E. LEDER.

CALCULATING MACHINE.

APPLICATION FILED DEC. 23, 1910.

989,507.

Patented Apr. 11, 1911.

3 SHEETS—SHEET 1.

Fig. 1

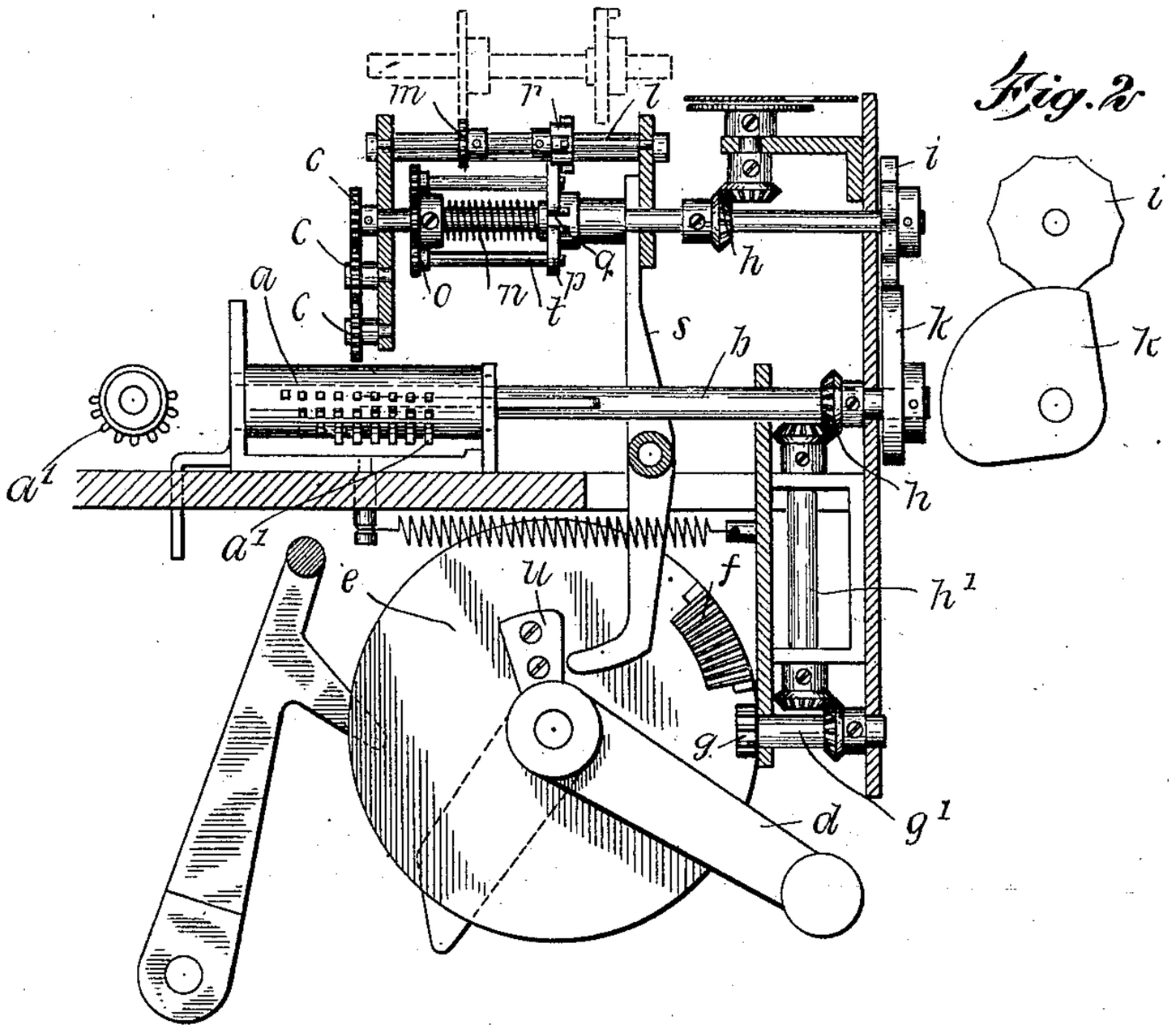

Fig. 2

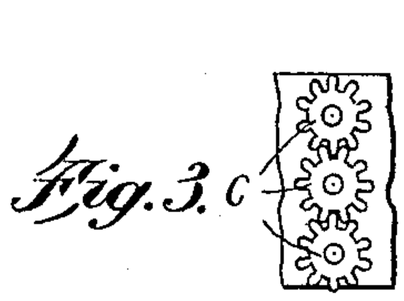

Fig. 3.

