A. A. HORTON.

ADDING MACHINE.

APPLICATION FILED AUG. 30, 1915. RENEWED NOV. 8, 1919.

1,326,504. Patented Dec. 30, 1919.

5 SHEETS—SHEET 1.

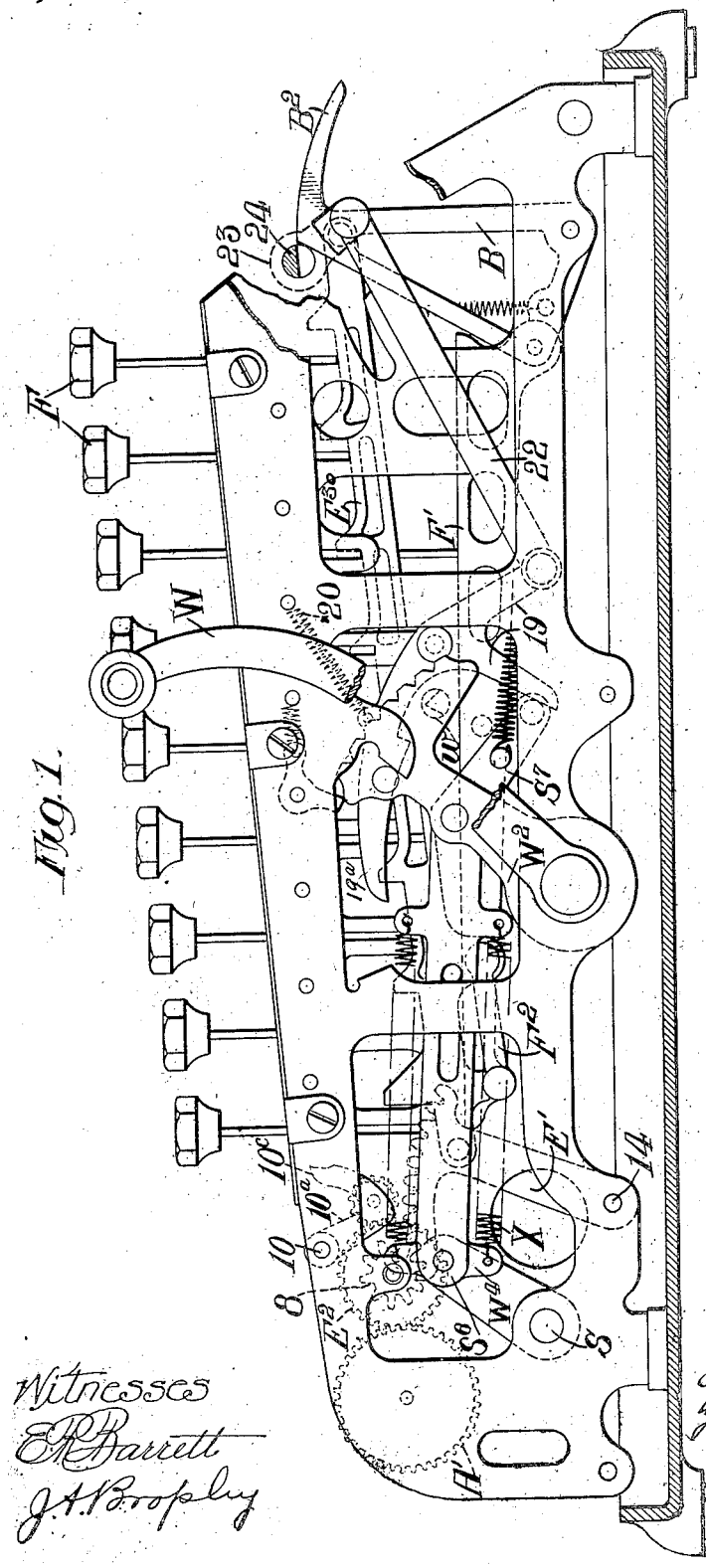

Fig. 1.

