No. 789,408. PATENTED MAY 9, 1905.

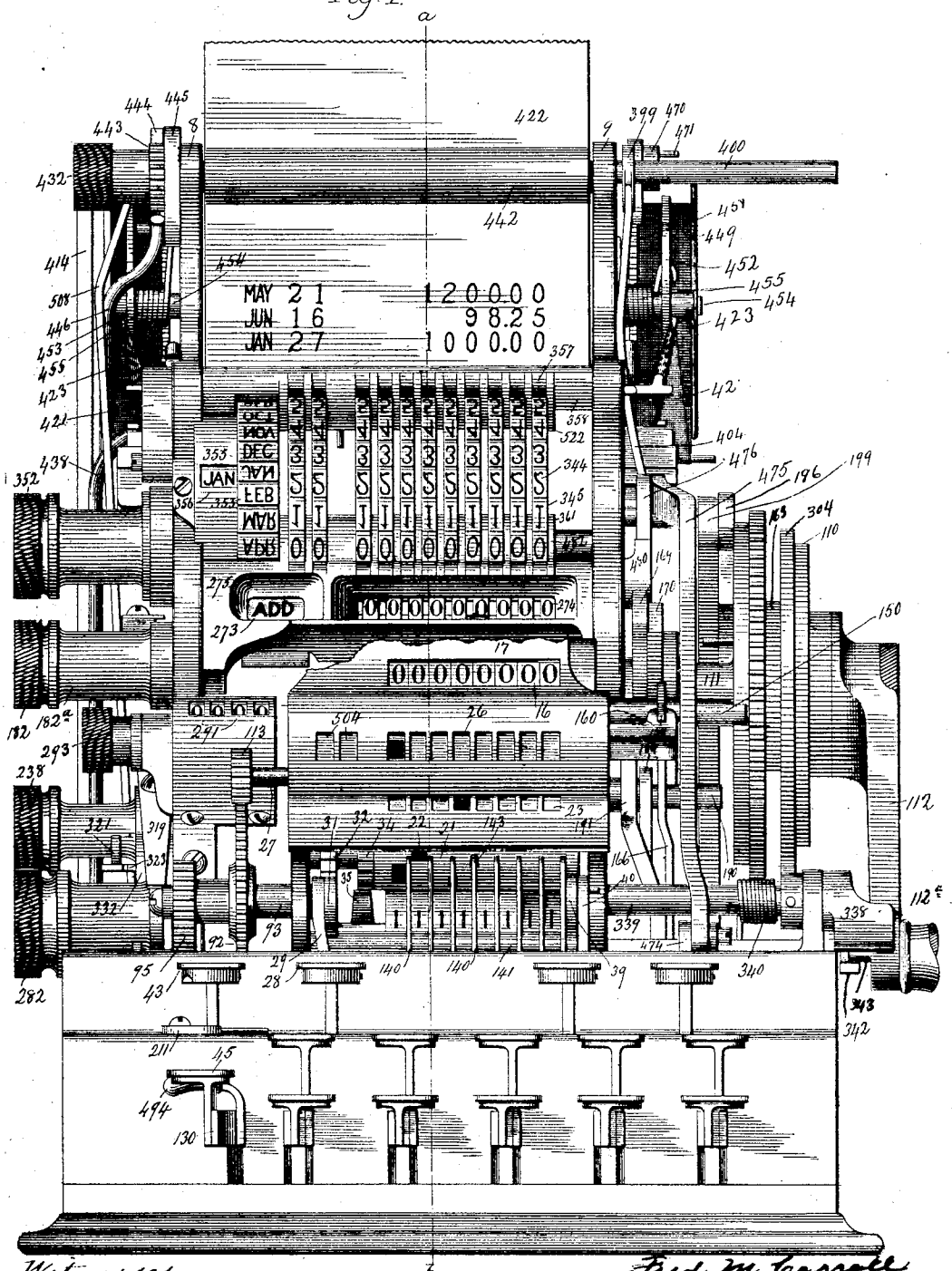
F. M. CARROLL.

COMPUTING MACHINE.

APPLICATION FILED MAR. 18, 1901.

17 SHEETS—SHEET 1.

Fig. 1.



Witnesses.
J. St. Shumway
Lillian D. Kelsey.

Fred M. Carroll
Inventor
By attys Seymour & Earle

No. 789,408. PATENTED MAY 9, 1905.

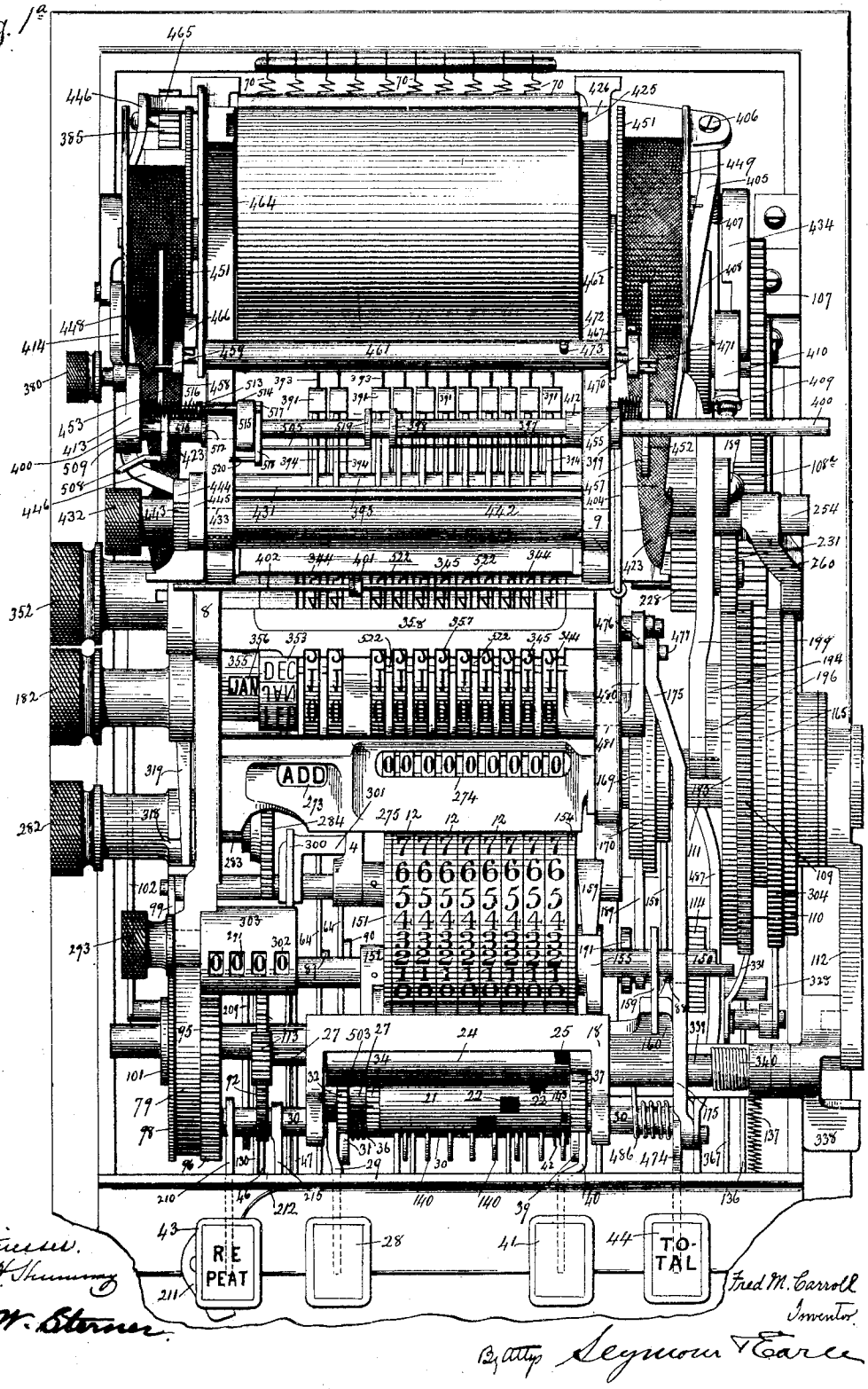
F. M. CARROLL.