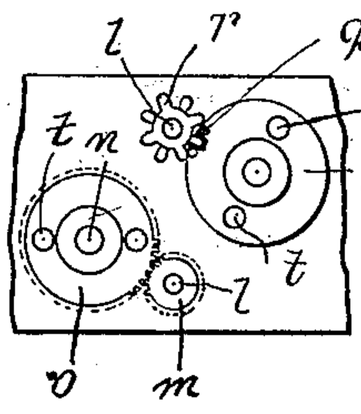

Fig. 4

WITNESSES

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3 SHEETS—SHEET 2.

Fig. 5

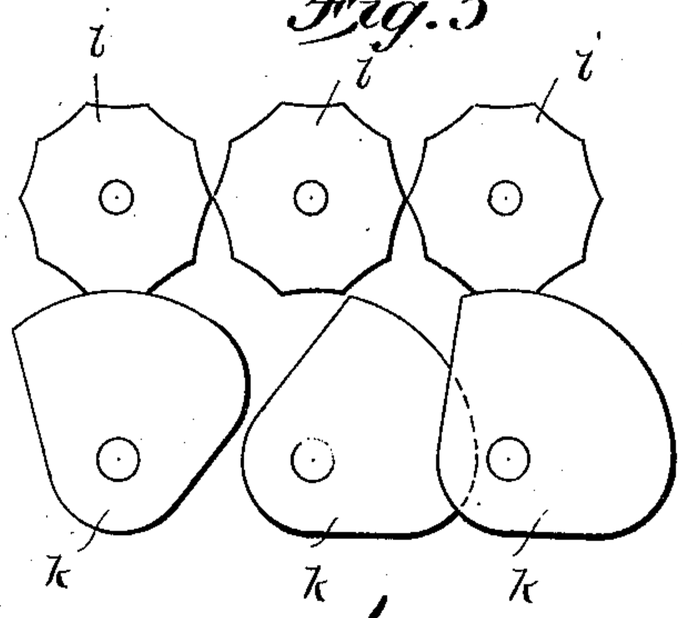
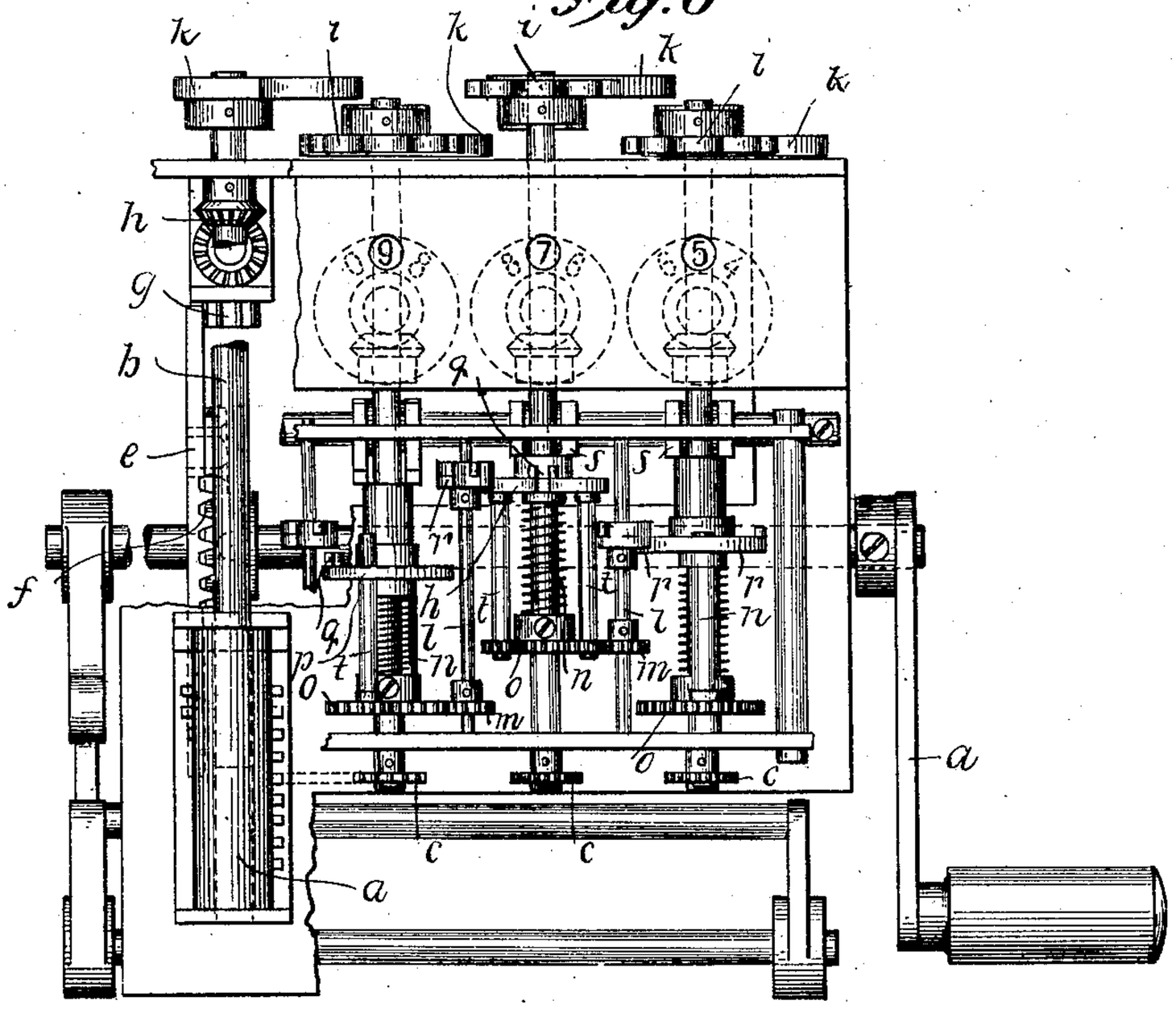