Witnesses
E. R. Barrett
J. A. Brophy

Inventor
Allen A. Horton
by Richards Coleman Davis & Macauley
His Attys

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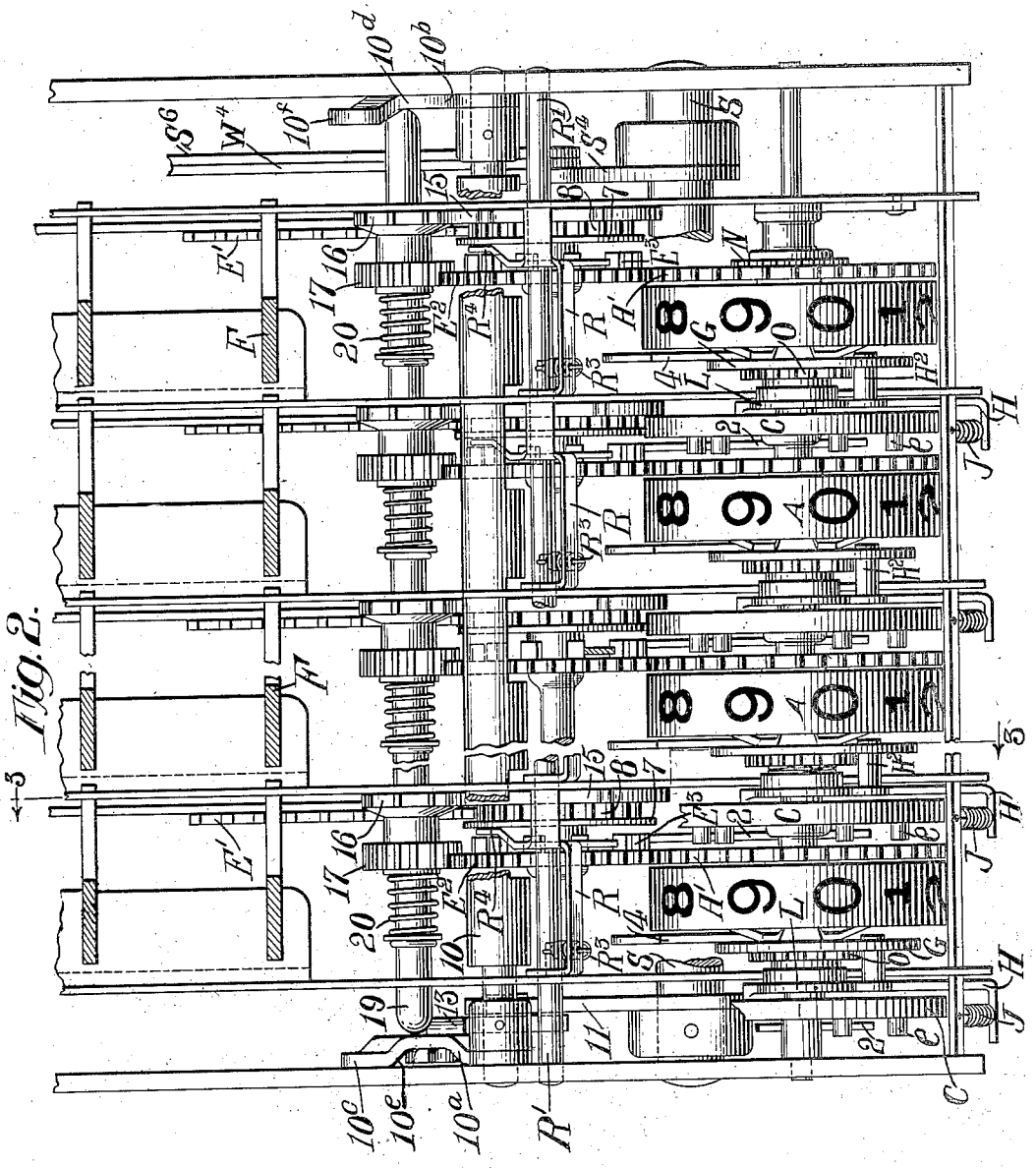

Fig. 2.

Witnesses
E. R. Barrett
J. A. Bopley

Inventor
Allen A. Horton

by Rector Hibben Davis & Macauley
His Attys

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5 SHEETS—SHEET 3.

Fig. 3

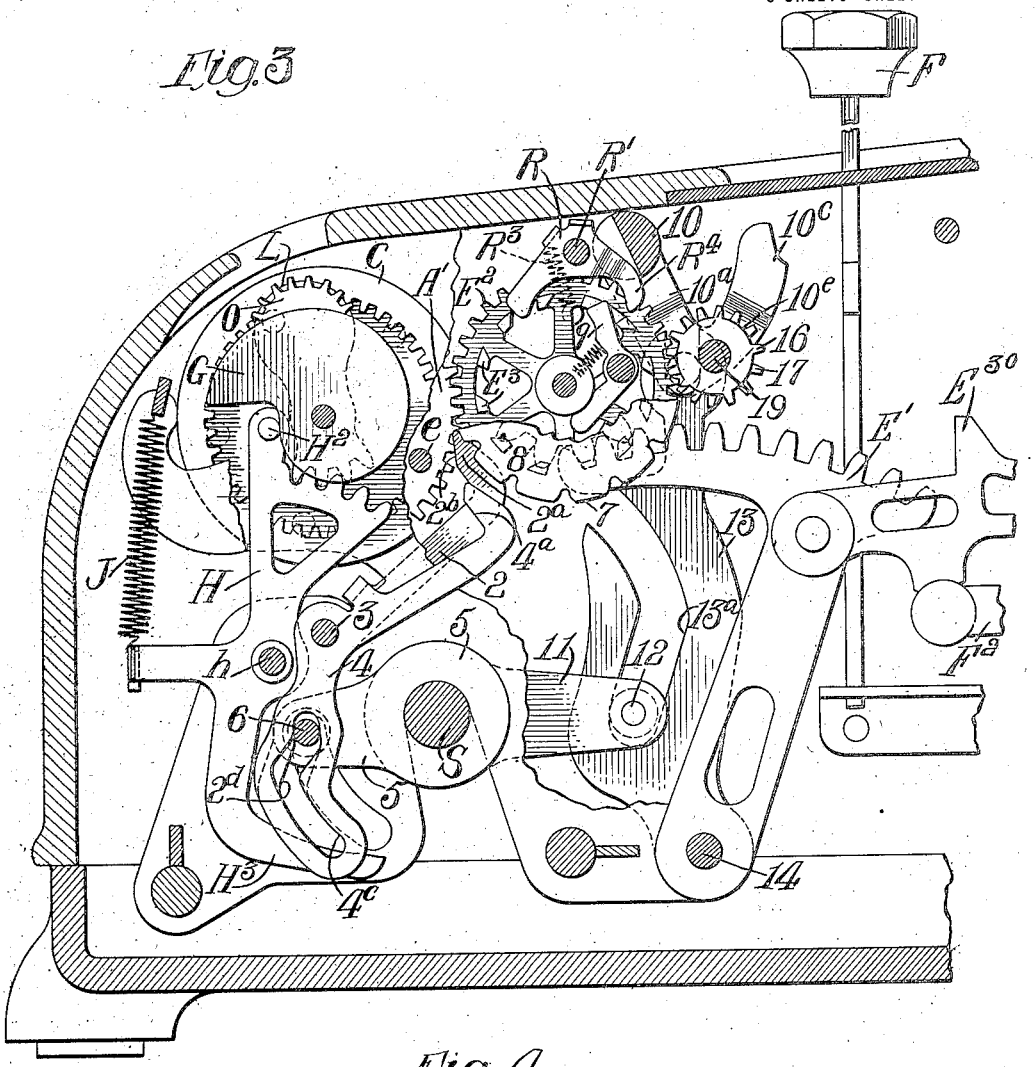
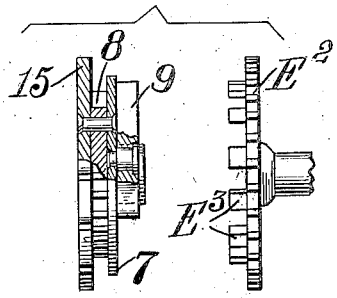


Fig. 4.