COMPUTING MACHINE.

APPLICATION FILED MAR. 18, 1901.

17 SHEETS—SHEET 2.

Fig. 1a



Witnesses.
J. A. Shumway
J. W. Storer

Fred M. Carroll
Inventor
By Atty Seymour & Earle

No. 789,408. PATENTED MAY 9, 1905.

F. M. CARROLL.

COMPUTING MACHINE.

APPLICATION FILED MAR. 18, 1901.

17 SHEETS—SHEET 3.

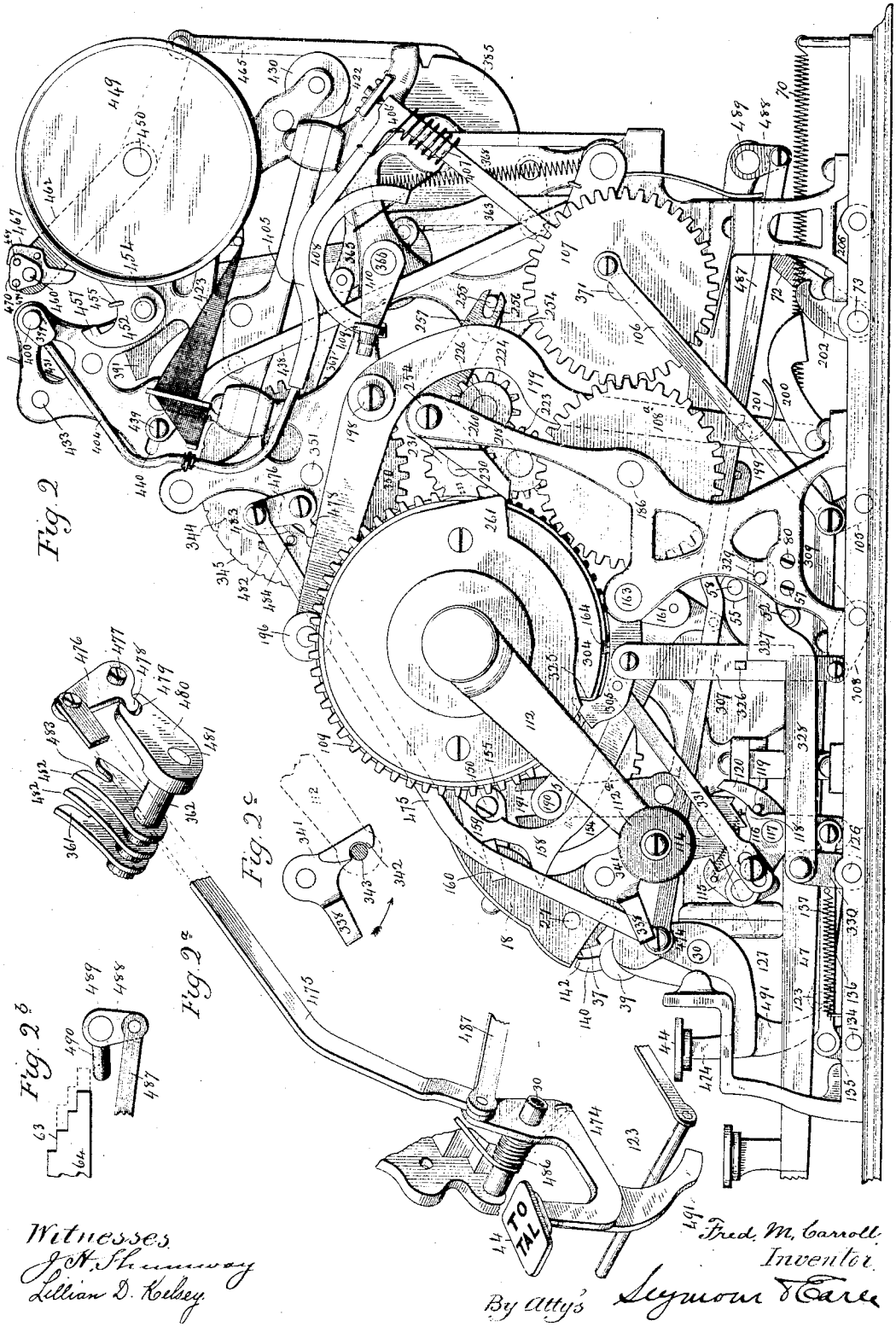


Fig. 2.

Fig. 2c.

Fig. 2a.

Fig. 2b.

Witnesses
J. N. Shumway
Lillian D. Kelsey.

Fred. M. Carroll
Inventor
By Atty's Seymour & Earle

No. 789,408. PATENTED MAY 9, 1905.

F. M. CARROLL.

COMPUTING MACHINE.

APPLICATION FILED MAR. 18, 1901.