Fig. 6



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3 SHEETS—SHEET 3.

Fig. 7

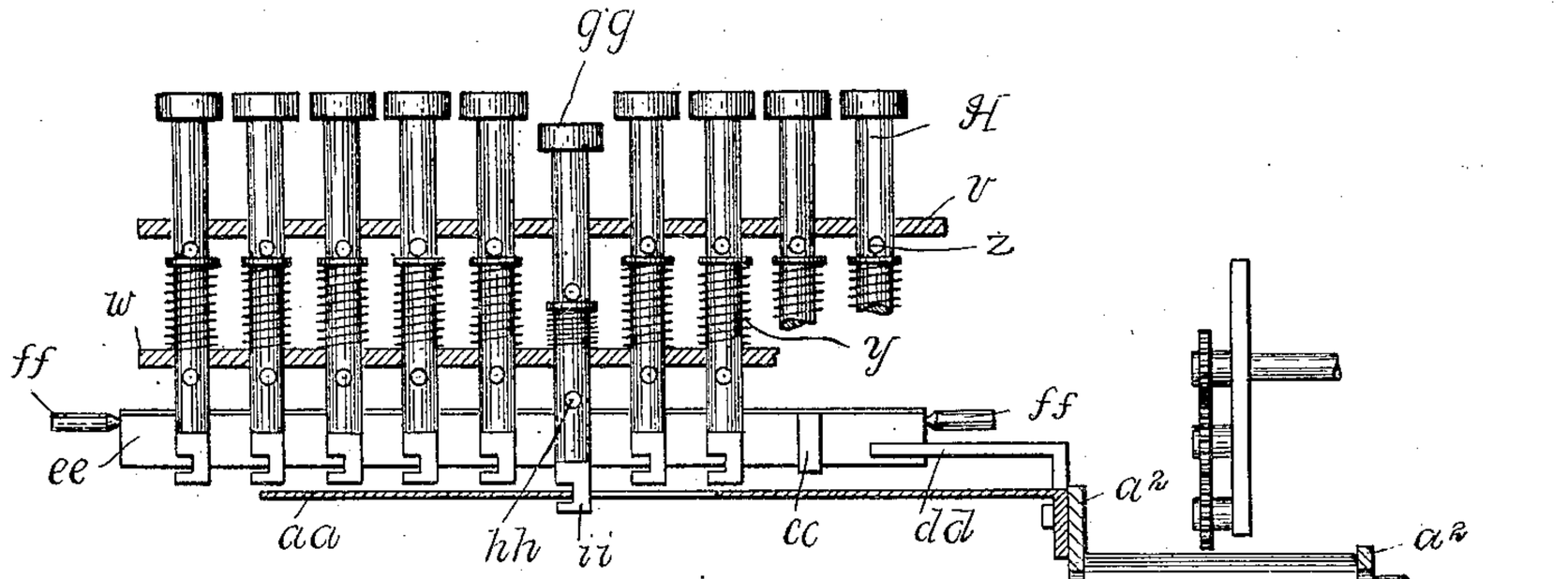
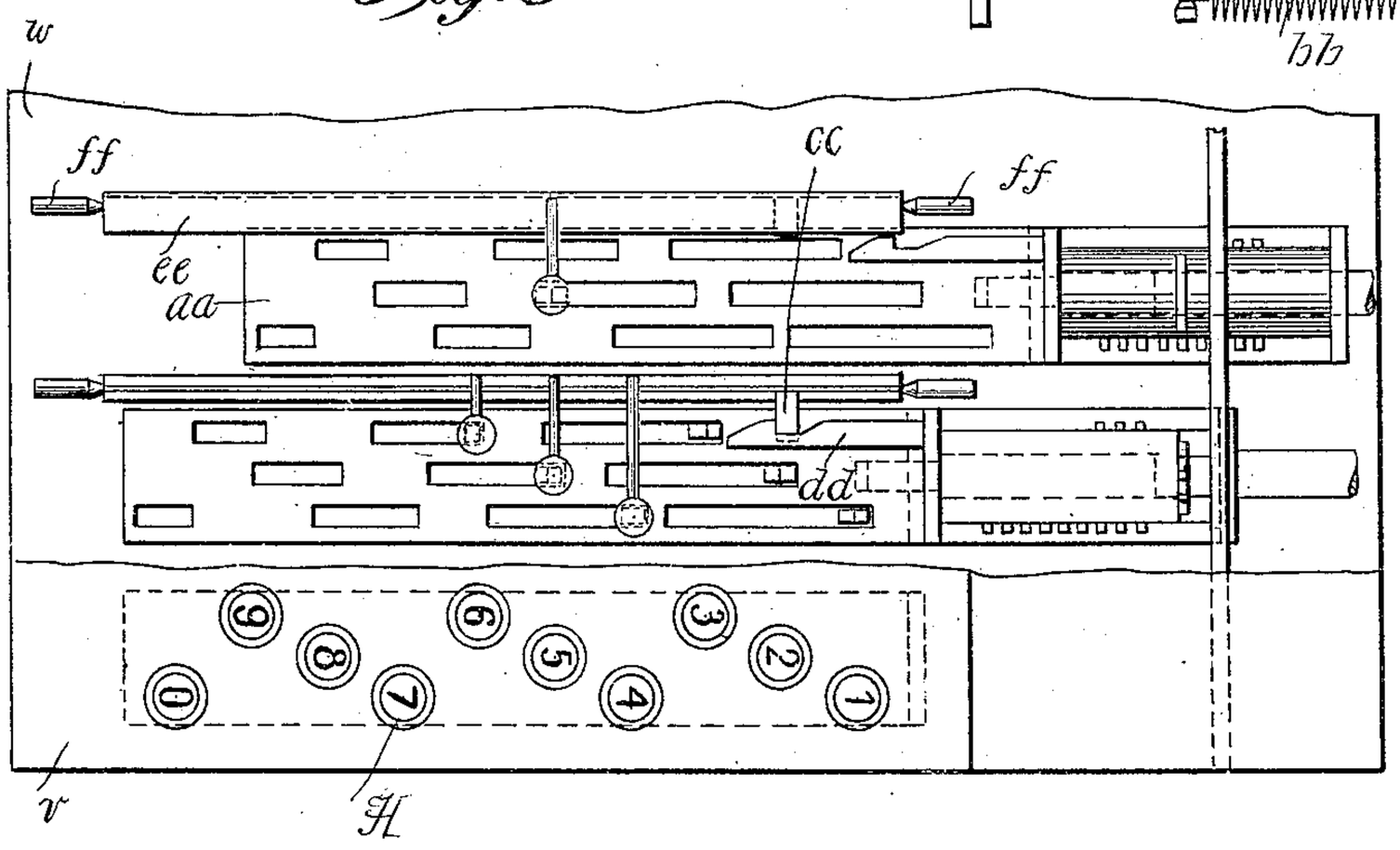