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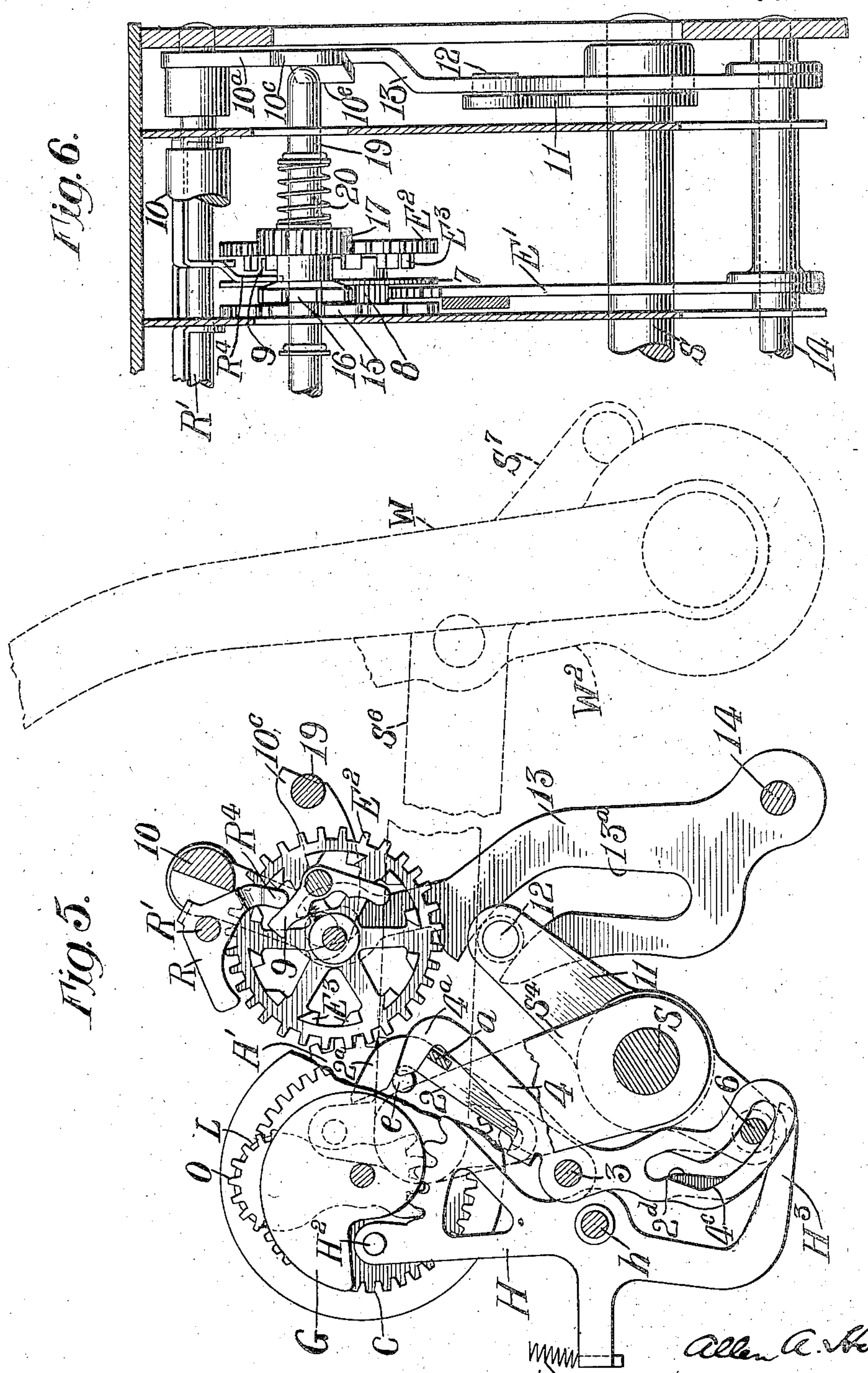

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J. A. Brophy

Inventor
Allen A. Horton

By Rector, Hibben, Davis & Macauley
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5 SHEETS—SHEET 5.

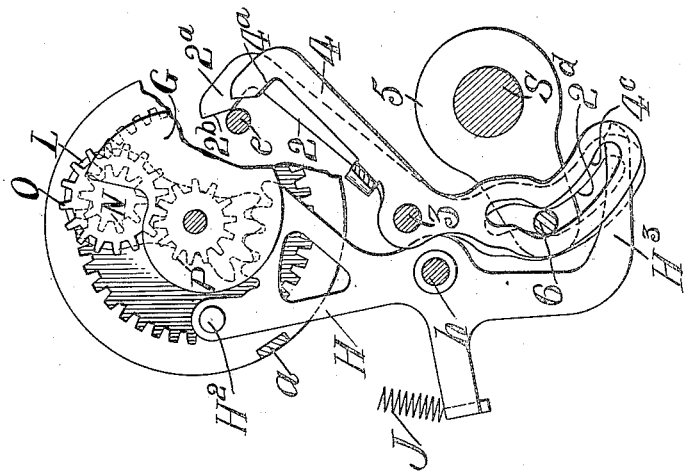

Fig. 8.