17 SHEETS—SHEET 4.

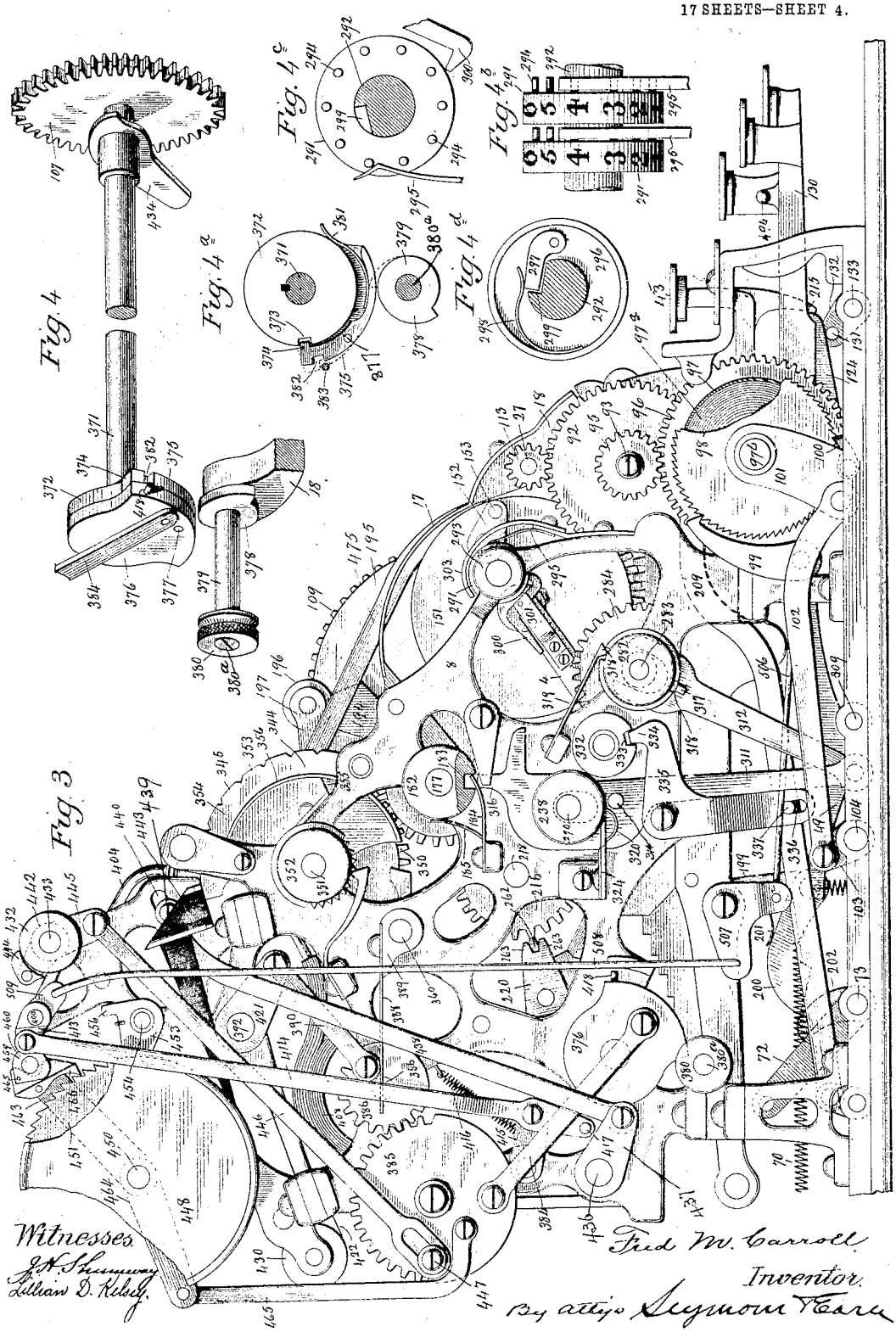


PHOTO LITHOGRAPHED BY SACKETT & WILHELMS LITHO. & PTG. CO. NEW YORK.

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F. M. CARROLL.

COMPUTING MACHINE.

APPLICATION FILED MAR. 18, 1901.

17 SHEETS—SHEET 5.

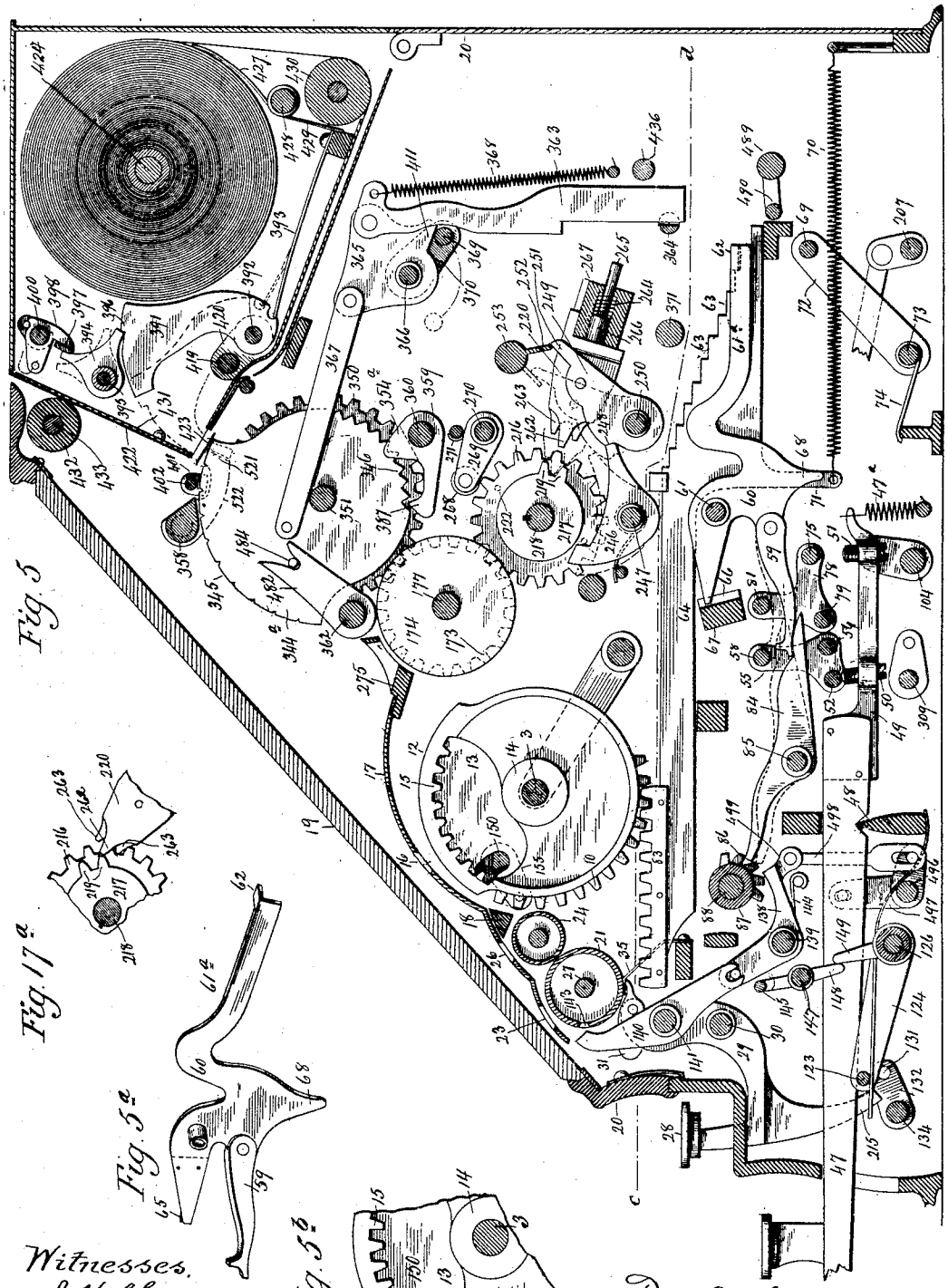


Fig. 5

Fig. 17a

Fig. 5a

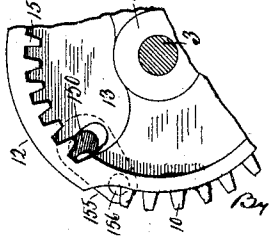


Fig. 5b

Witnesses.

J. H. Shumway.

Lillian D. Kelsey.

Fred. M. Carroll,

Inventor.

By attys. Seymour & Earle

No. 789,408. PATENTED MAY 9, 1905.

