No. 772,935. PATENTED OCT. 25, 1904.

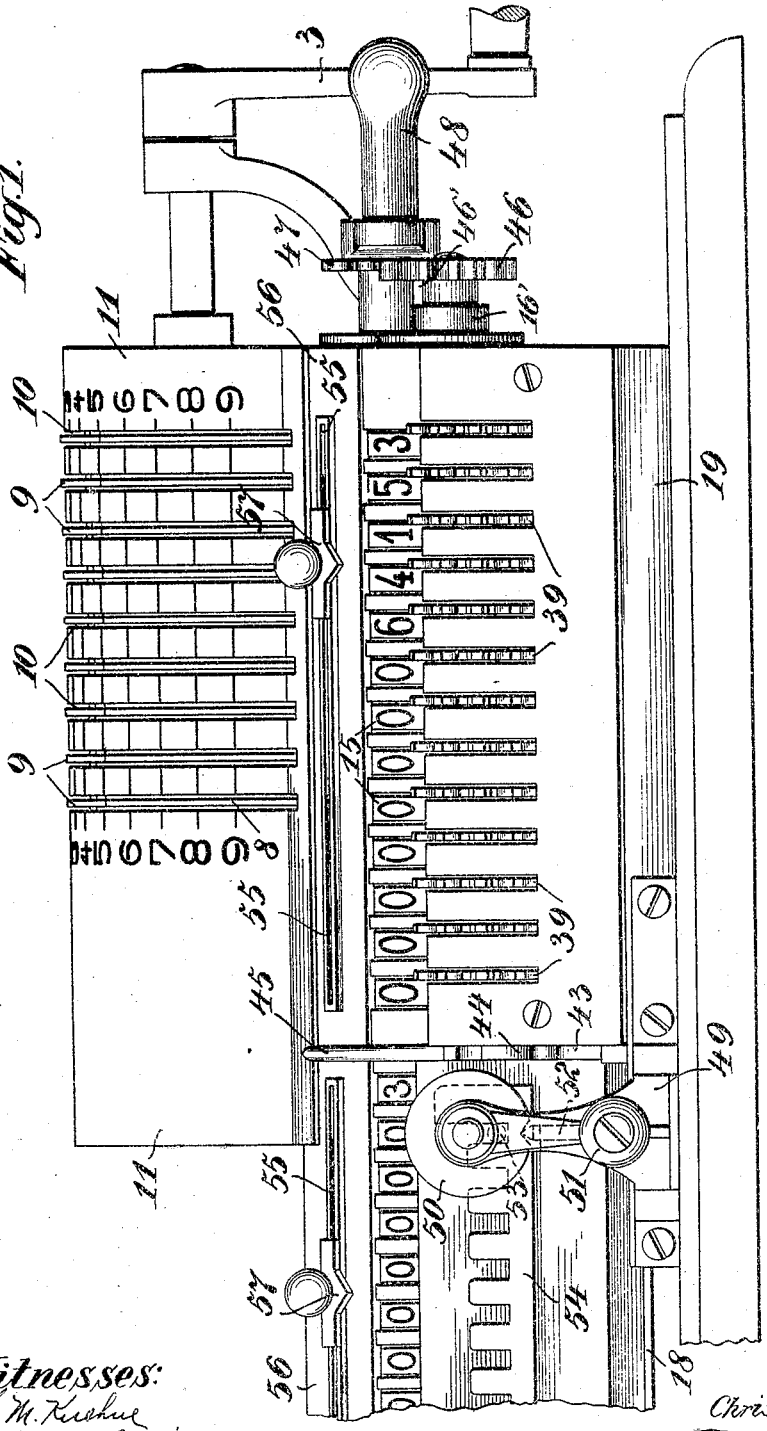
C. HAMANN.

CALCULATING MACHINE.

APPLICATION FILED OCT. 13, 1903.

NO MODEL. 4 SHEETS—SHEET 1.

Fig. 1.