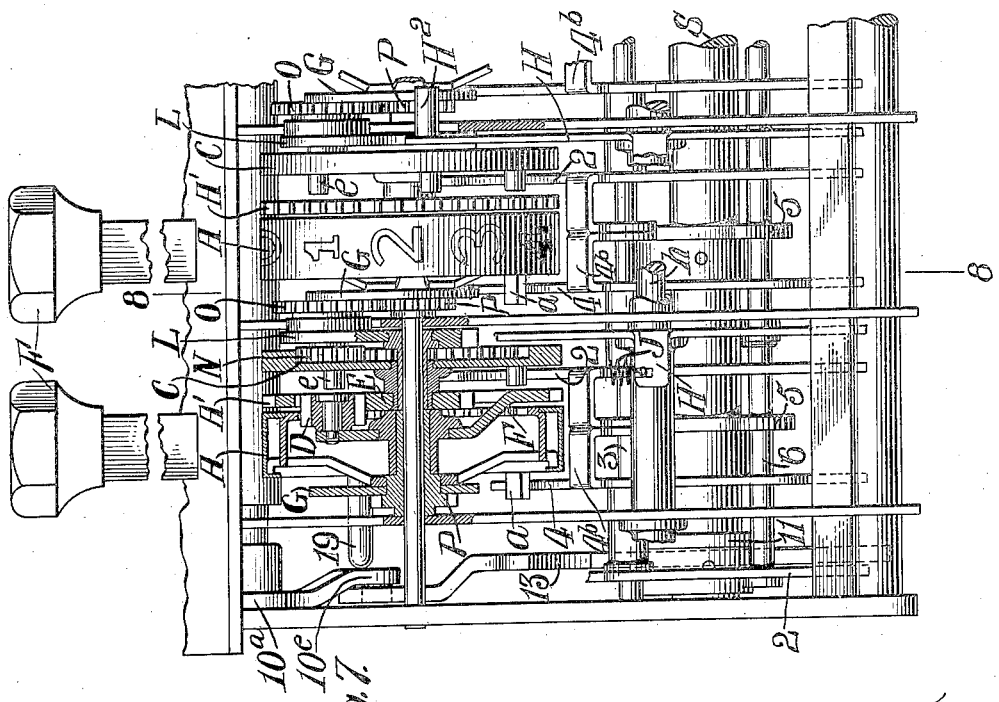

Fig. 7.

Witnesses;
E. R. Barrett
J. A. Brophy

Inventor
Allen A. Horton

by Rector, Hibben, Davis & Macauley
His Attys

UNITED STATES PATENT OFFICE.

ALLEN A. HORTON, OF DETROIT, MICHIGAN, ASSIGNOR TO BURROUGHS ADDING MACHINE COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF MICHIGAN.

ADDING-MACHINE.

1,326,504. Specification of Letters Patent. Patented Dec. 30, 1919.

Application filed August 30, 1915, Serial No. 48,007. Renewed November 8, 1919. Serial No. 336,732.

To all whom it may concern:

Be it known that I, ALLEN A. HORTON, a citizen of the United States, residing at Detroit in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Adding-Machines, of which the following is a specification.

This invention relates to zeroizing mechanism of machines of the general type shown in my prior Patent No. 1,016,501 issued February 6, 1912. The most familiar way of canceling or zeroizing in machines of this type is to advance all wheels except the units wheel to positions short of "0" and to complete the zeroizing through the operation of the transfer or carrying mechanisms as a result of turning the units wheel on to "0". The operation is customarily performed by reciprocation of a crank handle provided for the purpose, and a single reciprocation of that handle is sufficient. However, it is the habit of some operators to give the handle two reciprocations with the idea of making sure that complete zeroizing of the wheels is accomplished. This practice has developed the possibility of error by reason of interference with the carrying action, in so quickly executing the second stroke of the handle as to cut short the time required for the transmission of the carrying impulse throughout the series of wheels. It is entirely feasible to supply means for over-coming this difficulty, and in my companion application Serial No. 48,006, filed Aug. 30, 1915, I have shown an arrangement for prohibiting execution of a second stroke of the canceling or zeroizing handle until the carrying impulse has been completely transmitted.

By the present invention I overcome the difficulty in quite a different way for instead of following the old process of zeroizing and providing safe guards against mis-operation, I depart from that old process altogether and adopt a plan which makes wholly unnecessary the introduction of controlling devices for regulating successive strokes of the zeroizing handle.

In most if not all the machines of the type above referred to which have attained a commercial status, the carrying mechanisms between wheels employ springs for transmitting carrying impulses and these springs are wound up or tensioned by the forward turning of the wheels to register the varying amounts. By my present invention I propose to utilize the power stored in springs of this character to zeroize the wheels by backward rotation thereof. It is obvious that a spring put under tension by advance of a wheel from zero may serve to return that wheel to "0" position under proper control and with restraining devices disabled. Of course in these machines as heretofore built there are various devices which operate to restrain such springs and prohibit backward rotation of wheels, for example, the familiar back stop pawls and the ratchet and pawl driving connections. In carrying out my invention I provide for disabling all such devices and relieving the wheels from all interference with backward rotation so that they will be perfectly free to run backward, and I provide for setting appropriate stops to prevent the wheels from running backward past the "0" position, all as a result of one and the same act of the operator which may, and in the present embodiment of my invention does, consist in simply pulling forward a crank handle such as that heretofore commonly employed in these machines. I also preferably include auxiliary means of a positive character for driving the wheels backward in order to make absolutely certain of their being all brought to "0" even though the springs might for some reason fail in their duty in this regard.

Besides supplying a form of zeroizing mechanism which does not involve transmission of carrying impulses and so avoids all difficulties such as above mentioned as being occasioned by interference with transmission of such impulses, my present invention has the further advantage of presenting a much simplified zeroizing equipment for machines of this character, the number of parts being materially reduced as compared with previous constructions.