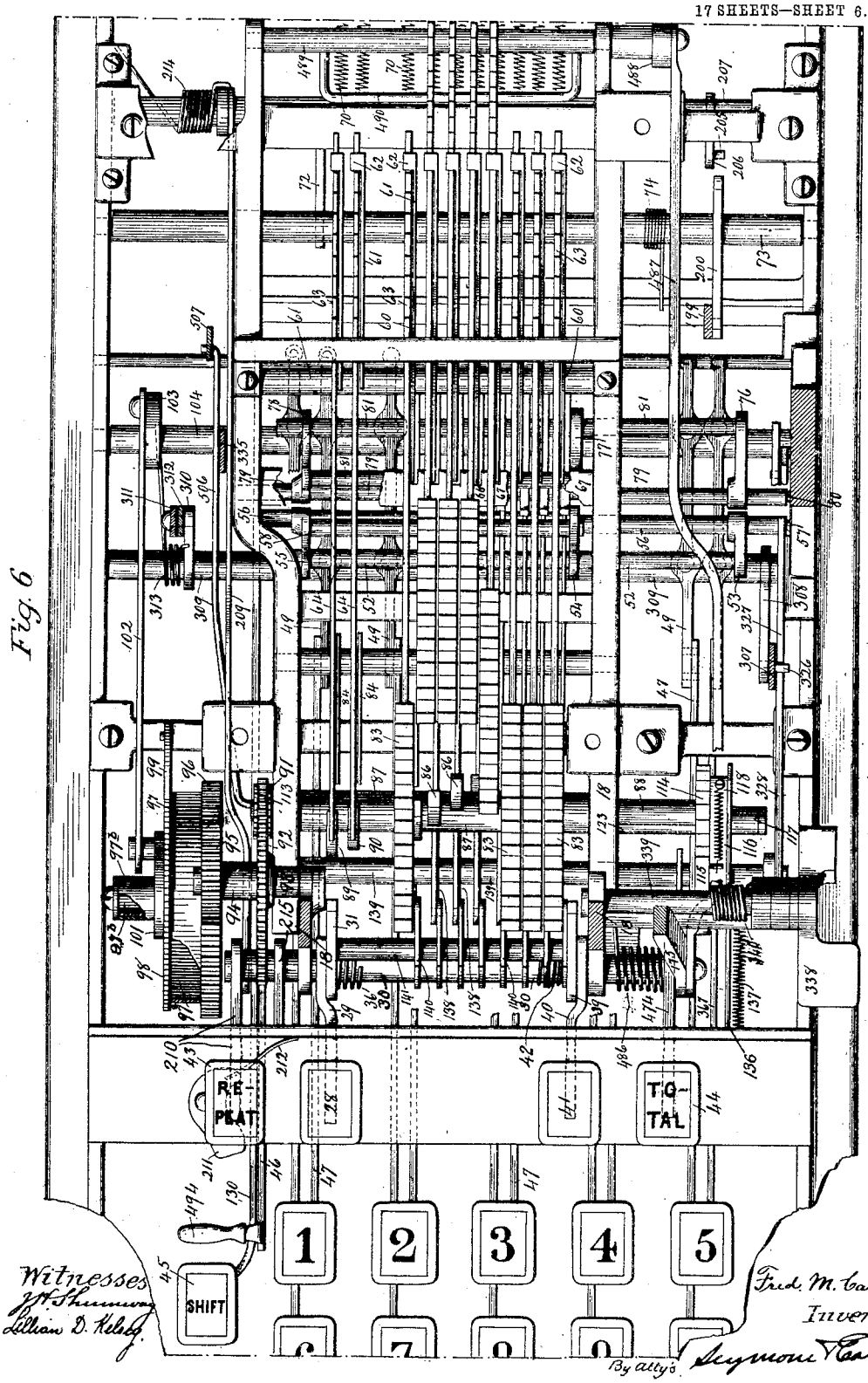
F. M. CARROLL.

COMPUTING MACHINE.

APPLICATION FILED MAR. 18, 1901.

17 SHEETS—SHEET 6.

Fig. 6



Witnesses
J. H. Shumway
Lillian D. Kelsey

Fred. M. Carroll
Inventor
By atty's Seymour Earle

No. 789,408. PATENTED MAY 9, 1905.

F. M. CARROLL.

COMPUTING MACHINE.

APPLICATION FILED MAR. 18, 1901.