Fig. 8



WITNESSES

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CALCULATING-MACHINE.

989,507. Specification of Letters Patent. Patented Apr. 11, 1911.

Application filed December 23, 1910. Serial No. 598,937.

To all whom it may concern:

Be it known that I, ERNST LEDER, a subject of the German Emperor, and a resident of Berlin, Germany, have invented a new and Improved Calculating-Machine, of which the following is a full, clear, and exact description.

This invention relates to calculating machines, and has reference more particularly to a machine of this kind having an operating member, numeral-bearing counter members, mechanism operable by the first member, for actuating the counter-bearing members, locking means for preventing overpass movements of the counter-bearing members, and auxiliary locking means, both the locking means being controlled by the operating member.

An object of the invention is to provide a calculating machine serving to effect arithmetical and other calculations, in which overshoot or overpass movements of the numeral rolls or disks, or other counter-bearing members are positively prevented, when these are actuated in the operation of the machine, in which the means employed for this purpose are simple and efficient, and which do not add to the complexity of the machine, in which the means for preventing the overpass movements do not interfere with the normal operation of the machine, and do not add to the force required to operate the machine, and in which the locking means prevent the possibility of error, due to overpass movements when the individual counter members are actuated, and during decimal transfer from one member to another.

A further object of the invention is to provide a calculating machine in which the operation of the mechanism for the through decimal transfer is regulated by means of auxiliary locking devices, so that forced and positive guidance or control of the operative parts are effected.

The invention consists in the construction and combination of parts to be more fully described hereinafter and particularly set forth in the claims.

Reference is to be had to the accompanying drawings forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views, and in which—

Figure 1 is a vertical, longitudinal section of one element of the machine; Fig. 2 is an elevation showing certain details of construction embodying parts of the locking mechanism; Fig. 3 is a fragmentary elevation showing a train of gears constituting part of the counter actuating mechanism; Fig. 4 is a similar view showing part of the counter-actuating mechanism, and including certain of the constructive details of the locking mechanism; Fig. 5 is a view similar to Fig. 2, showing additional parts of the locking mechanism; Fig. 6 is a plan view of part of the calculating machine, having portions broken away; Fig. 7 is a vertical section of the key-board used in connection with the calculating machine; and Fig. 8 is a fragmentary plan view showing part of the machine and the key-board used therewith.

Before proceeding to a more detailed explanation of my invention, it should be noted that in the calculating machines hitherto and at present employed, overpass or overshoot movements of the numeral-bearing rolls or disks are prevented, or limited, by means of braking devices, or through the employment of intermittently operable locking mechanism. It has been found that a braking or retarding device accomplishes in part only, the purpose for which it is employed, and furthermore, that the customary locking arrangement is also unsatisfactory and insufficient. As soon as it is necessary to effect a decimal transfer from one numeral bearing member to the other, in the operation of the calculating machine, the locking action must of course, be interrupted. This results in possibility of error even with the more efficient of the calculating machines, for example, those of the Thomas type. In my calculating machine, through the provision of suitable locking devices, in combination with auxiliary locking devices, this possibility of error is absolutely eliminated. Certain of the details of construction, shown for example herewith, form no part of the invention, and can be varied in accordance with individual preference and special conditions, without departing from the underlying spirit of the invention.