In the drawings which accompany and form part of this specification, Figure 1 represents a complete machine in right side elevation without its casing and with some parts broken away. Fig. 2 shows the front portion of the machine in top plan view with some parts broken away and some in hori-

zontal cross-section. Fig. 3 is a sectional right side elevation taken substantially on the line of 3—3 in Fig. 2. Fig. 4 shows details of ratchet and pawl driving devices. Fig. 5 is a view on the same order as Fig. 3 but illustrating the parts in operation for zeroizing. Fig. 6 is a sectional rear elevation of parts shown in Fig. 5. Fig. 7 is a partial front elevation of the machine with some of the parts in section and some omitted to disclose others. Fig. 8 is a view somewhat similar to Fig. 5 and taken substantially on the line of 8—8 of Fig. 7, but differing from Fig. 5 in that the parts are conditioned as when the zeroizing handle has just started its stroke.

While as above stated the general type of machine to which the present invention more particularly relates is that illustrated in my said prior patent, I have chosen for the purposes of the present disclosure a later construction of machine corresponding more closely with that illustrated in the Gooch Patent No. 1,128,679, issued February 16, 1915, as to the registering mechanism, and with the machine of the later Gooch Patent No. 1,150,937, issued Aug. 24, 1915, as to over-throw preventing devices, and with the machine of my prior Patent No. 1,156,600, issued October 12, 1915, as to actuator mechanism intervening between the keys and the register mechanism.

Referring first to Figs. 1, 2 and 7, A designates the numeral wheels and A′ the associated gear wheels which carry the planet pinions D engaged with sun gears E and with internal gears F on the numeral wheels, as in my said Patent 1,016,501. The carrying mechanisms comprise cams G and sun gears P carried by said wheels, intermediate internal gear wheels C on the hubs of the first mentioned sun gears E, oscillating gear carriers L whose gears N and O mesh respectively with said internal gears C and sun gears P, and levers H in gear with said carriers L and held against the cams G by springs J, all substantially as shown in said Gooch Patent No. 1,128,679, see particularly Figs. 10 to 12 thereof. Gear wheels E^2 mesh with the gear wheels A′ and are driven through ratchet and pawl connections by oscillating segments E′ which derive power from the keys F through connections of the kind shown in my said Patent No. 1,156,600. These connections comprise stop bars E^{30} coupled to the segments, bell crank levers B to which the rear ends of said stop bars are pivotally connected, and key-driven levers F′ connected by links F^2 to the forward portions of the stop bars.

It will be understood that through these driving connections and restoring springs of a customary character, depression of the keys causes oscillation of segments E′ and that through the medium of aforesaid ratchet and pawl devices and the planetary gearing first mentioned, the numeral wheels are advanced in a clockwise direction as viewed from the right hand side and it will be further understood that the corresponding rotation of the cams G swings the upper arms of levers H forward tensioning the springs J which, when the high points of the cams pass the lever studs H^2, operate to transmit carrying impulses as fully explained in said Gooch Patent No. 1,128,679. This of course involves the rotation of the intermediate gear wheels C in a counter-clockwise direction, the ratio of gearing being such, in the organization here shown, that in transmitting the carrying impulse one of these intermediate gear wheels makes one-fifth of a turn. In the machine of said Gooch patent zeroizing of the numeral wheels is accomplished by oscillating the gear carriers L in opposition to the springs J, as by forcing forward the upper arms of the levers H here shown, the intermediate gears C being locked against rotation in a clockwise direction so that the numeral wheels will be advanced by the turning of the gears N, O and P. The zeroizing in the Gooch machine is completed by transmission of carrying impulses in general correspondence with the zeroizing action of the machine of my said prior Patent 1,016,501.

Coming now to the particulars of my present invention, I pursue a procedure which is in a sense the reverse of that pursued by Gooch in that I turn the wheels rearward to "0" by rocking the upper arms of the levers H rearward under the power of their springs J, besides which I provide for positively driving said lever arms rearward, the intermediate gear wheels C being locked against a counter-clockwise rotation so as to convert the rearward swing of the levers H into backward rotation of the numeral wheels through the turning of the gears N, O and P. As a preliminary to releasing of the wheels for backward turning (through disablement of restaining devices as will be presently pointed out) I force the intermediate gears C to a slight extent in a clockwise direction in order to separate the lever studs H^2 from the surfaces of the cams G. This I accomplish by the same devices which serve to lock said intermediate gears against counter-clockwise rotation. Referring to Figs. 3, 5 and 8, these devices are in the form of levers 2 hung upon a cross rod 3, their upper arms terminating in hooks 2^a for engaging the studs *e* on the gear disks C. These hooks of course stand normally out of the paths of said studs as illustrated in Fig. 3. The ends of these hooks on said arms have cam edges 2^b and in the first part of a canceling or zeroizing operation these lever arms are thrown forward and said cam edges driven against studs *e* of said gear

disks C so as to slightly rotate the latter in a clockwise direction as illustrated in Fig. 8. Such rotation of said gear disks will swing the gear carriers L in a clockwise direction and therefore swing the upper arms of the levers H in a counter-clockwise direction separating their studs H^2 from the peripheries of the cams G. Continued forward swinging of the lever arms 2 results in full engagement of the hooks 2^a over the studs *e* as illustrated in Fig. 5, whereby the gear disks C are locked against rotation in a counter-clockwise direction which would otherwise occur upon the rearward swinging of the lever arms H by their springs J. With said disks locked against such movement and with the numeral wheels free to rotate backward, said springs J will so rotate them, for the rearward swinging of a lever arm H and the resultant counter-clockwise turning of the gear carrier L, causes the pinion N to traverse the internal gear teeth of the disk C as a fixed rack and the gear pinion O to correspondingly rotate and to turn the sun gear P which is fastened to the numeral wheel. Of course this involves the backward turning of the cam G which is also fastened to that wheel, in which connection it should be noted that the periphery of the cam will be constantly receding with relation to the stud H^2 so that notwithstanding the latter is moving rearward its separation from the periphery of the cam continues throughout the zeroizing operation.