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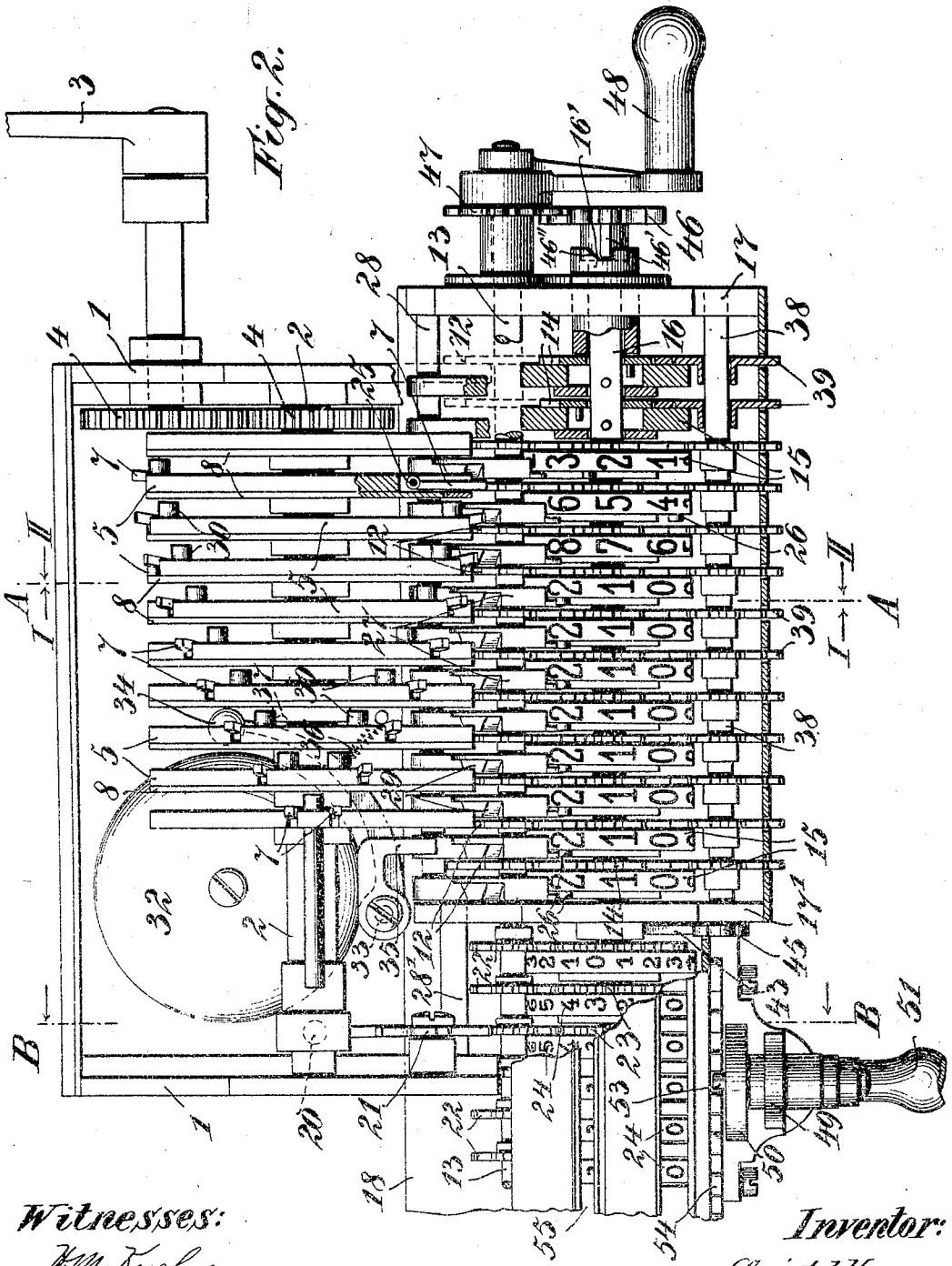
NO MODEL. 4 SHEETS—SHEET 2.

