No. 681,240. Patented Aug. 27, 1901.

A. J. MEYER.

ADDING MACHINE.

Application filed Oct. 13, 1900.

(No Model.) 2 Sheets—Sheet 1.

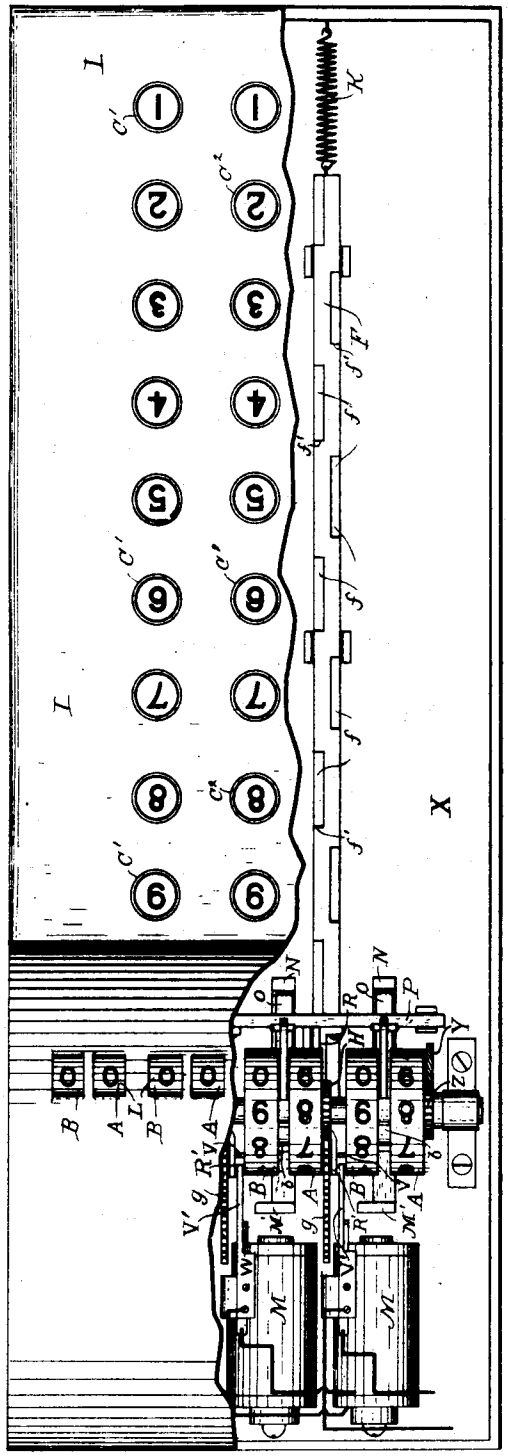

Fig. 1.

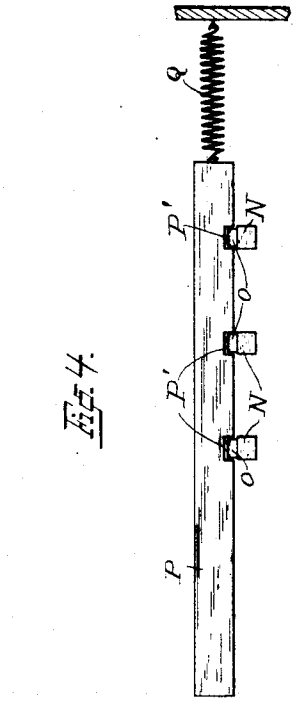

Fig. 4.

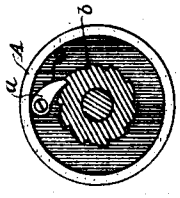

Fig. 3.

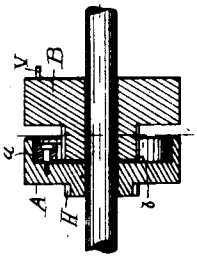

Fig. 2.

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No. 681,240. Patented Aug. 27, 1901.

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(No Model.) 2 Sheets—Sheet 2.

