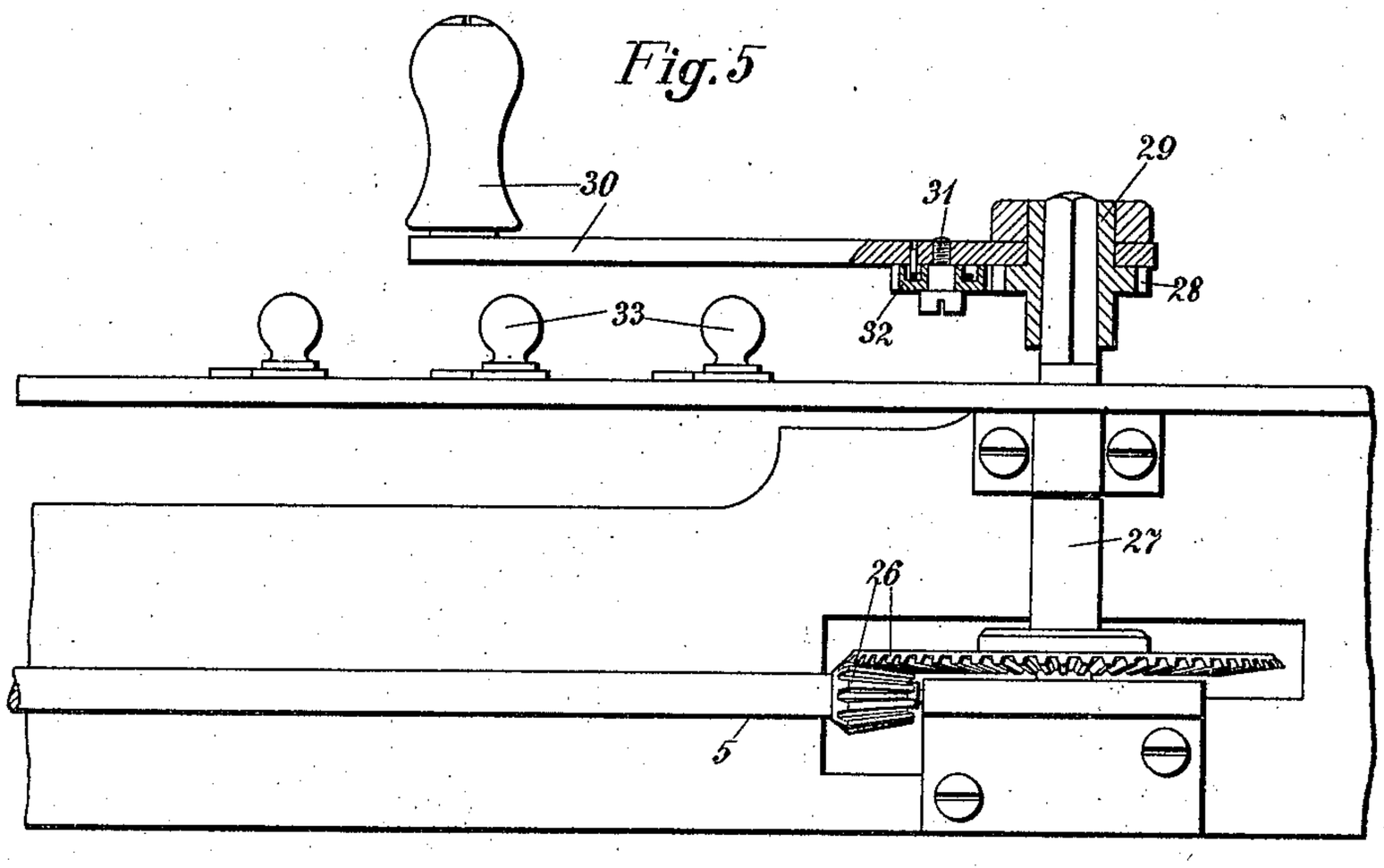
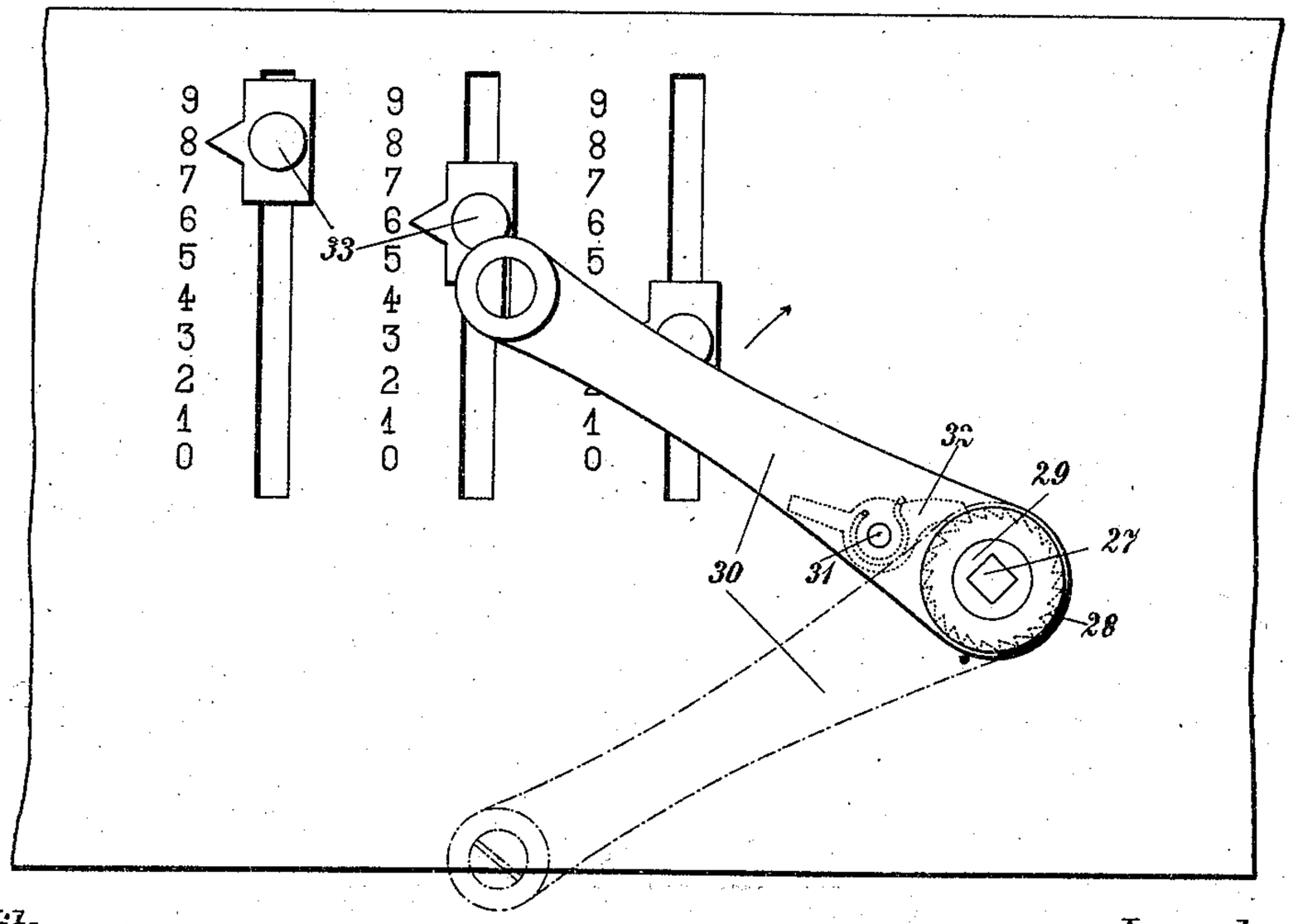