Fig. 2.



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NO MODEL. 4 SHEETS—SHEET 3.

Fig. 3.

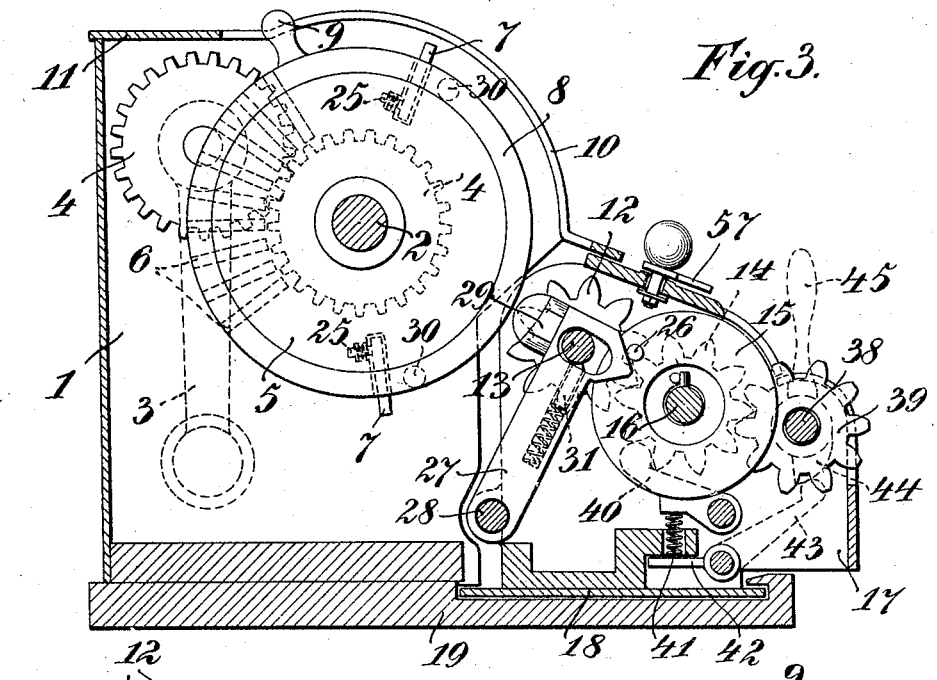

Fig. 9.

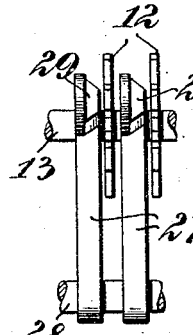

Fig. 4.

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NO MODEL. 4 SHEETS—SHEET 4.

Fig. 5.