17 SHEETS—SHEET 7.

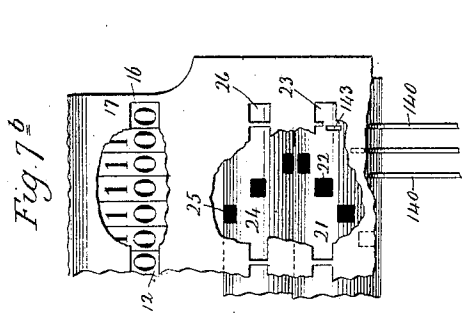


Fig. 7b

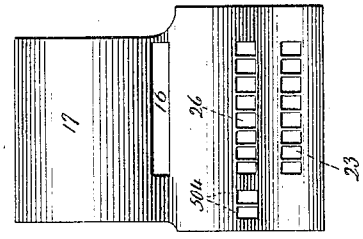


Fig. 7c

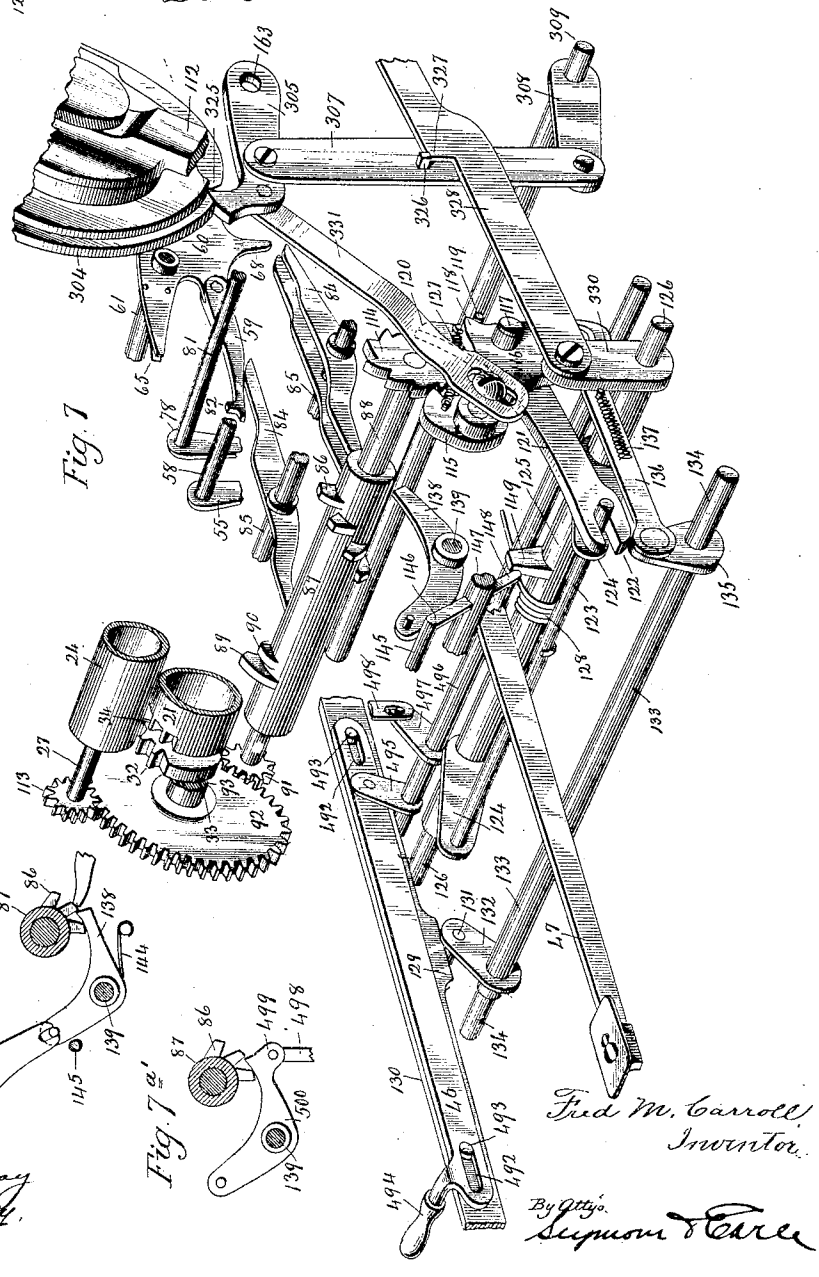


Fig. 7

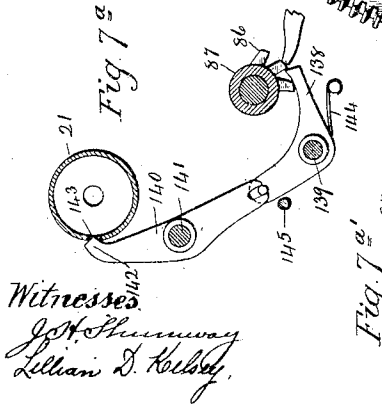


Fig. 7a

Fig. 7a'

Witnesses.
J. H. Shumway
Lillian D. Kelsey.

Fred M. Carroll
Inventor.
By Atty's.
Seymour & Earle

No. 789,408. PATENTED MAY 9, 1905.

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17 SHEETS—SHEET 8.

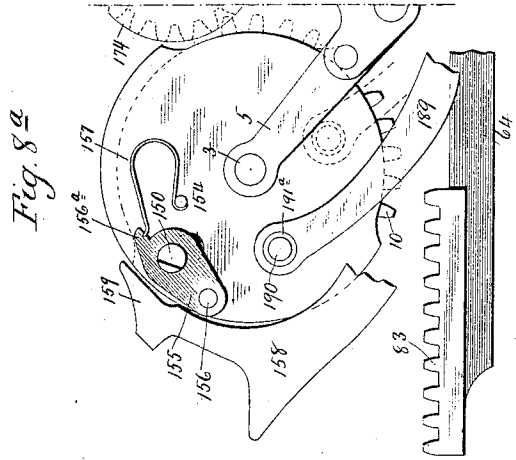


Fig. 8a

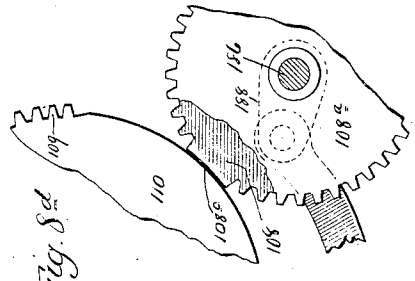


Fig. 8d

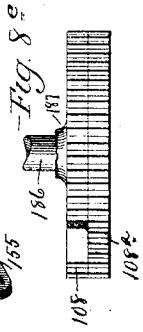


Fig. 8e

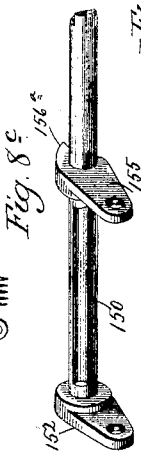


Fig. 8c

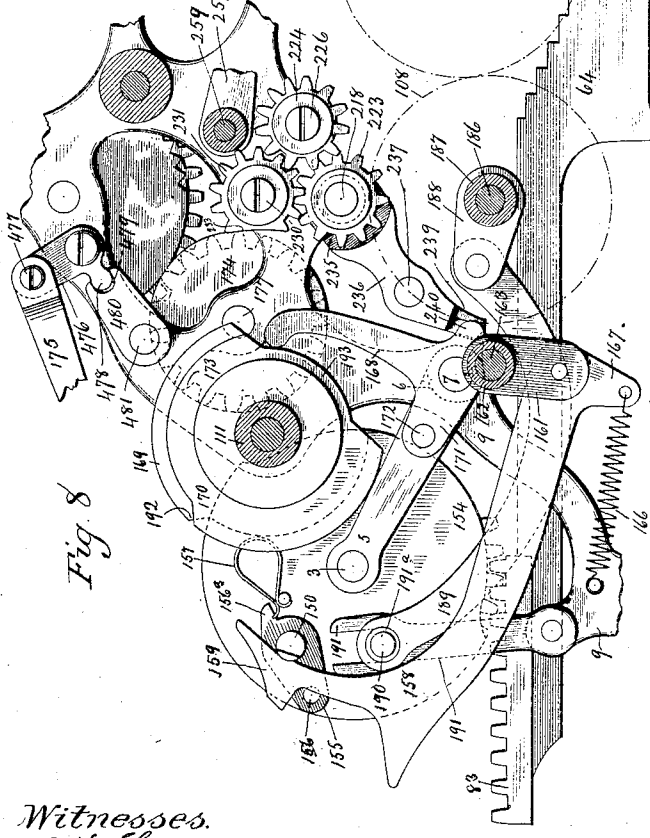


Fig. 8

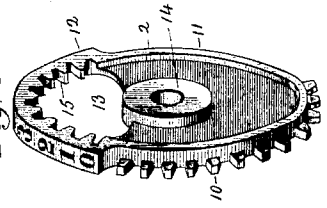


Fig. 8b

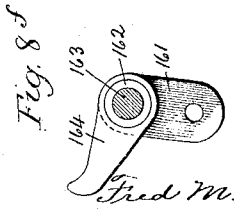


Fig. 8f

Witnesses.
J. F. Shumway
Lillian D. Kelley.

Fred M. Carroll.
Inventor
By Atty's Seymour & Earle

No. 789,408. PATENTED MAY 9, 1905.

F. M. CARROLL.

COMPUTING MACHINE.

APPLICATION FILED MAR. 18, 1901.

17 SHEETS—SHEET 9.

Fig 8 9

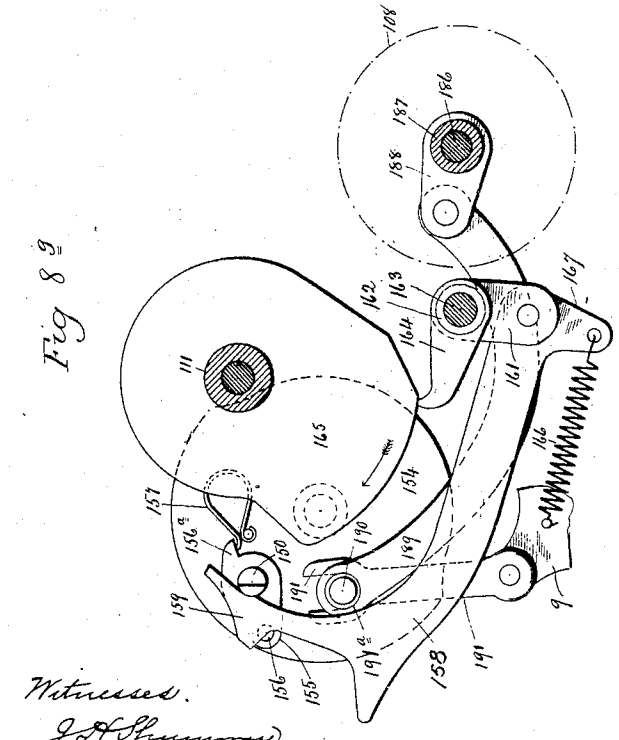
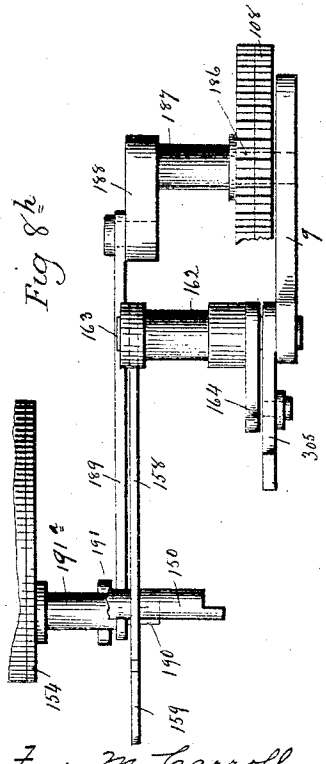


Fig 8 ½



Witnesses.