Fig. 6



Witnesses

S. Thrashears

Annie Cooper

Inventor

Tobias Bäuerle

by Paul E. Schilling,

his Attorney

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3 SHEETS—SHEET 3.

Fig. 7

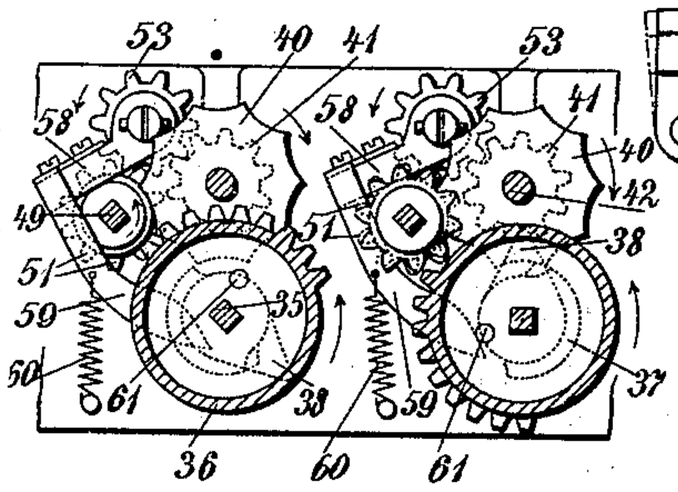


Fig. 9

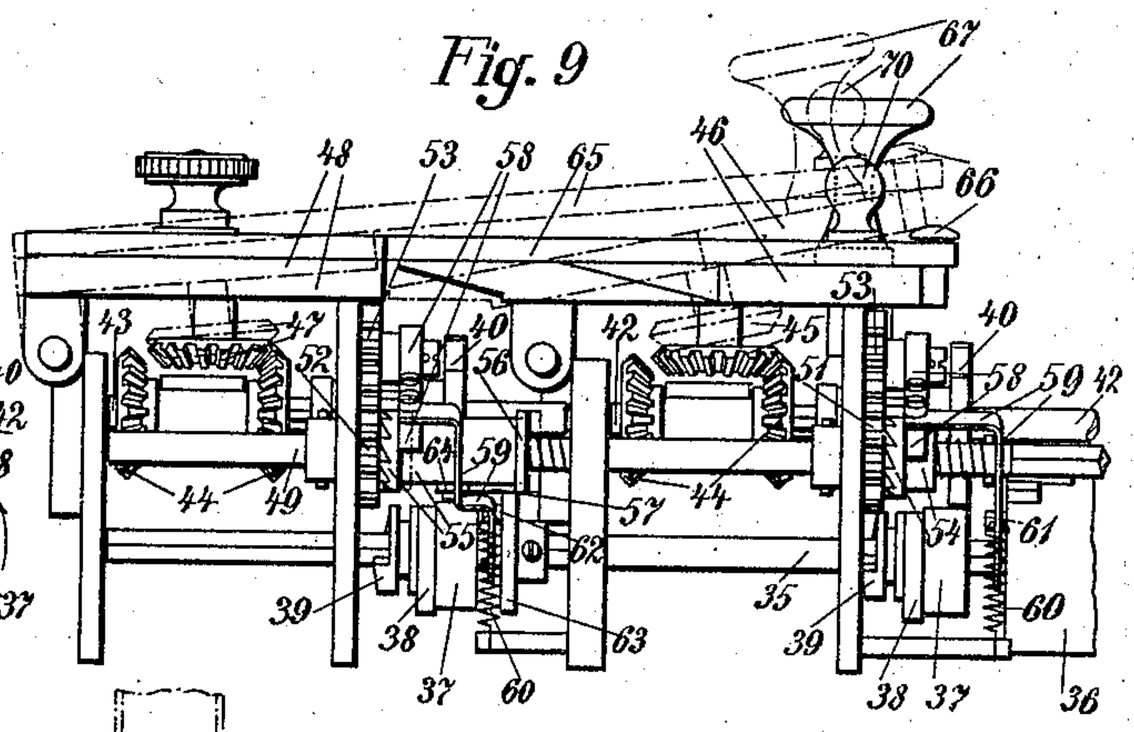
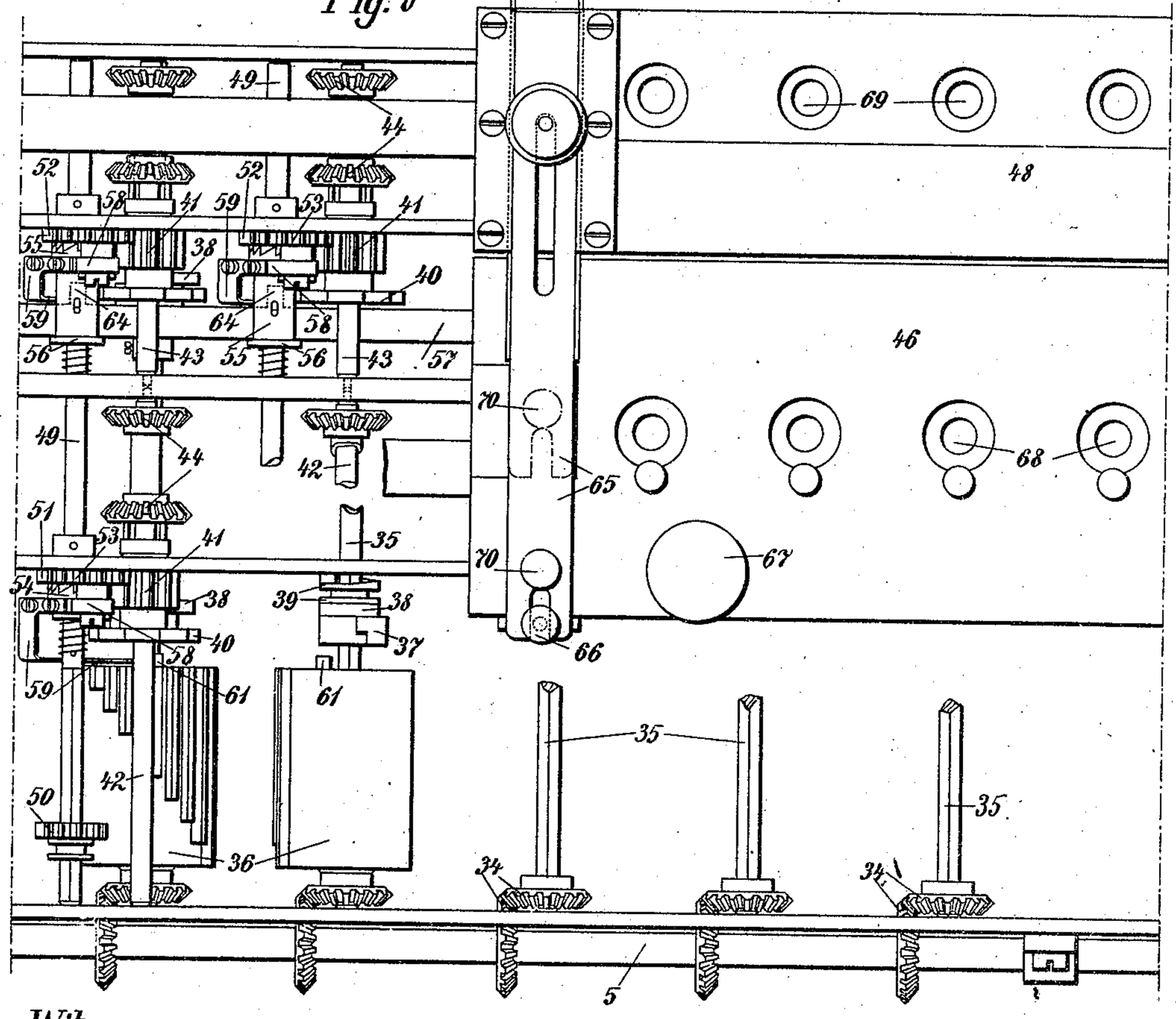