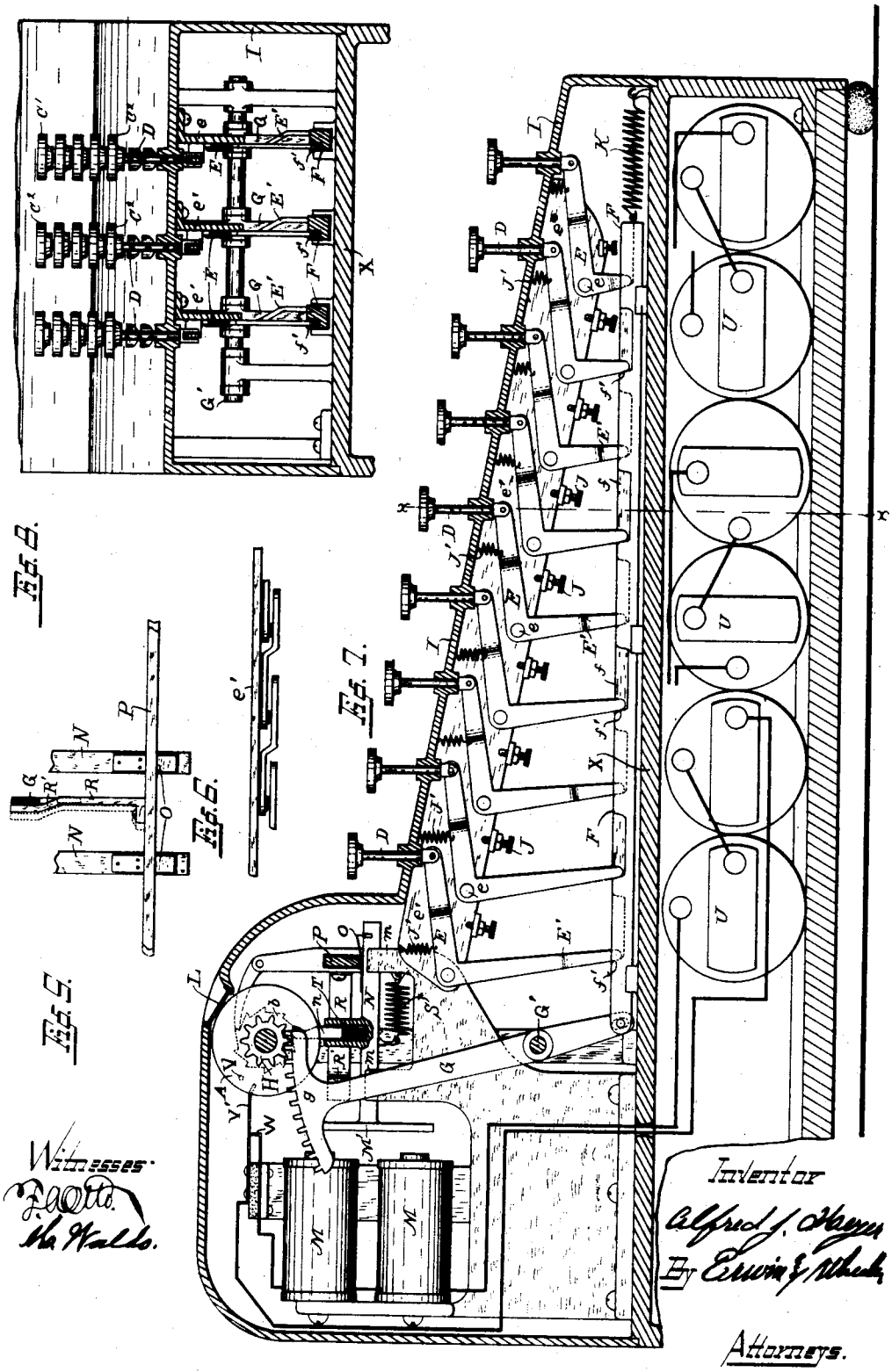

Fig. 8.

Fig. 6.

Fig. 7.

Fig. 5.

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

ALFRED J. MEYER, OF MILWAUKEE, WISCONSIN, ASSIGNOR OF ONE-FOURTH TO ALVIN W. KRAHN, OF SAME PLACE.

ADDING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 681,240, dated August 27, 1901.

Application filed October 13, 1900. Serial No. 33,017. (No model.)