Referring more particularly to the drawings, I provide setting mechanism including a plurality of graduated or stepped rolls a, slidably mounted in any suitable manner upon spindles b, though constrained to rotate therewith. Each roll has formed thereon a plurality of series of teeth a', so that in effect each roll constitutes a number of mutilated gears, the series or groups of teeth

representing the numerals 1, 2, 3, 4, 5, 6, 7, 8, 9, and 0, in the usual manner, and being adapted to be positioned in operative relationship with gears *c* of the counter mechanism. I provide an actuating disk *e* for each number-setting device or set, provided with teeth *f* in mesh with a gear *g*. The groups of teeth *f* of the different number-sets are arranged successively with reference to each other, in the customary manner. In Fig. 6 I have shown but a single actuating disk, to simplify the disclosure. The disk is provided with a hand crank *d*, by means of which it can be operated. When the teeth *f* of a disk actuate a gear *g*, the latter executes a complete revolution. The gears *g* are mounted upon spindles *g'*, operatively connected by means of bevel gears *h* and shafts *h'*, with the spindles *b*, so that a revolution of a gear *g* is transmitted to a spindle, *b*, which also executes a complete revolution, taking with it the corresponding roll *a*, which is splined or otherwise slidably mounted upon the spindle. In consequence, the particular group *a'* of teeth in mesh with the corresponding gear *c*, becomes effective to actuate the gear *c*, and to transmit to it a movement corresponding in extent to the number of teeth in the particular group. As the teeth *f* of the different number-sets are successively offset, the rolls *a* are not simultaneously actuated but are operated one after the other.

As soon as the teeth of a roll *a* have moved the gear *c* through a corresponding arc and have passed from engagement therewith, an overpass or overshoot movement of the gear *c* would, in all probability result, owing to the momentum of the moving parts and the kinetic energy acquired thereby. To prevent the overpass movement, I employ a locking device similar to that of the Thomas type of calculating machine, and comprising essentially, a preferably polygonal locking wheel or disk *i*, with which coöperates a pivoted locking member or dog *k*, as is shown most clearly in Figs. 2 and 5. The elements *i* and *k* constitute a lock, which becomes operative as soon as the engagement between the roll *a* and the counter mechanism ceases, and the gear *c* is at once brought to rest. The construction of the dog *k* in my calculating machine differs however, from that of the corresponding element employed in the Thomas machine, and herein is found one of the essential features of my invention. It is so constructed that as soon as the gear *c* has been brought to rest, the locking action ceases, and the further movement of revolution of the spindle releases the lock. The release results therefrom, that the continued movement of the spindle carries the dog out of engagement with the element *i*. Thus, the elements *i* and *k* are but temporarily operative, and the locking action, after it has been effected, is at once discontinued, and all of the parts of the counter-actuating mechanism are free to move as before. As the parts of the mechanism, owing to the interruption of the locking action of the elements *i* and *k* could easily be moved to greater or lesser degree, by shaking or concussion of the machine, I provide additional locking devices which are auxiliary to the above-described devices, and which will be described hereinafter.

The counter-actuating mechanism includes a plurality of spindles *l*, suitably journaled in the framework, and each provided with a gear *m*, rigidly secured thereon. Upon each of the spindles *n*, also constituting parts of the counter-actuating mechanism, and suitably journaled in the frame of the machine, I also provide a gear *o*, rigidly secured thereon, which is in mesh with one of the above-mentioned gears *m*, so that the movements of the gears *m* are transmitted to the gears *o*. Upon each of the spindles *n* is provided a disk *p* constrained to rotate with the spindle, and slidable in the direction of the length thereof. These disks are provided with recesses *q*, and are similar to corresponding elements found in electric counters. Upon each of the spindles *l*, is rigidly secured a toothed wheel *r*, the form of which also corresponds to the similar elements customarily employed in the electric counters above mentioned. The wheel *r* is provided at one side, with twice as many teeth as on the other. Each disk *p* is operatively associated with the next succeeding wheel *r*, so that its periphery engages the sides of two adjacent teeth. Consequently, the wheel *r* cannot turn until, the recess *q* reaches one of the teeth of the wheel *r* and then permits the wheel to turn when the corresponding tooth enters the recess, as is shown in Fig. 4. The amount of the revolution of the wheel then approximates the extent of one tooth, and as soon as it is completed, the wheel *r* again is held against revolution until the recess *q* again reaches a position such that the next tooth can enter it, whereupon a further movement of the wheel *r* is possible. The recess *q* is positioned so that the above-described operation takes place when the figure 9 of the corresponding number-set becomes a 10 in the course of the operation of the calculating machine.