Fig. 8



Witnesses

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Annie Cooper

Inventor

Tobias Bäuerle

by Paul & Schilling

his Attorney

UNITED STATES PATENT OFFICE.

TOBIAS BÄUERLE, OF ST. GEORGEN, SCHWARZWALD, GERMANY, ASSIGNOR TO THE FIRM OF MATH. BÄUERLE, OF BADEN, GERMANY.

CALCULATING-MACHINE.

967,489. Specification of Letters Patent. Patented Aug. 16, 1910.

Application filed February 9, 1909. Serial No. 476,982.

To all whom it may concern:

Be it known that I, TOBIAS BÄUERLE, a subject of the German Emperor, residing at St. Georgen, Schwarzwald, Baden, German Empire, have invented certain new and useful Improvements in Calculating-Machines, of which the following is a specification.

The present invention relates to improvements in the setting, disengaging and locking devices for the actuating mechanisms and for operation of the indicating mechanisms of calculating machines of the type, patented in France to M. Thomas, #138912, September 29, 1880.

According to my invention the arrangement is such that before coupling of the machine with the shaft driven by the electric motor, or in the case of machines having a crank handle before turning the crank, a pointer is set to a division corresponding to the number of rotations of the actuating shaft necessary for performing the various steps. In this manner a cam disk is rotated and a locking lever for the coupling or locking mechanisms released, which, during the course of operation of the machine is moved by the cam disk mechanically out of the path of the lever connected with the coupling and locking mechanisms and thus permits the latter to disengage at the right moment the notched disk, rigidly mounted in well-known manner on the intermediate shaft.

In prior machines the reversing gear shafts for actuating the indicating mechanisms for the individual and total results extend right through and are driven directly by the stepped cylinders, so that on the machine crank being turned both mechanisms always come into operation and it is only possible to disengage the mechanism for indicating the total results by uncoupling and completely flapping over the back bar which carries this mechanism. In the present machine on the contrary the transmission gears are mounted on two shafts which are located axially one behind the other and are under the influence of other shafts which are rotated by the stepped cylinders; in this manner the mechanism for indicating the total result can be disengaged without the bar carrying this mechanism having to be flapped over and the mechanism thus exposed. Furthermore, to prevent wrong calculations such as not infrequently occur with prior machines, owing to self-motion of the centrifugal masses, through turning of the locking disks, special locking devices are provided on the pawls of the shafts which are rotated by the stepped cylinders, which devices admit of rotation of the ratchet mechanisms independently of that effected by the stepped cylinders, for the purpose of transference from a lower to a higher denomination.

My invention is illustrated in the accompanying drawings, in which—

Figure 1 is a front elevation of the actuating mechanism, Fig. 2 a plan, the actuating shaft being uncoupled, and Fig. 3, a plan with actuating shaft coupled. Fig. 4 is a side elevation and part section. Fig. 5 is an elevation, partly in section, showing the crank for hand actuation. Fig. 6 is a plan of Fig. 5. Fig. 7 is a vertical section through the machine seen from the front, the section being taken just behind the front frame plate, through the mechanism shafts and stepped cylinders, in two prominent positions. Fig. 8 is a plan of Fig. 7 with the bars pushed to the right hand side. Fig. 9 is a side elevation, the actuating device and a portion of the mechanism shafts and stepped cylinder being omitted.