J. A. Shumway.

J. W. Sterner.

Fred. M. Carroll

Inventor.

By atty Seymour & Earle

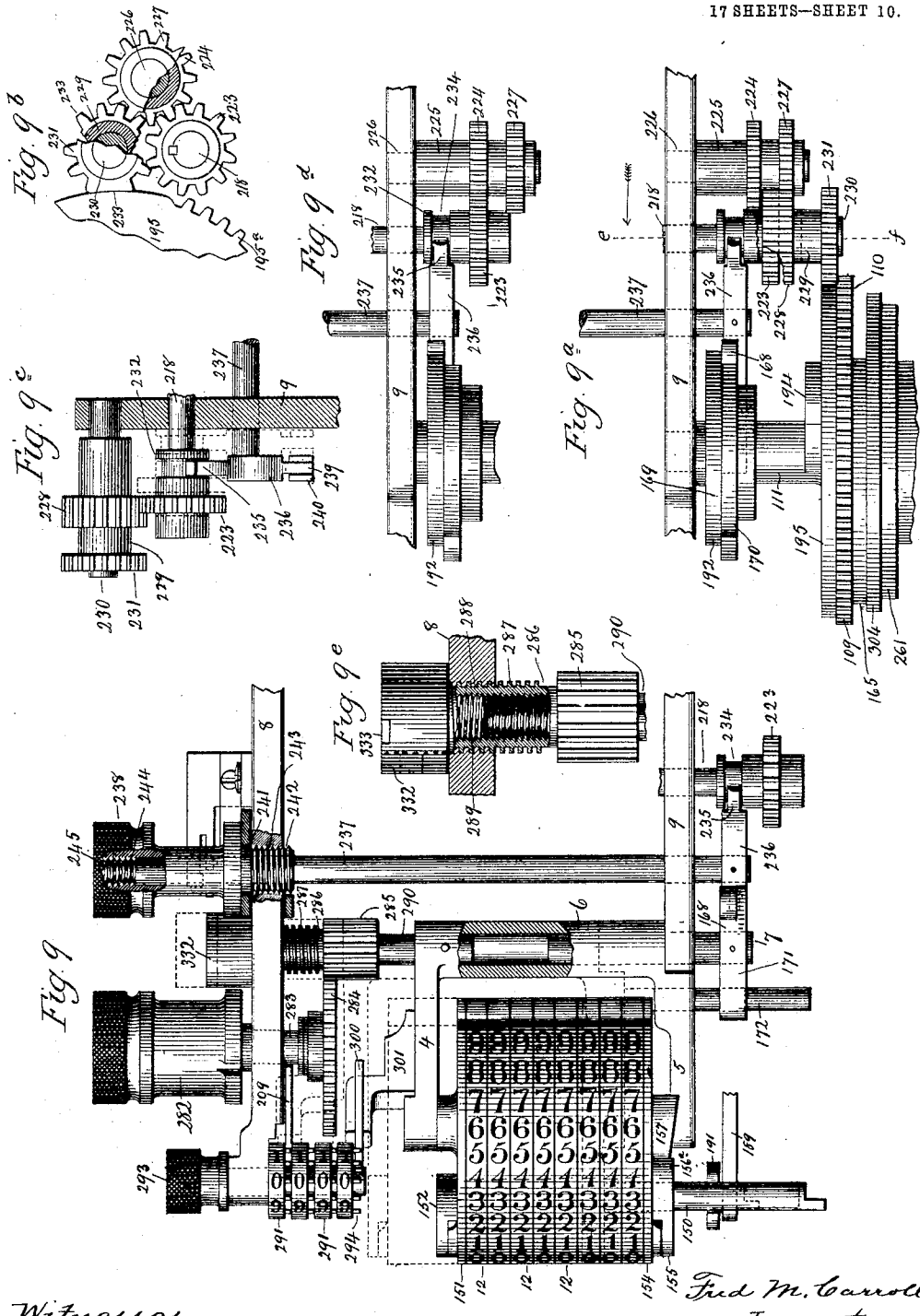
No. 789,408. PATENTED MAY 9, 1905.

F. M. CARROLL.

COMPUTING MACHINE.

APPLICATION FILED MAR. 18, 1901.

17 SHEETS—SHEET 10.



Witnesses.
J. H. Shumway
Lillian D. Kelsey.

Fred M. Carroll,
Inventor.