The above-described arrangement insures that at every movement of the operation of the counter-actuating mechanism, the parts are locked against accidental movement, and against overpass movements during the "carrying" from one order to the next higher order. No element of the counter mechanism can turn as long as the locking devices are operative as described. However, under these circumstances, it would be possible to turn the roll *a* no farther than the engage-

ment of the first tooth of the corresponding part of the roll *a* with the corresponding tooth of a gear *c*. Further movement would be prevented by the locking action of the above-described disk *p*. To permit a further operation of the counter mechanism, it is necessary to interrupt, temporarily, the locking of the mechanism, and this is effected by means of a releasing device including a pivoted fork *s*, which serves to actuate the disk *p*, the latter being movable in the direction of the length of a guide rod *t*, and thus can be forced out of engagement with the toothed wheel *r*. The release is actuated by means of a projection *u* secured upon a suitable part of the corresponding disk *e* and adapted to engage the lower end of the fork and swing the same through a suitable angle.

In the above description are included the essential elements of my invention, and those features of the calculating machine which embody my particular improvements. As already specified, many of the details of construction illustrated for example, herewith can be varied. The features described below constitute necessary parts of a complete and operative machine, but constitute no part of my invention. The rolls *a* are controlled by means of a key-board, as well as a replacing device, illustrated in Figs. 1, 6, 7 and 8.

Two horizontal sheets or plates *v* and *w* are provided with correspondingly formed openings, through which the shafts of the keys extend, the shafts being substantially vertical. The keys are held in normal positions by means of spiral springs *y*, which engage studs *z*, and press the keys upwardly against the plate *v*. The springs maintain the keys in normal positions until they are manually depressed. Slotted plates *a*, *a* are rigidly connected with the front of the bearing members a^2, provided for the rolls *a*, so that a movement of the rolls *a* in horizontal direction, produces a corresponding movement of the slotted plates *a*, *a*. Springs *b*, *b* are provided to produce a horizontal movement of the above-mentioned parts, but each is held initially from exerting this tendency by means of a stop block *c*, *c*, which engages a catch *d*, *d* rigidly connected with the bearing member and the slotted plate, and thus prevents the former from being projected in a forward direction. The catch *d*, *d* is rigidly mounted upon a swinging member *e*, *e* of angular cross-section, which is pivotally mounted between pin bearings *f*, *f*. Each of the keys *g*, *g* is provided with means for displacing a member *e*, *e* to disengage the stop *c*, *c* from the catch *d*, *d*, the means consisting of a horizontally arranged rod *h*, *h* which engages the member *e*, *e* when the key is depressed. As soon as the stop and the catch are released, the spring *b*, *b* becomes effective and advances the bearing member and the slotted plate in a forward direction until the hook provided at the lower end of the corresponding key *g*, *g* enters an opening of the slotted plate and then holds the roll bearing against movement. When this occurs, the roll *a* is so positioned that the corresponding gear *c* is in mesh with the teeth of the roll corresponding to the key which has been depressed. If a counter mechanism has been set in this way by means of the key, and if the hand crank *d* is then turned, the roll *a* will actuate as many teeth of the counter mechanism as are set by means of the key. With the remainder of the movement of the hand crank all the bearing members, and with them the rolls *a*, are returned to their original positions. For this purpose, I provide a finger *k*, *k*, rigidly secured upon the shaft of the actuating disk, which is adapted to engage levers *l*, *l*, having noses *l*, *l'* and a connecting bar *m*, *m*. The connecting bar is arranged to engage projections *n*, *n* with which the bearing members are provided, so that when the projections are in the path of movement of the bar *m*, *m* the bearing devices are returned to their original positions. That is, the bar *m*, *m* will force the bearing members backward until the stops *c*, *c* are brought into operative engagement with the catches *d*, *d*. In this way, all the bearing members which move forward when the corresponding keys are depressed, can be returned to their original positions simultaneously.