The intermediate shafting for transmitting motion consists of two shafts 3, 4 provided with clutch halves 1, 2 respectively. The clutch half 1 is rigidly mounted on the shaft 3, while the clutch half 2 slides on the shaft 4, so that the two shafts can be coupled and uncoupled as desired. The shaft 3 is driven by the electric motor, which is thrown in simultaneously on a lever being actuated to cause mutual engagement of the two clutch parts 1, 2. The shaft 4 is connected with the actual operating shaft 5 of the machine (which can equally well be actuated by means of a crank handle) by a spur wheel 6. On the shaft 4 there is also mounted a worm 7, which engages with a worm wheel 8 whose boss is loosely mounted on a vertical pin and which carries above a cam disk 10 (Figs. 1 and 2). The latter is connected with a wheel 8 by a star wheel 9 being secured to the top of the boss of the wheel 8 and a detent 9^+ pivoted to the lower face of the cam

disk 10 and being held in engagement with the star wheel by means of a spring. The cam disk 10 in this manner normally partakes of the rotary motion of the worm wheel 8, but can nevertheless be adjusted (that is to say turned) relatively to the worm wheel 8 by the employment of sufficient force to overcome the power of the spring of the pawl 9*. On the upper face of the cam disk 10 and rigidly connected with it is a toothed wheel 11, with which there engages a mutilated gear wheel 12, which can be turned by means of a pointer 14 moving over a dial 13 (Figs. 2 and 3). The dial is marked with the numerals I—IX and the pointer 14 is set to the corresponding figure, depending upon the number of rotations to be given to the actuating shaft 5 for the particular calculation. The rotation of the pointer 14 results in a rotation of the cam disk 10 also, the extent or angle of rotation of the latter depending upon which of the nine figures the pointer is set to.

On rotation of the disk 10 its cam releases a spring actuated lever 16 pivoted at 15, whose nose 17 bears laterally against a fork of a bent lever 18 which serves to shift the sliding clutch half 2; on the lever 18 being turned to the left hand the nose 17 snaps behind it and locks it, preventing its movement in backward direction. The rotation of the worm shaft 4 for operating the main shaft 5, effected by the coupling operation, results in the rotation of the worm wheel 8 with cam disk 10. The cam of this disk thus moves in accordance with the motion of the disk into the initial position, and in doing so it strikes the elevated end of the locking lever 16 (Fig. 4) and so turns it that the nose 17 leaves the bent lever 18 and thus releases the latter.

The vertically directed, forked end of the lever 18 is slotted to receive the pins of a collar located in the groove of the clutch half 2, and serves for shifting this part. The other arm of this lever 18 is connected with a lever 20, pivoted at 19, whose longer arm projects upwardly out of the top plate of the machine and terminates in a finger-knob 21. The lever 20 presents a projection 22 of insulating material against which there bears a spring 23, which has the tendency to hold the lever 20, bent lever 18, and clutch half 2 in the full line position (Fig. 1). In this position the locking tooth 24 of a bridge piece secured to the forked arm of the lever 18 enters a notch provided in a locking disk 25 (Figs. 4 and 1), which is secured to the worm shaft 4. The shafts 4 and 5 are thus held in the position of rest. If the actuating shaft 5 for the purpose of making some particular calculation has to be turned for instance four times, the pointer 14 (which can be turned from above the cover plate of the machine) must be turned to the mark IV of the dial 13 (Fig. 3). This adjustment causes the cam disk 10 to be turned from its position shown in Fig. 2 into that shown in Fig. 3. The locking lever 16 initially held by the cam disk 10 will thus be released and its nose 17 will bear against the side of the bent lever 18. After the pointer 14 has been set the lever 20 is operated by depression of the knob 21. On the lever 20 being thus depressed the spring 23 will close a circuit containing the electric motor, so that the latter will be started and the shaft 3 thus commence to rotate. On the lever 20 and the bent lever 18 with the sliding clutch part 2 arriving in the dotted line position Fig. 1, the nose 17 and the locking lever 26 will snap behind the bent lever 18 (Fig. 3) and will obstruct return of the latter; and at the same time the locking tooth 24 will leave the notch in the locking disk 25 and thus release the worm shaft 4. The machine thus operates, the cam disk 10 and the pointer 14 returning to their position of rest (Fig. 2) according to the number of turns of the worm. The other parts arrive in this position in the moment in which the actuating shaft 5 has executed four rotations. At this moment however the locking lever 16 being turned by the cam of the disk 10 will release the bent lever 18, which under the indirect influence of the contact spring 23 will turn to the right, whereby the shaft 4 will be uncoupled, while the locking tooth 24 will enter the groove in the disk 25 and retain the shaft 4 in a definite position.