To all whom it may concern:

Be it known that I, ALFRED J. MEYER, a citizen of the United States, residing at Milwaukee, county of Milwaukee, and State of Wisconsin, have invented new and useful Improvements in Registering and Computing Machines, of which the following is a specification.

My invention relates to improvements in registering and computing machines.

The objects of my invention are, first, to provide a simple and inexpensive means for securing differential movements from a series of keys each of which is actuated with equal pressure and a uniform stroke, and, second, to provide an automatic mechanism actuated from an independent source of power for imparting a step-by-step movement from one registering-wheel to another, the latter being actuated one step for each revolution of the former and said movement occurring in the intervals between the key movements, whereby the operation of carrying from units to tens, &c., will take place without interference with the movements imparted through the medium of the keys and without increasing the power necessary to be applied to the latter.

In the following description reference is had to the accompanying drawings, in which—

Figure 1 is a plan view of my invention with the casing partially broken away to show the interior mechanism. Fig. 2 is a detail sectional view of the counting and registering wheels. Fig. 3 is a side view of the pawl-and-ratchet mechanism for imparting motion from a counting-wheel to its corresponding registering-wheel. Fig. 4 is a front view in detail of the trip mechanism. Fig. 5 is a top view of one section of the same. Fig. 6 is a top view of a pair of differentiating-levers. Fig. 7 is a vertical longitudinal sectional view of the entire machine. Fig. 8 is a cross-sectional view drawn on line X X of Fig. 7.

Like parts are identified by the same reference characters throughout the several views.

The counting-wheels A and registering-wheels B are arranged in sets, as best shown in Fig. 2, the registering-wheel being provided with a ratchet *b*, in which a pawl *a*, mounted on the counting-wheel, is adapted to engage. In the construction shown there are three sets of these wheels, each set being arranged to be actuated from any one of a longitudinal row of keys on the keyboard of the machine. The row of keys C′ at the right hand in Fig. 1 are used for registering units, being connected with the right-hand counting and registering wheels. The adjacent row of keys C^2 represent tens, while the next row of keys would represent hundreds, &c. Motion is communicated, Fig. 7, from any one of a series or row of keys to its corresponding counting-wheel through the key-stem D, the elbow-lever E, connected therewith, sliding bar F, sector-lever G, toothed sector *g*, and pinion H, the latter being fast on the counting-wheel. A corresponding motion is simultaneously communicated from the counting-wheel to the registering-wheel through the pawl *a* and ratchet *b*. It will be observed that an elbow-lever is connected with each key of the row or series, the levers being pivotally secured at *e* to a flange *e′*, depending from the inclosed cover I of the machine. The upper arms of the elbow-levers are of uniform length throughout the series, while the lower arms are of graduated or increasing length, beginning with the shortest arm at the forward or lower end of the series, which is connected with the units-key, and ending with the longest arm at the upper or rear end of the series, which is connected with the key bearing the number "9." These elbow-levers are loosely engaged at their lower ends in an open slot or recess *f* in the bar F and are arranged to abut against a shoulder *f′*, whereby the bar may be actuated by any one of the elbow-levers without communicating motion to any of the other levers. If desired, each alternate lever may be offset at its lower end, as shown at E′ in Fig. 8, the recesses *f* in the bar F being in such case located alternately on opposite sides of the bar, as shown in Fig. 1, thus allowing for a stroke of such bar longer than the space between any two adjacent levers without communicating motion from one to the other. The downward-projecting arms of the levers E may, if desired, be made in exact proportion to the required length of stroke—*i. e.*, the arm of the second lever may be twice as long as the first and that of the third

lever three times as long as the first, &c.—in which case the upper arms of the levers may all be made of equal length, and the keys connected thereto may also have an equal stroke or length of movement. Set-screws J are used to limit the downward stroke of the elbow-levers and keys, and springs J′, connecting the upper arms of the elbow-levers with the cover I, are arranged to equalize the pressure required to actuate the keys. In the drawings these springs are located at successively-decreased distances from the lever-fulcrums, beginning with the units-lever at the front end of each series and ending with the "9" lever at the rear or inner end of the series. They are also graduated in length, the shortest spring being at the front and the longest at the rear end of the series. It will be understood, however, that any other means for applying a resistance to the movement of the levers in inverse proportion to the motion transmitted by them to the bar F will be within the scope of this portion of my invention.