While the wheels could not turn backward a full step beyond "0", by reason of the encounter of the substantially radial edges of the cams with the studs H^2, it is not customary to have the studs and cam edges in contact when the wheels are at "0", and, in the interests of perfect alinement, it is desirable to provide special means for definitely checking the wheels against backward rotation beyond the "0" position. To this end I mount upon the before mentioned cross rod 3 another set of levers 4 whose upper arms are formed as hooks 4^a, quite similar to the hooks 2^a, and adapted to be thrust forward in the paths of lugs, *a*, on the adjacent numeral wheels. One of these lugs is shown in section in Fig. 5, where the associated hook 4^a is in overthrow-preventing position. These lugs may also be seen in Fig. 7 where the lateral relationship of parts is better disclosed. It will here be noted that each lever 4 is at the left of the numeral wheel with which it coöperates and its yoke-form hub portion 4^b is assembled with a similar hub portion of that one of the levers 2 which acts upon the studs *e* of the gear disk C to the right of said numeral wheel.

The above described overthrow-preventing and gear-locking lever arms are operated by the same machine element, which is in the form of a bail comprising arms 5 and a cross-rod 6 which occupies cam slots 2^d and 4^c in lower arms of the levers 2 and 4, as shown in Fig. 3. The said bail-arms 5 are secured to a rock shaft S of similar character to that so designated in my said prior Patent 1,016,501. The cam slots 2^d and 4^c are preferably so formed as to provide for forward swinging of the upper arms of the levers 4 in advance of the forward swinging of the upper arms of the levers 2, so as to guard against the possibility of backward movement of a numeral wheel already standing at zero, in consequence of the slight forcing clockwise of the gear disk C by the associated hook 2^a. This might result in a positioning of the wheel-stop-lug *a* in front of the hook 4^a and a consequent locking up of the machine and damaging strain upon the handle connections.

The rock shaft S is operatively connected with a crank handle W, as in the construction of my said Patent 1,016,501, through the medium of a crank arm S^4, links S^6 and W^4, springs X and crank arm W^2 on the handle shaft. The downward swinging of the bail 5—6, as caused by pulling forward the crank handle W, besides operating the levers 2 and 4 as above described, also serves to drive the levers H by way of supplementing the action of the springs J, and insuring a zeroizing action of said levers even though the springs should fail. To this end the levers H have a special formation being formed below their pivot rod *h*, with elbow shaped arms H^3. The rearwardly extending portions of these arms are adapted to be acted upon by the bail cross rod 6 to swing the levers H in a clockwise direction in case the springs J should fail for any reason to effectively swing said levers in the zeroizing operation.

Passing next to the matter of disabling various restraining devices which would interfere with backward rotation of the numeral wheels, I shall first point out a special formation of the gear wheels E^2, which, besides having advantages irrespective of the zeroizing operation, lends itself to simplification in the matter of disabling back-stop pawls and driving pawls as will presently appear. This gear wheel is constructed with a circular series of ratchet lugs E^3 with open space between them as clearly shown in Figs. 3 and 4. Back-stop pawls R pivoted on a frame cross rod R′ outside the circle of said ratchet lugs, have forwardly extending arms with terminal noses which are forced into the spaces between said lugs by springs R^3, the relationship being such as to permit the wiping of the lugs past said noses when the gear is turning in a counter clockwise direction but such as to cause the said noses to block turning of said gear in the opposite direction. Alongside the gear E^2 and mounted to turn on the same shaft is a disk 7 which

is compounded with a gear wheel 8 in mesh with the associated sector E'. A driving pawl 9 is pivoted upon said disk and occupies a position within the circle of ratchet lugs E^3, the end of its upper arm being designed to act against beveled rear sides of said lugs to drive the gear wheel E^2 in a counter-clockwise direction. This engagement is enforced as usual by a spring and the pawl has a tail to abut against the hub of the disk for limiting its pivotal movement. It will be seen that this construction makes possible the employment of a single ratchet element for both back-stopping and driving purposes and that this element is part of the driven gear wheel. Furthermore the construction facilitates the matter of disabling the pawls for zeroizing purposes. To this end the back stop pawls R have off-set tail pieces R^4 in rear of their pivot rod R' and extending in the planes of the driving pawls. In the zeroizing operation the back stop pawls are swung in opposition to their springs R^5 so as to remove their noses entirely from the spaces between the ratchet lugs, and by the same act their tail pieces R^4 are caused to operate upon the driving pawls so as to disengage them from said ratchet lugs. It should be noted that the driving pawls extend laterally beyond the ratchet lugs, (Fig. 6) and it is this extended portion of a driving pawl which is engaged by the off-set tail portion of the associated back-stop pawl so as to avoid any interference with reverse rotation of the gear wheel E^2 which accompanies a backward turning of the numeral wheel.

I shall next point out the means employed for collectively displacing or disabling the back-stop pawls. A rock shaft 10 extends from side to side of the machine and is journaled in the supporting side plates thereof. This rock shaft runs above the tails of the back stop pawls and is cut out to accommodate them as clearly shown in Figs. 2 and 3. The flat faces thus formed diametrically of the rock shaft run closely adjacent the off-set tail portions of the back stop pawls, and it will be seen that rocking of the shaft in a clockwise direction will disengage the front arms of the pawls from the ratchet lugs as illustrated in Fig. 5. Furthermore the tail pieces of the back-stop pawls will be driven against the driving pawls and the latter will be forced within the circle of the ratchet lugs as also illustrated in Fig. 5. Said rock shaft is operated through connection with the before mentioned rock shaft S. Thus the latter carries at its left hand end a crank arm 11 having a stud 12 which occupies the cam slot 13^a of a lever 13. The latter is pivoted at its lower end upon a frame cross rod 14 and its upper end is bifurcated to embrace a stud upon a crank arm 10^a fastened to the rock shaft 10. It will be obvious that through these connections the rock shaft will be oscillated as an accompaniment to reciprocating the zeroizing handle W.