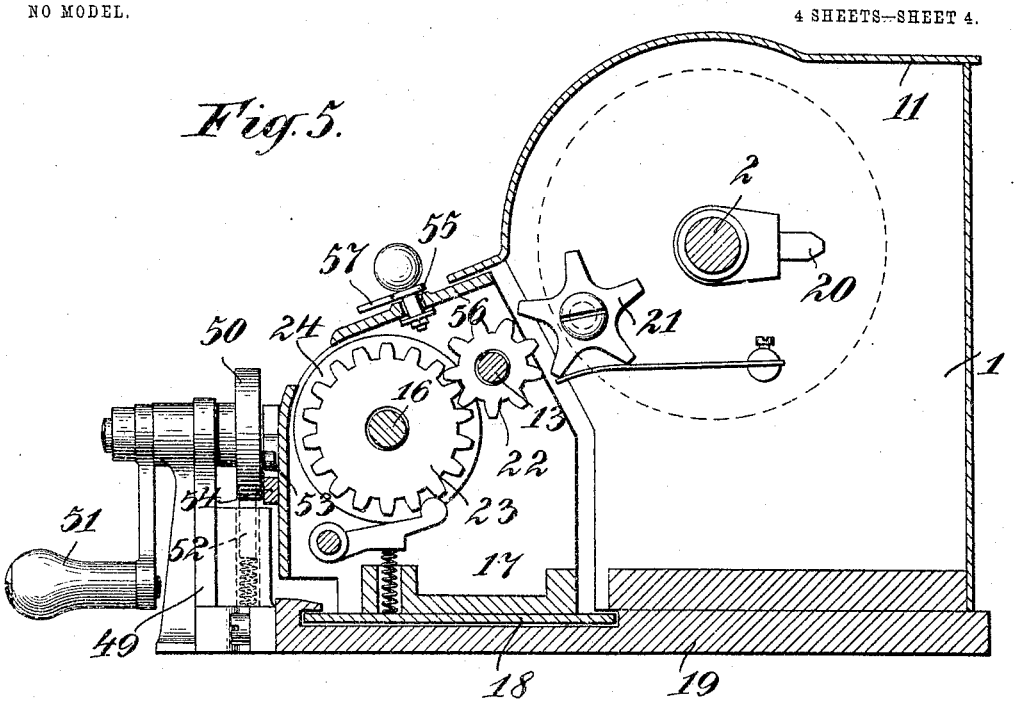
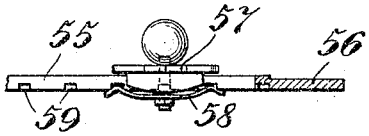


Fig. 7.



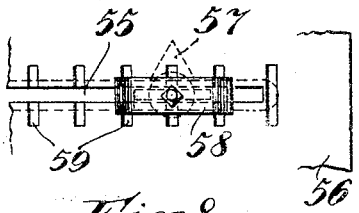
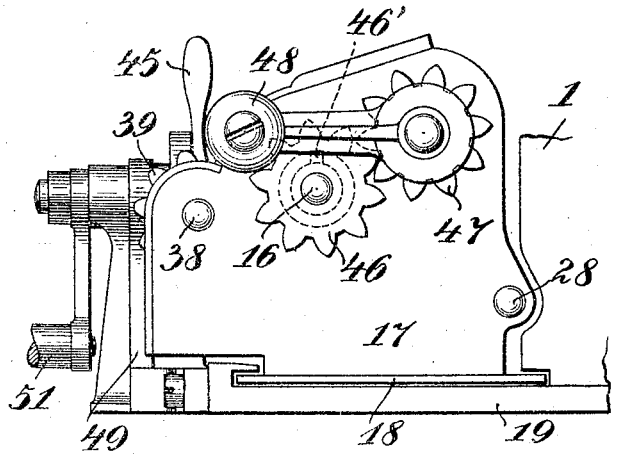


Fig. 8.

Fig. 6.



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UNITED STATES PATENT OFFICE.

CHRISTEL HAMANN, OF FRIEDENAU-BERLIN, GERMANY.

CALCULATING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 772,935, dated October 25, 1904.

Application filed October 13, 1903. Serial No. 176,918. (No model.)

To all whom it may concern:

Be it known that I, CHRISTEL HAMANN, engineer, a citizen of the Kingdom of Prussia, and a resident of Friedenau-Berlin, Germany, (whose post-office address is Hedwigstrasse 17,) have invented certain new and useful Improvements in Calculating-Machines, of which the following is a specification.

My invention relates to improvements in counting-machines having adjusting-disks with shiftable gear-teeth, and has for its object to overcome various errors and defects in known counting-machines of the construction explained in the following description and illustrated in the accompanying drawings. In the first place a counting-machine must work entirely accurately within the number of places provided independently of the order in which the operator takes the stages of the operation, or if it cannot fulfil this requirement it must immediately indicate any mistake caused by its construction, and thereby prevent the operator from using the wrong results.