It will be observed that the lever G is fulcrumed at a point G′ below its center, whereby the movement of the keys and elbow-levers is not only multiplied in the sector *g* and counting-wheel, but the differential or increased movement caused by one elbow-lever over another is also multiplied, thus enabling me with a short movement of the keys and a slight difference in the length of the lower arm of the elbow-levers to secure not only the desired movement of the counting-wheel, but also a sufficient difference of movement as imparted by the different elbow-levers to move the counting-wheel the desired distance in each case. It will of course be understood that both the counting and registering wheels are provided with peripheral numbers ranging from "0" to "9," inclusive, as is customary in adding and registering machines.

With the construction shown it is obvious that the movement of any key may be communicated to move the counting-wheel a distance equal to the peripheral distance on said wheel between the "0" point and the number corresponding with the number of the actuated key. The "0" point of the counting-wheel is preferably located underneath the sight-glass L, so that a number on the counting-wheel corresponding with the number of the actuated key will appear underneath the sight-glass as soon as the key is struck, thus enabling the user to verify the work. When the key is released from downward pressure, the spring K retracts the bar F, and the motion of the latter is communicated through the elbow-lever of the depressed key to raise the latter to its normal position and also through the lever G, sector *g*, and pinion H to retract the counting-wheel, while the registering-wheel is allowed to remain in its advanced position.

M is an electromagnet, one of which is located in the rear of each registering-wheel, except that occupying the units position.

M′ is an armature suitably supported by a bar N, which is slidably mounted in frame-bearings *m*. This bar N is provided with a spring-catch O near its free end, which is adapted when the armature is attracted by the magnet to yield sufficiently to permit its being drawn underneath a latch-bar P. This latch-bar P is provided with notches P′ and is normally held, by means of a spring Q, with the notches in a position of registry with the spring-catches O, the notches being of such depth that the catches O are free to move through them in either direction without engaging the bar. The bar P is, however, provided with arms R, projecting rearwardly and in the path of the levers G, the free end of each bar being offset at R′ and passing in close proximity to one side of its corresponding lever G. The offset portion R′ presents an angular surface in the path of the lever G, so that when the latter is actuated it engages the surface of the portion R′ and forces the bar R and latch-bar P laterally, so that the notches P′ are out of registry with the catch O. Assuming that the magnet be then energized, the movement of the armature attracted thereby will draw the bar N forwardly, the catch O yielding to pass under the bar P, which will then engage the vertical face of the catch and prevent the retraction of the bar N and armature until all the levers G are again in their normal positions, when the spring Q will restore the bar P to its normal position, and the bar N, with the armature, will then be retracted by means of a spring S, the catch O being permitted to pass through the notch P′ in registry therewith. It is therefore obvious that while the armature of any magnet may be attracted at any time during the forward movement of any one or all of the levers G the return movement of the armature will not take place until all the levers G are returned to their normal positions.

It will be observed that the bar N is provided with a pawl *n*, adapted to be held by a spring T in engagement with a ratchet-wheel *b*, which is rigidly attached to one face of each registry-wheel. When the armature M′ is attracted by the magnet, this pawl is drawn rearwardly and engages in the next succeeding notch of the ratchet-wheel, so that when the armature is retracted through the medium of the spring S after the latch-bar P has been permitted to resume its normal position the pawl *n* will move the ratchet-wheel *b* and its corresponding registering-wheel one step, and as the distance between the teeth of the ratchet-wheel corresponds with the distance between the numbers on the registering-wheel it is evident that such registering-wheel will have been advanced one number.

U represents batteries for energizing the electromagnets, one battery being preferably provided for each magnet. Each of the registering-wheels is provided with a pin V, which

is arranged for contact with a spring-electrode V′ as the registering-wheel completes its revolution. The electrode V′ is depressed by the pin into contact with an electrode W of opposite polarity, whereby the circuit of one of the batteries is closed through the magnet M pertaining to the next succeeding registering-wheel, the magnet being thus energized to attract its armature and actuate the trip mechanism connected therewith, as above explained. The electrode V′ being of spring metal, it will yield sufficiently to permit the pin V to pass, whereupon the electrode V′ will return to its normal position out of contact with the electrode W, thus breaking the circuit and deënergizing the magnet.