In the event of the calculating machine having a crank handle instead of being operated electrically, the arrangement would only differ from the above in so far that the clutch halves 1, 2 and the shaft 3 are dispensed with, so that the bent lever 18 only carries the tooth 24, which serves for locking the disk 25 of the shaft 4. The shaft 5 is in this case actuated in well known manner by means of a bevel gear 26 (Figs. 1, 2, 5, right hand) from the crank shaft 27. For rotating the crank shaft 27 the latter is provided with a square head to receive a sleeve 29 (Figs. 5, 6) having a ratchet wheel 28 and adapted to receive the crank 30, which has a spring controlled pawl 32 pivoted by means of a screw 31 and engaging with the ratchet wheel 28. The crank can thus be turned in a direction contrary to that of the arrow (Fig. 6) without the shaft 27 being affected, the latter only being rotated when the crank is turned in the direction of the said arrow. Backward rotation of the crank is necessary in order that the crank in the event of its standing at the completion of a calculation above the knobs 33 of the slides (Figs. 5, 6) may be turned back for instance into the dotted line position (Fig. 6) so as

to admit of unobstructed manipulation of the knobs again. The arrangement might also obviously be such that the ratchet wheel 28 and the pawl 32 be mounted on the transmission gearing 26. In this case the crank would be arranged as ordinarily and will admit of backward rotation in the already described manner.

The shafts 35 carrying the stepped cylinders 36 (that is to say rollers with teeth of increasing length) are driven from the shaft 5 by means of the bevel gear 34 and pass right through the machine, being provided with sliding teeth 38, secured to the cylindrical segments 37, for transferring to a higher denomination; they also carry collars 39 having projections. The cylindrical segments 37 serve to set the locking disks 40, which with the wheels 41 for the transference to a higher denomination are secured to reversing gear shafts 42, 43 mounted axially one behind the other. These shafts 42, 43, also carry the necessary sliding reversing gears 44 for driving the indicating mechanism. The reversing gears of the shafts 42 (Fig. 9) can in well known manner be brought into engagement alternately with the bevel gears 45 of an indicating mechanism which is mounted on a pivotal and sliding bar 46 and serves for indicating the various individual results. The reversing gears 44 of the shafts 43 act in the same manner on the bevel gears 47 of mechanism for indicating the total results, which mechanism is mounted on a pivotal and sliding bar 48. The reversing gear shafts 42, 43 are driven by means of the rotary motion of the shafts 49 which at the front end carry the toothed wheels 50 (Fig. 8), which are capable of sliding and engage with the teeth of the stepped cylinders 36. For this purpose spur wheels 51, 52 are mounted on the shaft 49 in the plane of motion of the wheels 41. These spur wheels 51, 52 engage with wheels 41 by means of intermediate wheels 53. They are also provided with crown teeth with which there engage the crown toothed sleeves 54, 55 which are capable of sliding and are controlled by springs. The crown toothed sleeves 55 are provided at one end with a shoulder 56 (Figs. 8, 9) and can also be moved forward with positive motion by a rod 57, that is to say, brought out of engagement with the crown teeth of the wheels 52. The wheels 51, 52 are loosely mounted, so that when the sleeves 55 are disengaged from the crown teeth of the wheels 52 and the shafts 49 rotated, the reversing gear shafts 43 remain at rest. In this case by operating the calculating machine it is only the shafts 42 and with the aid of their reversing wheels 44 the mechanism on the bar 46 that will be operated for the purpose of indicating the individual results.

In order to prevent sliding of the crown wheel sleeves 54, 55, and thus avoid possible rotation of the wheels 41, 53, 51, 52 and the shafts 42, 43 through centrifugal force of the parts of the mechanism at the moment in which the segments 37 for a short time are out of engagement with the disks 40 (Fig. 7 left hand) there are mounted on the axes of the intermediate wheels 53 pawls 58 which engage behind the sleeves 54, 55. The pawls have arms 59 which are controlled by springs 60 and project into the path of the pins 61, 62 of which those marked 62 project from disks 63 (Fig. 9) secured to the shaft 35, while those marked 61 project from the rear end of the stepped cylinders 36 (Figs. 7, 8, 9). At each rotation of the stepped cylinders 36 with their shafts 35 the arms 59 of the pawls 58 are pressed back by the pins 61, 62, and the pawls temporarily release the sleeves 54, 55 otherwise prevented from shifting by them. This release occurs at the moment in which transference to a higher denomination takes place (Fig. 7 right hand) and is requisite in order that this transference may take place independently in each of the two mechanisms. This however is only possible if at the period in which the wheels 41 are advanced through the distance of one tooth by the teeth 38 (Fig. 7 right hand)—which rotation is also made by the intermediate wheels 53 and the wheels 51, 52—if the sleeves 54, 55 do not engage with the crown toothed wheels 51, 52 that is to say can slide forwardly. This is necessary in order that the shafts 49 which are coupled by the sleeves 54, 55 of the two mechanisms, on completion of the transference to the higher denomination may remain at rest in the one mechanism. To disengage the indicating mechanism for the total result, that is to say bring the sleeves 55 out of the province of the crown teeth of the wheels 52, the pawls which prevent these sleeves from sliding must be swung back. For this purpose lugs 64 (Figs. 8 9) are furnished on the bar 57 which serve for disengagement of the sleeves 55 by bearing against their shoulders 56. These lugs 64 on sliding of the bars toward the left in Fig. 8 strike the arms 59 of the pawls 58 and by raising them from the necks of the sleeves cause release of the latter. In this manner the bar 57 can be moved forward longitudinally and carries the sleeves 55 with it.