In the annexed drawings, Figure 1 is a front view of the machine to which my invention is applied. Fig. 2 is a plan view of the same, the cover removed and some parts in horizontal section. The carriage carrying the two counting devices has been moved to the right by two places. Fig. 3 is a cross-section on line A A of Fig. 2 seen in the direction of the arrow I. Fig. 4 is the same section seen in the direction of the arrow II, with parts in a different position of Fig. 3. Fig. 5 is a cross-section on line B B of Fig. 2. Fig. 6 is a partial side elevation of the machine seen from the right. Figs. 7 and 8 are detail views showing the indicator for the decimals which slides in a slot of the cover in front view and seen from below, respectively. Fig. 9 is a detail view showing two of the tens-transfer levers in rear elevation.

For the better understanding of my invention I will first give a short description of the construction of the machine to which my invention is applied.

In the two side walls 1 of the machine the main shaft 2 is supported, which is operated by the crank 3 by aid of the two gears 4 at the right-hand end of the machine. To the shaft 2 a series of adjusting-disks 5 is keyed, each of which is provided with nine adjustable gear-teeth 6 and two tens-transfer teeth 7, Figs. 3 and 4. The adjustment of the gear-teeth 6 is effected in the well-known manner (see Letters Patent No. 650,066) by turning the ring 8, one of which is attached to each adjusting-disk 5 by means of the handles 9 projecting through the slots 10 in the cover 11 of the machine, Figs. 1 to 4. On the shaft 2 being rotated those teeth 6 which are in their raised position, Fig. 4, will come into engagement with the intermediate gears 12, turning loosely upon the shaft 13, said intermediate gears 12 meshing with the gears 14, which are connected to the figure-wheels 15, turning loosely upon the shaft 16. Thus the figure-wheels 15 are turned for a number of figure-intervals corresponding to the number of teeth 6 shipped on the respective adjusting-disks 5. In making a multiplication, for example, the multiplicand-digit is introduced by the number of teeth 6 shipped on the different adjusting-disks 5, while the multiplier-digit is introduced by the number of revolutions of the adjusting-disks 5.

The two shafts 13 and 16 carrying the intermediate gears 12 and the figure-wheels 15, respectively, are supported in the side walls 17 and 17′ of a laterally-shiftable carriage, the base-plate 18 of which moves in guide-grooves arranged in the base-plate 19 of the machine. In order to multiply the multiplicand introduced by the units, tens, hundreds, &c., digits of the multiplier, when the latter consists of several figures, it is necessary to shift said carriage laterally to such an extent that the first adjusting-disk from the right operates either the first or the second or the third, &c., figure-wheel 15 from the right.

For registering and indicating the number of revolutions of the main shaft 2—that is to say, for indicating the multiplier-digits in a multiplication—the following arrangement well-known in this kind of machines is provided: Next to the left-hand side wall 1 of the machine a pawl 20 is fastened to the main shaft 2, Figs. 2 and 5, said pawl 20 engaging at each revolution of the main shaft a star-wheel

21 and turning said star-wheel 21 by one tooth. Hereby the star-wheel 21 comes into engagement with one of the gear-wheels 22, mounted loosely upon the left-hand end of the fixed shaft 13, said gear-wheels 22 meshing with the gear-wheels 23, which are connected to the figure-wheels 24, said figure-wheels 24 being loosely mounted upon the left-hand end of the shaft 16. Thus each revolution of the main shaft 2 is transmitted to the respective figure-wheel 24 and indicated by the latter.

The carrying over of the tens in counting-machines is effected in such a manner that when there are only nines in the result-apertures naughts are caused to appear in said apertures by the addition of one, or by subtracting one nines are caused to appear in the place where there were previously naughts.