Reviewing the operation of the device and assuming that the number "666" has been registered and that it is desired to add the number "896" thereto, the operation will be as follows: The key bearing the number "6" in the units column or series at the right hand, as shown in the drawings, is selected, together with the key bearing the number "9" in the tens-column and the key bearing the number "8" in the hundreds-column. When the key bearing the number "6" in the units-column is struck, motion will be communicated through its respective elbow-lever, the bar F, and the intervening connections to rotate both the counting-wheel and registering-wheel six steps—*i. e.*, a distance equal to the space occupied by six of the numbers on its periphery—and as the counting-wheel starts at "0" it will of course be rotated to exhibit the number "6," while the registering-wheel, starting at "6," (the amount of the previous registry,) will be rotated to exhibit the number "2." Similarly the counting-wheel pertaining to the tens-column will be actuated by pressure upon the key bearing the number "9" to exhibit the peripheral number "9" under the sight-glass L, while its corresponding registering-wheel will be advanced nine steps beyond the number "6" and will exhibit the number "5." The key bearing the number "8" in the units-column will likewise communicate motion to rotate its corresponding counting-wheel to exhibit the number "8," while the registering-wheel actuated thereby will exhibit the number "4." As the registering-wheels in each case have been caused to revolve beyond the "0" point, it is obvious that the pin V of each registering-wheel will have engaged its corresponding contact-arm of the electromagnet pertaining to the next succeeding registering-wheel, thus setting the trip mechanism of the wheels representing the tens, hundreds, and thousands columns, respectively, through the medium of the armatures of said magnets. As soon as the pressure is removed from the three keys struck the levers G of each column will be restored to their normal positions by means of the spring K retracting the bar F, whereupon the latch-bar P will also be retracted by the spring Q bringing the notches P′ into registry with the catches O, when the armature-bars N will be retracted with the armatures of each of the electromagnets and each of the registering-wheels from the tens-column upward will be advanced one step. It is obvious that the same result will be obtained whether the keys representing the number "896," as above explained, are struck simultaneously or independently, and if independently the result will be attained regardless of the order in which the keys are struck, inasmuch as the carrying is accomplished independently and after the keys have been restored to their normal positions.

If desired, a record of the various transactions may be printed by attaching any ordinary form of printing mechanism to the apparatus shown and described; but as such printing mechanism is common to nearly all adding-machines no further description or illustration of the same is necessary.

The inclosing case is formed with the base portion X and a cover I. The keys and elbow-levers are supported from the cover I, while the remainder of the machine is supported from the base. I am therefore enabled to remove the cover I at pleasure, as there are no fixed connections between the elbow-levers and bar F. When the cover is thus removed, all portions of the machine are easily reached without further separation of the parts.

While I have illustrated a three-column machine with four registering-wheels, it will be understood that any number of columns and wheels may be employed. The last registering-wheel is readjusted to "0" position by a rack Y and pinion Z. The other wheels may be adjusted by operating the keys.

Having thus described my invention, what I claim as new, and wish to secure by Letters Patent, is—

1. The combination with suitable registering-wheels; a series of elbow-levers having alined pivotal fulcrums, with offset overlapping arms of equal length, and other arms graduated in length throughout the series; alined keys secured to the ends of the offset arms; a sliding bar adapted to be engaged and independently actuated by each of said levers; a connecting-lever, having arms of unequal length, with its shorter arm attached to said sliding bar; and motion-transmitting gearing connecting the longer arm of said lever with a registering-wheel, whereby the motion of the key-lever and bar is multiplied or increased by the connecting-lever.

2. The combination with suitable registering-wheels; a series of elbow-levers having alined pivotal fulcrums with offset overlapping arms of equal length throughout the series; equalizing-springs attached to the arms of said levers at unequal distances from the fulcrums, and connected with fixed points of support; and motion transmitting and multiplying mechanism connecting said graduated arms with one of the registering-wheels.