The connection between the bars 46, 48 is constituted by a slide 65 forked at one end and sliding with friction on the bar 48. The full line position of the slide 65 is that when the bars are coupled. The fork part of the slide engages the neck of a stud 66 (Figs. 8, 9) secured to the front bar 46. The bars are operated by means of the knob 67 which projects from the bar 46. For this

purpose the bar 46 is first moved by means of the knob 67 into the dotted line position (Fig. 9), whereby this bar is disconnected from the frame plate and the bar 48 is turned simultaneously so that the bevel wheels 45, 47 of the two indicating mechanisms are disengaged from the reversing gears 44, whereupon the bar can be slid along to the rows of figures in question. The figures of the individual results appear in the apertures 68 of the front bar 46, and the rows of figures of the sum appear in the apertures 69 of the rear bar 48 (Fig. 8).

To uncouple the bars the slide 65 is moved back by means of the knob 70 from the full line into the dotted line position (Fig. 8). This shifting must be effected when only the front indicating mechanism for the individual results is in use, while the totalizing mechanism remains at rest. The front bar, for the purpose of overcoming the connection and uncoupling of the gears 45, 44 can then be turned, slid along and flapped down for effecting the required operation, without the rear bar being carried with it.

The operation of the apparatus is as follows:—Suppose the individual results and the total sum are to be indicated, that is to say both indicating mechanisms are to be used, which is done by actuation of the shaft 5. The stepped cylinders 36, owing to their engagement with the gears 50 (Fig. 8) in question and previously adjusted, will turn the shafts 49 through a certain angle. The sliding crown toothed sleeves 54, 55 which engage the crown teeth of the wheels 51, 52 cause these wheels to be rotated, and they transmit their rotary motion to the reversing gear shafts 42, 43 by means of the intermediate wheels 53 and the wheels 41 for transference to a higher denomination. From these shafts the indicating mechanism is actuated by rotation of the bevel gears 45, 47 which mesh with the reversing gears 44. The transference to a higher denomination, which is done in well known manner with the aid of the teeth 38, can be effected in the two mechanisms independently of each other, since the crown toothed sleeves 54, 55 on rotation of the wheels 41 and thus also of the wheels 51, 52 can remain out of engagement with the latter, that is to say with the crown teeth of these wheels. The bars 46, 48 are coupled together if both indicating mechanisms are to be used, and the coupling slide 65 will occupy the full line position (Figs. 8, 9), so that on actuation of the bar 46 by means of the knob 67 the bar 48 will be moved also and accordingly both individual results and the total result will be indicated. If on the contrary the totalizing mechanism of the bar 48 is to remain at rest, so that only the individual results are to be indicated, the bar 57 by rotation of a lever in connection with it but not shown in the drawing, is first moved toward the left for the purpose of lifting the pawl 58 out of the sleeve 55 (Fig. 8) and then moved forwardly parallel with itself (Fig. 9) to cause disengagement, and the slide 65 of the bars 46, 48 is pushed back into the dotted line position (Fig. 8) to uncouple the latter. The gear wheels 52, 53, 41, 44, 47 and the actuating shafts 43 of the totalizing mechanism thus remain at rest during operation of the machine. The operation of the indicating mechanism for the individual results is effected in the manner already described, the bar 46 being capable of being shifted as required independently of the bar 48 which remains at rest.

Having thus described my invention, I declare that what I claim is—

1. In a calculating machine of the character described, comprising separate indicating mechanisms for the individual results and their totals, the combination of a shaft comprising two parts in line with each other, a clutch member on each part of the shaft, one of which members is slidable and the other stationary, a pivoted lever engaging the movable member, a locking lever for said pivoted lever, means for actuating the pivoted lever to bring the clutch members together, a shaft, a pointer lever carried thereby, a second shaft geared with the pointer lever, and a cam disk carried by the second shaft for actuating the locking lever.

2. In a calculating machine of the character described, comprising separate indicating mechanisms for the individual results and their totals, the combination of a shaft comprising two parts in line with each other, a clutch member on each part of the shaft, one of which members is slidable and the other stationary, a pivoted lever engaging the movable member, a locking lever for said pivoted lever, means for actuating the pivoted lever to bring the clutch members together, a graduated dial, a shaft, a pointer lever carried by said shaft, and movable over said dial, and means whereby the movement of the pointer shaft the number of steps indicated on the dial will disengage the locking lever and permit of a number of revolutions of the clutch shafts corresponding with the number indicated on the dial.