When an actuating disk is turned, by means of a hand crank, the teeth *f* cause a complete revolution of the gear *g*, and consequently, a complete revolution of the corresponding roll *a*. At the moment when the first tooth of the roll *a* engages the corresponding tooth of a gear *c*, the movement of the counter mechanism begins. This is possible as the releasing fork *s* first displaces the wheel *r* and interrupts the locking action of the disk *p*. As long as the teeth of the roll *a* are in mesh with the teeth of a gear *c*, the movement of the latter is forced and guided, that is, it is not capable of independent, accidental or other movement. The moment that the engagement of the teeth ceases, the locking action of the elements *i* and *k* begins. During the period of this locking action, the releasing member *s*, and with it the disk *p*, return to their original positions, and the previously interrupted locking of the counter mechanism again becomes effective, so that all the parts of the counter mechanism are again secured against accidental movement, as soon as the locking action of the elements *i* and *k* has ceased.

Having thus described my invention, I claim as new, and desire to secure by Letters Patent:

1. In a calculating machine, an operating

member, counter actuating mechanism operable by said member, locking means for preventing overpass movements of said mechanism, and an auxiliary locking means, one of said locking means being controlled directly, and the other indirectly by said operating member.

2. In a calculating machine, an operating member, counter mechanism, setting mechanism, means for transmitting the movement of said member to said counter mechanism, locking means for preventing overpass movement of said setting mechanism at the end of the movement of said member, and locking means for preventing overpass movement of said counter mechanism in carrying from one order to the next higher order, said first means being associated with said operating member and said setting mechanism, said second means being independent of said first means, and being associated with said setting mechanism and said counter mechanism, both of said locking means being controlled by said operating member.

3. In a calculating machine, an operating member, setting mechanism adapted to be actuated thereby, counter mechanism, means whereby said operating member serves to actuate said counter mechanism through said setting mechanism, said means constituting locking means for preventing overpass movement in said counter mechanism, in carrying from one order to a next higher order, and locking means associated with said operating member and said setting mechanism for momentarily preventing overpass movement of said setting mechanism.

4. In a calculating machine, an operating member, setting mechanism, counter mechanism, means whereby said operating member serves to actuate said setting mechanism, locking means associated with said operating member and said setting mechanism and operative momentarily at the end of the movement of said operating member, for preventing overpass movement of said setting mechanism, and means whereby the movement of said operating member is transmitted to said counter mechanism through said setting mechanism, said last-mentioned means including locking means operative after said first mentioned locking means, to prevent overpass movement in said counter mechanism, in carrying from one order to the next higher order.

5. In a calculating machine, an operating member, setting mechanism adapted to be actuated thereby, transferring devices for transmitting the movement from one element of said counter mechanism to another, in carrying from one order to a next higher order, means whereby said devices are normally locked to prevent overpass movements, means operable by said operating member, for releasing said devices, and locking means associated with said operating member and said setting mechanism, to prevent overpass movements of said setting mechanism, said last-mentioned means being momentarily operative before said transferring devices are released by said operating member.

6. In a calculating machine, an operating member, counter mechanism, spindles for operating said mechanism, setting mechanism including shafts, locking means for preventing overpass movement, and associated with said spindles and said shafts, said means being momentarily operative at the end of the movement of said member, means for operatively connecting said setting mechanism and said spindles, transferring mechanism having means whereby the movement of one of said spindles can be transmitted to the next one of said spindles in carrying from one order to the next higher order, said transferring mechanism constituting locking means for preventing overpass movement, and means operable by said operating mechanism, for releasing said transferring mechanism, to permit the operation of the device.

7. In a calculating machine, an operating member, counter mechanism comprising a plurality of units, spindles, each adapted to operate one of said units, setting mechanism including shafts, locking means for preventing overpass movement, and associated with said spindles and said shafts, said locking means consisting of dogs and polygonal members adapted to engage, said locking means being momentarily operative at the end of the movement of said operating member, means for operatively connecting said setting mechanism and said spindles, transferring mechanism serving to transmit the movement of one of said spindles to the next one in carrying from one order to the next higher order, setting mechanism including double-toothed pinions, and disks having single notches, whereby said pinions and said disks are normally locked, except when said disks are in position such that said notches receive teeth of said pinions, and means controlled by said operating member, for momentarily disengaging said pinions and said disks.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ERNST LEDER.

Witnesses:

HENRY HASPER,

WOLDEMAR HAUPT.