When "9" of either of the figure-wheels 15 appears at the respective aperture and another number is added, a ten must of course be carried to the figure-wheel on the left. This is effected by means of the tens-transfer teeth 7, of which two are provided, as already mentioned in each adjusting-disk 5, Figs 2 to 4. One of the two tens-teeth 7 is operated by the rotation of the main shaft 2 to the right and the other by the rotation of the said shaft to the left—that is to say, for addition or multiplication and substraction or division, respectively. The said teeth are pivoted at 25 and are held in their disengaged position by springs, so that they are not normally in engagement with the intermediate gears 12. When one of the figure-wheels 15 is indicating "9," a pin 26 at its side extends under the projecting end of a single-armed lever 27, one of which is at the side of each figure-wheel 15. (In the zero position (shown in Fig. 3,) the pin 26 lies above the projecting end of the lever 27.) The single-armed levers 27 are rotatably fastened to a shaft 28, which is supported in the side walls 17 and 17′ of the laterally-shiftable carriage. On their upper end the levers 27 are provided with a projection 29, directed toward the adjusting-disks 5 and having two cam-surfaces, Figs. 2, 3, and 9. On the figure-wheel 15 indicating "9" being rotated the pin 26 presses back the lever 27 on the left, and the projection 29 thereon is thus moved into the path of the tens-transfer teeth 7 of the respective adjusting-disk 5. According to the direction of rotation, one or other of the cam-surfaces momentarily moves one of the tens-transfer teeth 7 into engagement, which thus gears with the respective intermediate gear 12 (see Fig. 2, the second adjusting-disk from the right) and rotates said intermediate gear by one tooth. The figure-wheel 15 in engagement with said gear 12 is of course also rotated by one number, and if a "0" was previously at the aperture a "1" will now appear. When the tens-transfer tooth has cleared the projection 29, the lever 27 is forced back into its normal position by that one of the two pins 30 being arranged at the side of each adjusting-disk which according to the direction of rotation follows after the respective tens-transfer tooth. The projection 29 of the levers 27 is held in path of the tens-transfer teeth 7 until forced back by the action of the pin 30 by means of a spring-catch 31, which is arranged in the bar of the lever 27, Fig. 3, and which is pressed against the shaft 13.

Since the tens-transfer teeth 7 must be arranged at certain intervals behind each other on the various adjusting-disks 5, Fig. 2, so that they will come successively and not simultaneously into engagement, and since the said intervals are also restricted, owing to the fact that the other nine gear-teeth 6, Figs. 3 and 4, have to be arranged on the circumference of the adjusting-disks, the number of the latter is of course limited. Since, furthermore, in making a calculation with factors with many digits the product has more digits than the several factor, more figure-wheels than adjusting-disks must be arranged in the machine. A disadvantage resulting hereby is the insufficient provision of carrying over of the tens, which is exhausted at the last adjusting-disk on the left, and the machines also have no means for indicating and for correcting errors arising from the insufficient carrying over of the tens. The arrangements hereinafter described remove these disadvantages and increase the accuracy of the counting.

The indicating device to be provided essentially consists of a bell 32, Figs. 2 and 4, arranged on the base-plate 19 of the machine, and a two-armed lever pivoted on a pin or pillar 33, and one arm, 34, of which is formed as a hammer, while the other arm, 35, is bent at a right angle. Whatever position the carriage carrying the two counting devices is in one of the levers 27 or the lateral projection 28′ of the last one on the left, Fig. 2, is always in front of the arm 35, which lies at the last adjusting-disk 5. When the figure-wheel belonging to this lever 27 is rotated beyond the "9," its pin 26 presses back the lever 27, which abuts against the arm 35, and thus causes the bell 32 to be sounded as a sign that no ten has been transmitted to the next figure-wheel on the left. After striking against the arm 35 the hammer 34 is drawn back by the spring 36 and is held in its original position by the stop-pin 37.