By Attys. Seymour & Earle

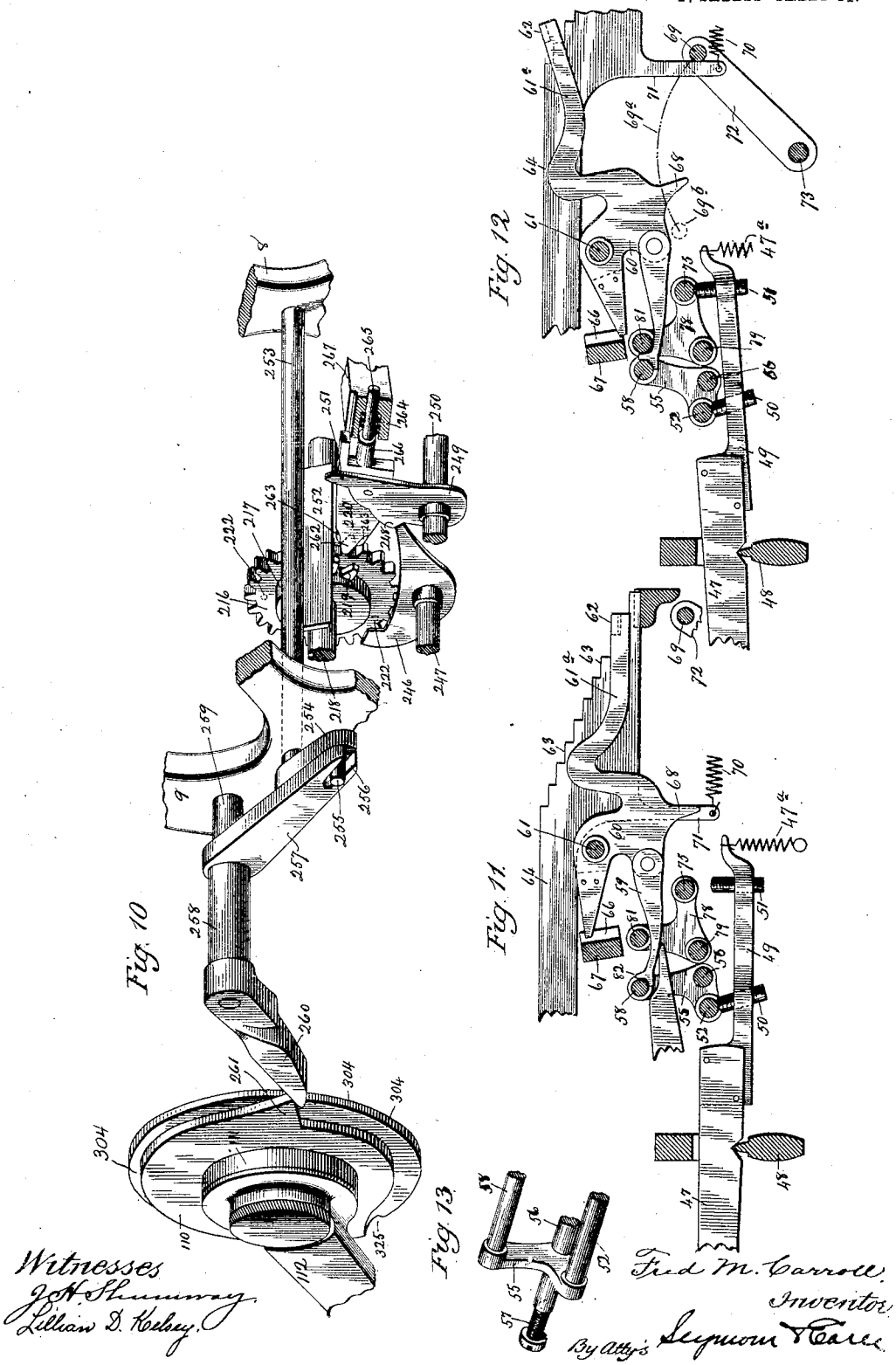
No. 789,408. PATENTED MAY 9, 1905.

F. M. CARROLL.

COMPUTING MACHINE.

APPLICATION FILED MAR. 18, 1901.

17 SHEETS—SHEET 11.



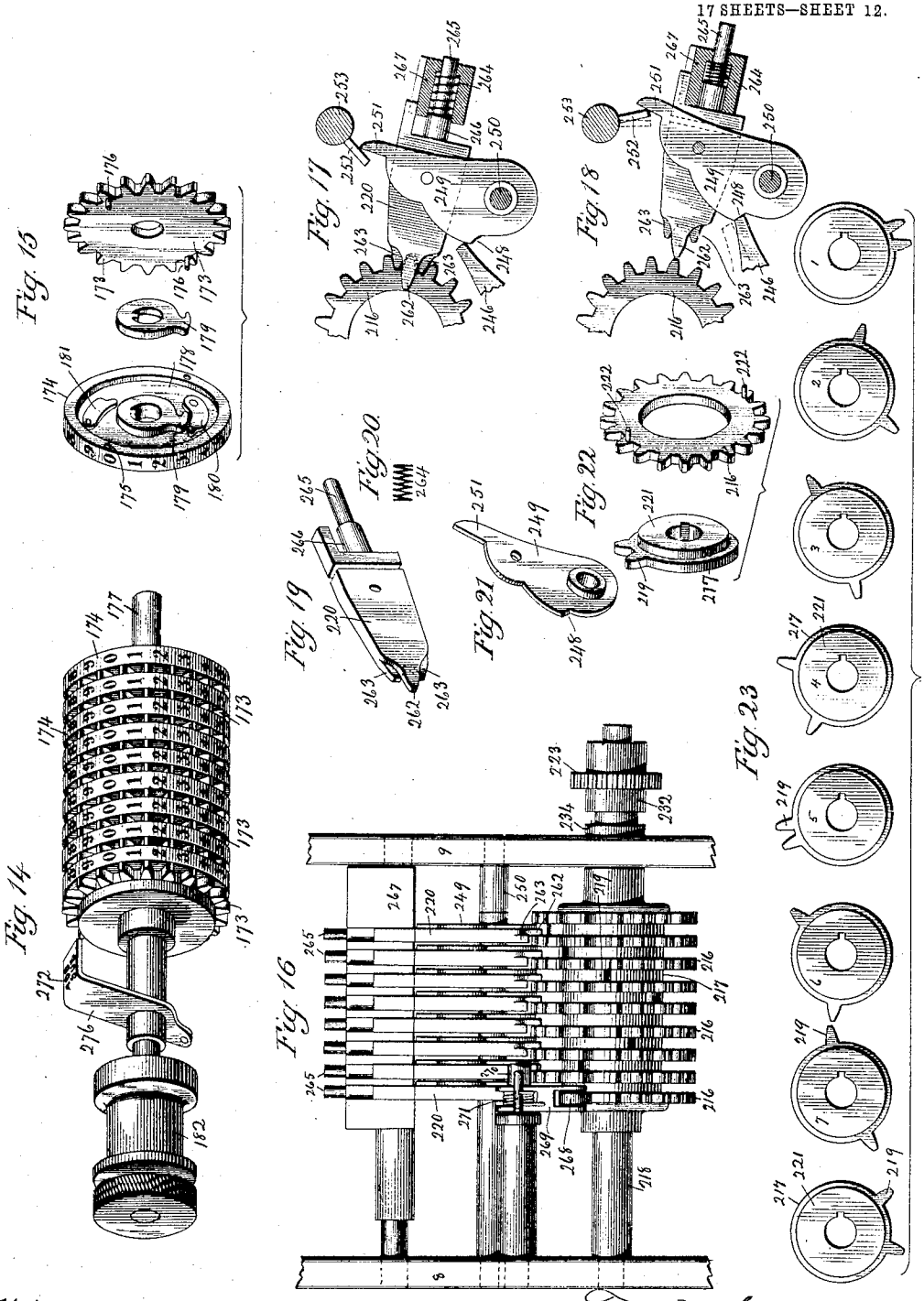
No. 789,408. PATENTED MAY 9, 1905.

F. M. CARROLL.

COMPUTING MACHINE.

APPLICATION FILED MAR. 18, 1901.

17 SHEETS—SHEET 12.



Witnesses.
J. F. Shumway
Lillian D. Kelley.

Fred M. Carroll.
Inventor.
By Atty's. Seymour & Earle

No. 789,408. PATENTED MAY 9, 1905.

F. M. CARROLL.

COMPUTING MACHINE.

APPLICATION FILED MAR. 18, 1901.