The machine here shown is equipped with the over-throw preventing devices of the Gooch Patent No. 1,150,937. The purpose of these devices as explained in said patent is to prevent the driven wheel from running ahead of the driving element, and also to prevent overthrow of said driven wheel upon the cessation of the stroke of the driving element. These devices comprise a notched disk 15 compounded with the before mentioned driver pawl carrying disk 7 and the gear wheel 8 (Fig. 4); and a mutilated pinion 16 on the same hub with and laterally spaced from a gear pinion 17 which is in mesh with the gear wheel E^2, see Fig. 2. The relationship of said devices is such that with the associated numeral wheel otherwise free to rotate backward, its backward rotation would be interfered with by them, for backward rotation of the numeral wheel involves rotation of the gear wheel E^2 and corresponding rotation of the pinion 17 and mutilated pinion 16 and a turning of the latter is necessarily accompanied by the turning of the notched disk 15 which is constantly in gear with the actuating segment E'. Of course the numeral wheel in turning backward to "0" should move independently of the actuator mechanism, and consequently the overthrow-preventing devices above described must be disabled in a zeroizing operation. This I provide for by mounting the mutilated pinions 16 with their companion pinions 17 upon a shaft 19 which is arranged to slide laterally in the division plates of the frame work, said pinions 17 being broad enough to maintain engagement with the gear wheels E^2. The said shaft 19 is confined between arms 10^c and 10^d, the former being part of the before-mentioned crank arm 10^a secured to the left-hand end of the rock-shaft 10, and the arm 10^d being part of a similar elbow-shaped piece 10^b secured to the right hand end of the shaft. These arms have reversely related cam portions 10^e and 10^f. Normally the left-hand end of the shaft is in engagement with the offset portion of the arm 10^c inward of the cam portion 10^e as shown in Fig. 2, and the right hand end of said shaft is adjacent the inner portion of the other arm 10^d. Thus the shaft is in its right-hand position with the mutilated gears and notched disks coöperatively related to each other. When the zeroizing handle is pulled forward and the shaft 10 rocking as before described, the arms 10^c and 10^d are swung forward and the cam portion 10^f of the arm 10^d forces the shaft 19 to the left, (as permitted by the cam 10^e passing by the left-hand end of the shaft), so that the muti-

lated gears 16 are displaced from the planes of the notched disks.

The pinion units 16—17 are preferably mounted to slide to a limited extent upon the supporting shaft, being held up to their proper positions thereon (to the right) by springs 20 surrounding the shaft. This is in the present instance a mere safeguard provision. Thus should the teeth of any mutilated pinion, while laterally displaced, get out of alinement with the notches of its companion disk, the striking of one of such teeth against the side of the disk, upon return of the zeroizing handle, will not lock up the machine or cause damaging strains, as might otherwise be the case. The spring 20 will yield, and then as soon as the pinion has thereafter turned sufficiently to realine the teeth and notches. the pinion will slide into proper position.

It is desirable to employ an interlock between amount keys and zeroizing handle to prevent simultaneous use of these manipulative elements. To this end each bell crank lever B has a segmental rearward extension B^2 alined with the notch of a rock shaft 24. The latter is connected by a crank arm 23 and link 22 to a latch lever 19′. Normally this lever is restrained by an extension S^7 of the handle link S^6 as shown in Fig. 1, so that its latching arm 19^a is in position to block the handle W,—a shoulder of said latching arm being in the path of movement of a stud *w*, on the segment integral with the handle-shaft crank-arm W^2. A spring 20 tends to retract said latching arm and does so as the handle is pulled forward. The rocking of the lever 19 rocks the shaft 24 through the connections described and sections of said shaft back of the notches swing in front of the bell cranks B and thereby prevent depression of amount keys. Vice versa, depression of an amount key with the zeroizing handle at normal swings the segment B^2 of the associated bell crank into the notch of the shaft and thereby blocks the latch-lever 19 so that it remains in position to block the handle.

It is to be understood that my invention herein disclosed is susceptible of embodiment in other forms than that shown, and that appended claims are purposely drawn to express the full scope of the invention without limitation to structural details.

I claim:

1. The combination of register wheels, means for advancing them, carrying springs repeatedly tensioned by successively continuous rotations of the wheels, means for periodically releasing the power so stored in said springs, as governed by completion of rotations of wheels of respectively lower orders, means for transmitting such spring power to wheels of respectively higher orders, means for holding the wheels advanced, and means for disabling said latter means and permitting the springs to turn the wheels backward, with provisions for limiting the backward turning so as to insure zero-positioning of the wheels.

2. The combination of register wheels, means for advancing them, carrying springs repeatedly tensioned by successively continuous rotations of the wheels, means for periodically releasing the power so stored in said springs, as governed by completion of rotations of wheels of respectively lower orders, means for transmitting such spring power to wheels of respectively higher orders, means for holding the wheels advanced, means for preventing their over-rotation, and means for disabling said two latter means and permitting the springs to turn the wheels backward with provisions for limiting the backward turning so as to insure zero-positioning of the wheels.

3. The combination of register wheels, actuators therefor, pawl and ratchet connections between the actuators and wheels, carrying springs repeatedly tensioned by successively continuous rotations of the wheels, means for periodically releasing the power so stored in said springs, as governed by completion of rotations of wheels of respectively lower orders, means for transmitting such spring power to wheels of respectively higher orders, and means for disabling the pawl and ratchet connections to permit backward turning of the wheels by said springs, with provisions for limiting the backward turning so as to insure zero-positioning of the wheels.