The device for correcting the errors resulting from the insufficient carrying over of the tens is as follows: In the side walls 17 and 17′ of the laterally-shiftable carriage a shaft 38 is supported, Figs. 2 to 4. On said shaft 38 the gear-wheels 39, which are in engagement with the gear-wheels 14 of the figure-wheels 15, are loosely mounted, the teeth of the gear-wheels 39 partly projecting through slots in the casing, so that they can be adjusted with the figure-wheels 15 by hand. The figure-

wheels 16 are frictionally held by the pawls 40, Figs. 3 and 4, which are subjected to the action of the springs 41. The springs 41 of all pawls 40 rest with their under ends upon a hinged bar 42. An arm 43, fastened to said bar 42, is pressed against a cam 44, being rotatably fastened to the fixed shaft 38, Fig. 3, by the action of the springs 41. By turning backward said cam 44 by means of the handle 45 the arm 43 is released and the springs 41 will expand, Fig. 4. Thus the action of the latter upon the pawls 40 is weakened, and now the figure-wheels 15 may be easily adjusted by hand by aid of the gear-wheels 39. As soon as the handle 45 is turned upward again the springs 41 are compressed and their action upon the pawls 40 is increased.

As the figure-wheels 24 of the revolution-counter are rotated in one or the other direction by nine figure-intervals only, no tens mechanism is required for this counting device.

For resetting the figure-wheels to zero the shaft 16 in the machines hitherto used is turned by means of a thumb-screw or a knob, (see Letters Patent No. 650,066,) for which purpose it is necessary to place the hand on three times in order to complete a revolution. I therefore employ instead of the thumb-screw or the like a toothed-wheel 46, which is fastened to the shaft 16, Figs. 1, 2, and 6, and rotated by the toothed wheel 47 by means of the crank-handle 48, the hub of said toothed wheel 47 turning loosely on the shaft 13. On the toothed wheel 46 being rotated a nose 46′, fastened to the shaft 16, glides over the cam-surface 46″, being arranged on the hub 16′, which is fastened to the side wall 17 of the counter-carriage, Fig. 2, and thus the shaft 16 is shifted laterally, so that the well-known take-about parts are brought into engagement. On the crank 48 being turned once the zero position is produced, which is easily effected when the action of the springs 41 is weakened as described.

The laterally-shiftable carriage, carrying the two counting devices, was hitherto moved by hand through the desired intervals of space. In order to accurately adjust the carriage so that the teeth of the adjusting-disks 5 will come into exact engagement with the respective gear-wheels, I have provided the following arrangement: A support 49, Figs. 1, 2, 4, to 6, in which a disk 50, operated by a crank 51, is arranged, is rigidly connected to the base-plate 19 of the machine. The said disk 50 is provided on its circumference with a recess into which a spring-catch 52 engages at each revolution. Each revolution is indicated by this spring-catch and also the position of the crank 51 and disk 50 determined. The disk 50 carries a pin 53, which engages the slots of the toothed bar 54, connected to the laterally-shiftable carriage, Figs. 1, 2, and 5. As the distance between the slot-intervals of the bar 54 is equal to the distance between the intermediate gears 12, it follows that by turning the crank 51 once the carriage is moved by one place. Since the spring-catch 52 in the position of rest engages the recess in the disk 50 and the pin 53, the toothed bar 54 of the carriage is fixed. If the crank 51 is turned by one hundred and eighty degrees from its position shown in Fig. 1, the pin 53 is disengaged and the carriage can be moved by hand as desired.

In making a calculation with decimals the place of the decimal-point was hitherto marked by means of a so-called "comma-pin" which was put into holes being arranged in the cover-plate between the reading-apertures. In the present case I replace the said holes by a slot 55, being arranged above the reading-apertures in the cover-plate 56 of the carriage, Figs. 1 to 5, 7, and 8. In said slot 55 a shiftable pointer 57 is arranged which carries on its lower side a flat spring 58, engaging into notches 59, which are arranged on the under side of the cover-plate 56. Figs. 7 and 8, whereby the pointer 57 is fixed in the desired position and at the same time prevented from falling out.