3. The combination with a series of registering-wheels; a series of differentiated actuating-levers and motion-transmitting connections for each wheel; trip mechanism for advancing said registering-wheels step by step; means for setting the trip mechanism of one registering-wheel from an adjacent wheel; and trip-holding devices supported by the trip mechanism in a position to be engaged and held by the motion-transmitting connections when the trip is set, and said connections are out of normal position of rest.

4. The combination with suitable registering-wheels; a series of levers, each provided with an arm differing in length from those of any other lever in the series; suitable connections for communicating motion from any one of said levers to the registering-wheels; and means for applying a resistance to the movement of the levers, in inverse ratio to the length of the arms, whereby the pressure required to actuate the levers is equalized.

5. The combination with a series of registering-wheels; a series of keys for each wheel; means for communicating motion from any of the keys to its corresponding registering-wheel; independently-actuated trip mechanisms for advancing said registering-wheels step by step; means for setting the trip mechanism of one registering-wheel from an adjacent wheel, and means, controlled by the keys, for holding said trip mechanism and releasing the same on completion of the key-stroke in two directions.

6. The combination with a series of registering-wheels; a series of primary actuating connections for each wheel; trip mechanism for additionally advancing said wheels step by step; means, controlled by one wheel, for setting the trip mechanism of an adjacent wheel; and means controlled by the primary actuating connections of all the wheels for preventing the release of said trip mechanism until said primary connections are all substantially in normal position.

7. The combination with a series of registering-wheels; a series of primary actuating connections for each wheel; trip mechanisms for additionally advancing said wheels step by step; electromagnetic means for setting said trip mechanisms; means, controlled by one registering-wheel, for closing an electric circuit through an electromagnet pertaining to the trip mechanism of an adjacent wheel; and means controlled by said primary actuating connections, for regulating the movement of the trip mechanisms in one direction.

8. The combination with a series of registering-wheels; a series of counting-wheels, arranged to communicate motion in one direction to the registering-wheels; a graduated series of levers for each counting-wheel; a movable bar for each series of levers, and adapted to be actuated by any one of said levers; and a connecting-lever secured to said movable bar, and having motion-transmitting connections with the counting-wheel.

9. The combination with a series of registering-wheels; a series of counting-wheels, arranged to communicate motion in one direction to the registering-wheels; a graduated series of levers for each counting-wheel; a sliding bar for each series of levers, and adapted to be actuated by any one of said levers; and a connecting-lever secured to said sliding bar, and having gear connections with the counting-wheel; together with a series of trip mechanisms adapted to advance the respective registering-wheels step by step; means for setting the trip mechanisms for one wheel from an adjacent wheel, and means, controlled by the connecting-levers, for regulating the movement of the trip mechanisms.

10. The combination with registering-wheels, adapted to be actuated independently; of electromagnetic mechanism for communicating movement from one wheel to another, at predetermined-distance intervals, and means for limiting such movement to the intervals between the independent wheel movements.

11. The combination with registering-wheels adapted to be actuated independently; of means for mechanically actuating said wheels either simultaneously or separately; electromagnetic mechanism for communicating movement from one wheel to another at predetermined-distance intervals; and means for limiting such movement to the intervals between the independent wheel movement.

12. The combination with registering-wheels adapted to be actuated independently; of means for actuating the same, either simultaneously or separately; a trip mechanism for advancing said registering-wheels step by step; electromagnetic means, controlled by one registering-wheel, for setting the trip mechanism of an adjacent wheel, together with means for releasing the trip mechanism.

13. The combination with registering-wheels, of means for manually actuating the same; ratchet-wheels connected with the registering-wheels; a spring-retracted bar, provided with a spring-actuated pawl adapted to engage the ratchet of each wheel; an elastic catch secured to said bar; a latch-bar arranged transversely of the pawl-supporting bars in the path of the catches, and provided with notches, adapted, when in registry with said catches, to permit the passage of the latter in either direction; means, controlled by one registry-wheel, for actuating the pawl-supporting bar of an adjacent wheel against the tension of its retraction-spring; and means for shifting the latch-bar to retain or release the catches.

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

ALFRED J. MEYER.

Witnesses:
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LEVERETT C. WHEELER.