4. The combination of register wheels, actuators therefor, pawl and ratchet connections between the actuators and wheels, carrying springs repeatedly tensioned by successively continuous rotations of the wheels, means for periodically releasing the power so stored in said springs, as governed by completion of rotations of wheels of respectively lower orders, means for transmitting such spring power to wheels of respectively higher orders, backstop pawls for the wheels, and means for disabling the pawl and ratchet connections and said backstop pawls to permit backward turning of the wheels by said springs, with provisions for limiting the backward turning so as to insure zero-positioning of the wheels.

5. The combination of register wheels, actuators therefor, pawl and ratchet connections between the actuators and wheels, carrying springs repeatedly tensioned by successively continuous rotations of the wheels, means for periodically releasing the power so stored in said springs, as governed by completion of rotations of wheels of respectively lower orders, means for transmitting such spring power to wheels of respectively higher orders, means for preventing their

over-rotation, and means for disabling the latter means and the said pawl and ratchet connections to permit said springs to turn the wheels backward, with provisions for limiting the backward turning so as to insure zero-positioning of the wheels.

6. The combination of register wheels, actuators therefor, pawl and ratchet connections between the actuators and wheels, carrying springs repeatedly tensioned by successively continuous rotations of the wheels, means for periodically releasing the power so stored in said springs, as governed by completion of rotations of wheels of respectively lower orders, means for transmitting such spring power to wheels of respectively higher orders, backstop pawls for the wheels, means for preventing their over-rotation, and means for disabling the pawl and ratchet connections, the backstop pawls and the overrotation preventing means to permit backward turning of the wheels by said springs, with provisions for limiting the backward turning so as to insure zero-positioning of the wheels.

7. The combination of register wheels, means for advancing them, carrying springs repeatedly tensioned by successively continuous rotations of the wheels, means for periodically releasing the power so stored in said springs, as governed by completion of rotations of wheels of respectively lower orders, means for transmitting such spring power to wheels of respectively higher orders, means for holding the wheels advanced, and means for disabling said latter means and permitting the springs to turn the wheels backward, with provisions for driving the wheels backward in aid of the springs, and provisions for limiting the backward turning so as to insure zero-positioning of the wheels.

8. The combination of register wheels, actuators therefor, one-way driving connections between the actuators and wheels, notched disks turning with the actuators, mutilated gears turning with the wheels and coacting with said disks, springs opposing advance of the wheels, and means for effecting relative lateral displacement between the notched disks and the mutilated gears to permit backward turning of the wheels by said springs.

9. The combination of register wheels, actuators therefor, driving connections between said actuators and wheels comprising ratchet wheels and pawls, springs opposing advance of the wheels, pawls preventing backward movement of wheels, and means for displacing said latter pawls, these pawls adapted to displace the pawls of the driving connections, substantially as and for the purpose described.

10. A driven wheel having a single set of ratchet projections, a driving pawl and a back stop pawl engaging the same, one located within and the other without the circle of said projections.

11. A driven wheel having a single set of ratchet projections, a driving pawl and a back stop pawl engaging the same, one located within and the other without the circle of said projections and one pawl having a tail portion to engage and displace the other pawl when the first pawl is moved out of engagement with the ratchet projections.

12. The combination of register wheels, having cams and sun gears, intermediate gears geared to higher order wheels, gear carriers whose gears mesh with said sun gears and said intermediate gears, gear-carrier oscillating members controlled by the cams, springs applied to said members, means for holding the wheels from backward movement, and means for disabling said latter means and locking the intermediate gears whereby to cause backward turning of the wheels by said springs.

13. The combination of register wheels having cams and sun gears, intermediate gears geared to higher order wheels, gear-carriers whose gears mesh with said sun gears and said intermediate gears, gear-carrier oscillating members controlled by the cams, springs applied to said members, means for holding the wheels from backward movement, and means for disabling said latter means and locking the intermediate gears whereby to cause backward turning of the wheels by said springs, together with provisions for preliminarily turning the intermediate gears to disengage said members from the cams.

14. The combination of register wheels having cams and sun gears, intermediate gears geared to higher order wheels, gear carriers whose gears mesh with said sun gears and said intermediate gears, gear-carrier oscillating members controlled by the cams, springs applied to said members, means for holding the wheels from backward movement, and means for disabling said latter means and locking the intermediate gears whereby to cause backward turning of the wheels by said springs, together with means for positively driving said members in aid of the springs.

15. The combination of register wheels having cams and sun gears, intermediate gears geared to higher order wheels, gear carriers whose gears mesh with said sun gears and said intermediate gears, gear-carrier oscillating members controlled by the cams, springs applied to said members, means for holding the wheels from backward movement, and means for disabling said latter means and locking the intermediate gears whereby to cause backward turning of the wheels by said springs, said means comprising a reciprocating structure and a

series of levers operated thereby to lock said gears.

16. The combination of register wheels having cams and sun gears, intermediate gears geared to higher order wheels, gear carriers whose gears mesh with said sun gears and said intermediate gears, gear-carrier oscillating members controlled by the cams, springs applied to said members, means for holding the wheels from backward movement, and means for disabling said latter means and locking the intermediate gears whereby to cause backward turning of the wheels by said springs, said means comprising a reciprocating structure and a series of levers operated thereby to lock said gears and having cams to first force the latter slightly backward.

17. The combination of register wheels, actuators therefor, one-way driving connections between the actuators and wheels, notched disks turning with the actuators, mutilated gears turning with the wheels and coacting with said disks, and means for effecting relative lateral displacement between the notched disks and the mutilated gears to permit backward turning of the wheels.

18. The combination of register wheels, actuators therefor, one-way driving connections between the actuators and wheels, notched disks turning with the actutors, mutilated gears coacting with said disks and compounded with pinions in gear with the wheels, a sliding shaft supporting said mutilated gears, and springs holding the latter in position on said shaft.

ALLEN A. HORTON.

Witnesses:
R. S. MIELERT,
J. A. BROPHY.