Most machines are provided with indicating-figures at the side of each separate slot, through which the adjusting parts project and which are arranged in the cover of the machine, so that in machines in which the slots are arranged close together a clear view cannot be obtained, owing to the many figures. The present improvement consists in providing indicating-figures on both sides of the whole series of slots only and connecting same with each other by parallel lines, as shown in Fig. 1.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

1. A counting-machine, comprising a base-plate, a plurality of figure-wheels, adjusting-disks, said disks being less in number than the figure-wheels and an indicating device consisting of a bell 32 arranged on the base-plate of the machine, and of a double-armed lever pivoted at 33 and having one arm formed as a hammer 34 and the other arm 35 bent at a right angle, said arm 35 lying at the last adjusting-disk on the left, substantially as described and for the purpose set forth.

2. In a counting-machine the combination with the adjusting-disks 5, the figure-wheels 15 having gears 14 connected thereto and operated by said adjusting-disks 5, the tens-transfer levers 27 operated by said figure-wheels 15, of an indicating device consisting of a bell 32 arranged on the base-plate of the machine and of the double-armed lever pivoted at the base-plate of the machine and having one arm formed as a hammer 34 and the other arm 35 bent at a right angle, said indicating device

being adapted to be operated by the tens-transfer lever 27 of that figure-wheel, which is operated by the last adjusting-disk on the left, of a shaft 38, a series of gear-wheels 39 loosely mounted upon said shaft 38 and meshing with the gear-wheels 14 of the figure-wheels 15, the teeth of the gear-wheels 39 partly projecting through the casing of the machine, substantially as described and for the purpose set forth.

3. In a counting-machine the combination with the shaft 16, the figure-wheels 15 loosely mounted upon the shaft 16, the gear-wheels 14 connected to said figure-wheels 15, of a shaft 38, a series of gear-wheels 39 loosely mounted upon said shaft 38 and meshing with the gear-wheels 14, the teeth of the gear-wheels 39 partly projecting through the casing of the machine, of the spring-pawls 40 engaging the teeth of the gear-wheels 14, a hinged bar 42 upon which the springs of said pawls rest, an arm 43 fastened to said bar 42 and a cam 44 adapted to act upon said arm 43, substantially as described and for the purpose set forth.

4. In a counting-machine the combination with the shaft 16, the figure-wheels 15 loosely mounted upon said shaft, the gear-wheels 14 connected to said figure-wheels 15, of a guide-socket 16′ for said shaft 16 and arranged in the side wall of the machine, a cam-notch 46″ in said socket 16′, a nose 46′ fastened to the shaft 16 and engaging said cam-notch 46″, a toothed wheel 47, a toothed wheel 46 fastened to said shaft 16 and engaging said toothed wheel 47 and a crank-handle 48 connected to said toothed wheel 47, substantially as described and for the purpose set forth.

5. In a counting-machine the combination with the shaft 16, the figure-wheels 15 loosely mounted upon said shaft, the gear-wheels 14 connected to the figure-wheels 15, of the spring-pawls 40 engaging the teeth of the gear-wheels 14, a hinged bar 42 on which the springs of said pawls rest, an arm 43 fastened to the bar 42 and a cam 44 adapted to act upon said arm 43, of a guide-socket 16′ for the shaft 16, said socket 16′ arranged in the side wall of the machine and having a cam-notch 46″, a nose 46′ fastened to the shaft 16 and engaging said cam-notch 46″, a toothed wheel 47, a toothed wheel 46 fastened to said shaft 16 and engaging said toothed wheel 47 and a crank-handle 48 connected to said toothed wheel 47, substantially as described and for the purpose set forth.

6. A counting-machine comprising a counter-carriage and a device for shifting laterally said carriage, said device consisting of a support 49 fastened to the base-plate of the machine, of a disk 50 having its axle journaled in said support, a spring-catch 52 being arranged in the support 49 and engaging a recess in the circumference of the disk 50, a toothed bar 54 connected to the casing of the counter-carriage and a pin 53 fastened to the disk 50 and engaging the slots of said toothed bar, substantially as described and for the purpose set forth.

In testimony whereof I affix my signature in presence of two witnesses.

CHRISTEL HAMANN.

Witnesses:

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WOLDEMAR HAUPT.