3. In a calculating machine of the character described, comprising separate indicating mechanisms for the individual results and their totals, the combination of a shaft comprising two parts in line with each other, a clutch member on each part of the shaft, one of which members is slidable and the other stationary, a pivoted lever engaging the movable member, a locking lever

for said pivoted lever, means for actuating the pivoted lever to bring the clutch members together, a graduated dial, a shaft, a pointer lever carried by said shaft and movable over said dial, and means whereby the movement of the pointer shaft the number of steps indicated on the dial will disengage the locking lever and permit of a number of revolutions of the clutch shafts corresponding with the number indicated on the dial and disengage the locking lever at the end of said movement and permit the clutch members to separate.

4. In a calculating machine of the character described, comprising separate indicating mechanisms for the individual results and their totals, the combination of a shaft comprising two parts in line with each other, a clutch member on each part of the shaft, one of which members is slidable and the other stationary, a pivoted lever engaging the movable member, a locking lever for said pivoted lever, means for actuating the pivoted lever to bring the clutch members together, a shaft driven from the clutch shaft, a cam disk on said driven shaft adapted to release the locking lever, a pointer lever and means actuated by the pointer for setting the cam disk in position to release the locking lever after the extent of movement indicated by the pointer.

5. In a calculating machine of the character described, comprising separate indicating mechanisms for the individual results and their totals, the combination of a shaft comprising two parts in line with each other, a clutch member on each part of the shaft, one of which members is slidable and the other stationary, a pivoted lever engaging the movable member, a hand lever for actuating the pivoted lever, a contact screw, a contact spring, and a screw on the hand lever bearing on the contact spring to actuate said spring against the contact screw simultaneously with the engagement of the clutch members.

6. In a calculating machine of the character described, comprising separate indicating mechanisms for the individual results and their totals, the combination of a shaft comprising two parts in line with each other, a clutch member on each part of the shaft, one of which members is slidable and the other stationary, a pivoted lever engaging the movable member, a locking lever for said pivoted lever, means for actuating the pivoted lever to bring the clutch members togetner, a worm on one of the clutch shaft parts, a second shaft, a worm wheel on the second shaft engaging the worm, a locking lever for the pivoted lever, a cam disk on the second shaft for actuating the locking lever, and means for governing the extent of movement of the second shaft.

7. In a calculating machine of the character described, comprising separate indicating mechanisms for the individual results and their totals, the combination of separate shafts, reversing gears for the indicating mechanisms carried on said separate shafts, carrying wheels on said shafts, means for actuating said shafts, and means for actuating the reversing mechanisms independently or together.

8. In a calculating machine of the character described, comprising separate indicating mechanisms for the individual results and their totals, the combination of separate shafts, reversing gears for the indicating mechanisms carried on said separate shafts, carrying wheels on said shafts, means for actuating said shafts, and means for actuating the reversing mechanisms independently or together, comprising two pivoted bars of which one is connected with each of the reversing mechanisms, and means for connecting the bars for conjoint operation.

9. In a calculating machine of the character described, comprising separate indicating mechanisms for the individual results and their totals, the combination of separate shafts, reversing gears for the indicating mechanisms carried on said separate shafts, carrying wheels on said shafts, means for actuating said shafts, and means for actuating the reversing mechanisms independently or together, comprising two pivoted bars, one connected with each of the reversing mechanisms, one of said bars being provided with a stud, and a slidable notched bar on the other pivoted bar to engage said stud for connecting the two pivoted bars for conjoint operation.

10. In a calculating machine of the character described, the combination with a shaft, a step-toothed cylinder carried thereby, a parallel shaft, carrying mechanism mounted on said second shafts, an intermediate parallel shaft geared to the first and second named shafts, a pivoted pawl engaging the carrying mechanism, and a pin on the end of the step-toothed cylinder for actuating said pawl.

11. In a calculating machine of the character described, a shaft, a step-toothed cylinder thereon, a crown toothed sleeve on said shaft, reversing gears, a driving wheel therefor having crown teeth adapted to engage the crown teeth of the sleeve, and means for sliding the sleeve for engagement with and disengagement from the driving wheels.

12. In a calculating machine of the character described, a shaft, a step-toothed cylinder thereon, a crown toothed sleeve on said shaft, reversing gears, a driving wheel therefor having crown teeth adapted to engage the crown teeth of the sleeve, means for

sliding the sleeve for engagement with and disengagement from the driving wheels, comprising a spring for yieldingly holding the sleeve in engagement, a bar engaging the sleeve, and means for positively actuating the bar to disengage the sleeve from the driving wheel.

In testimony whereof I affix my signature in presence of two witnesses, at New York, N. Y.

TOBIAS BÄUERLE.

Witnesses:
WILLIAM R. BAIRD,
ALAN C. MCDONNELL