17 SHEETS—SHEET 13.

Fig. 26

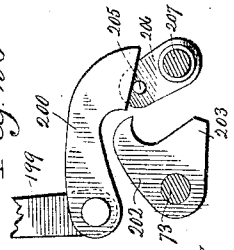


Fig. 27

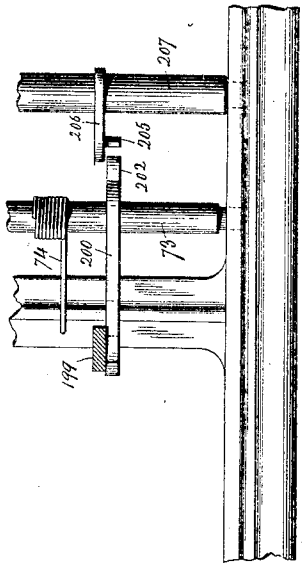


Fig. 25

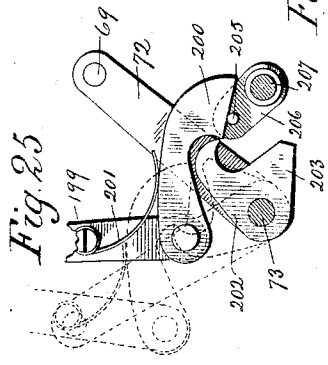
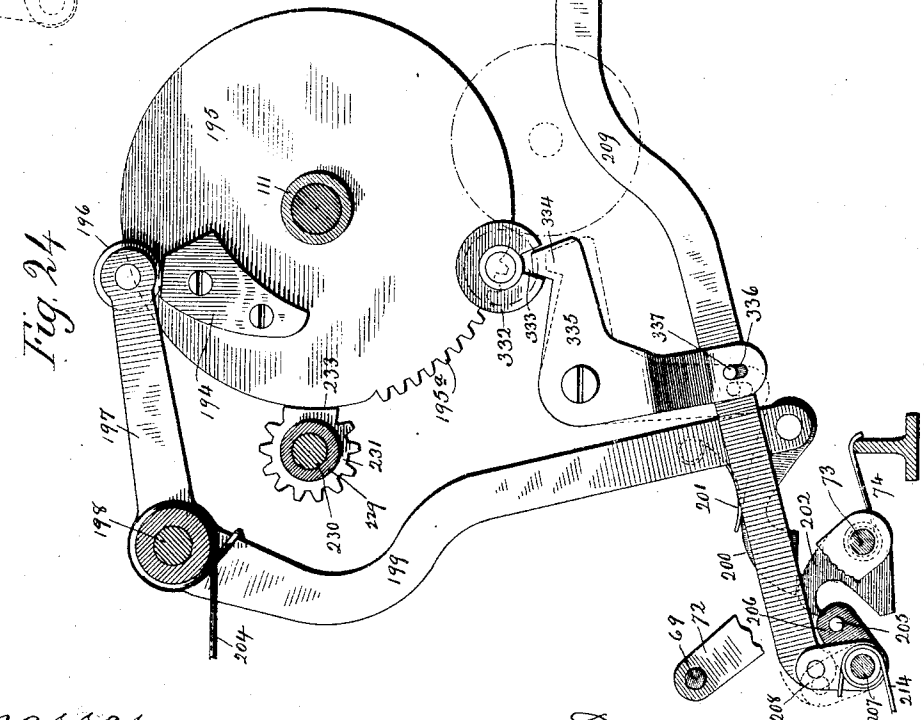


Fig. 24



Witnesses.

J. H. Shumway.

Lillian D. Kelley.

Fred M. Carroll,

Inventor.

By Atty's Seymour & Earle.

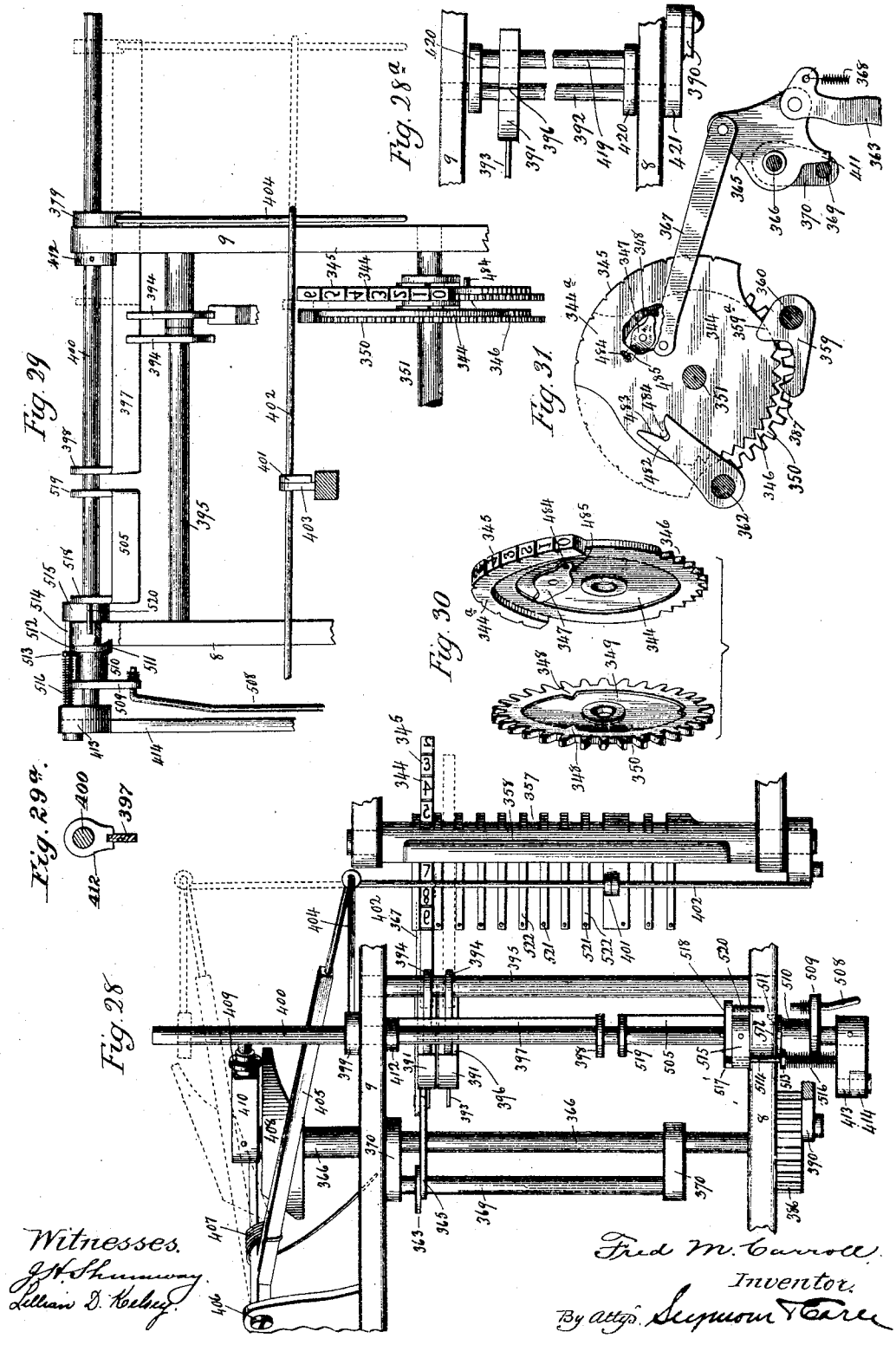
No. 789,408. PATENTED MAY 9, 1905.

F. M. CARROLL.

COMPUTING MACHINE.

APPLICATION FILED MAR. 18, 1901.

17 SHEETS—SHEET 14.



Witnesses.
J. H. Shumway.
Lillian D. Kelley.

Fred M. Carroll.
Inventor.
By attys. Seymour & Earle

No. 789,408. PATENTED MAY 9, 1905.

F. M. CARROLL.

COMPUTING MACHINE.

APPLICATION FILED MAR. 18, 1901.

17 SHEETS—SHEET 15.

Fig. 33

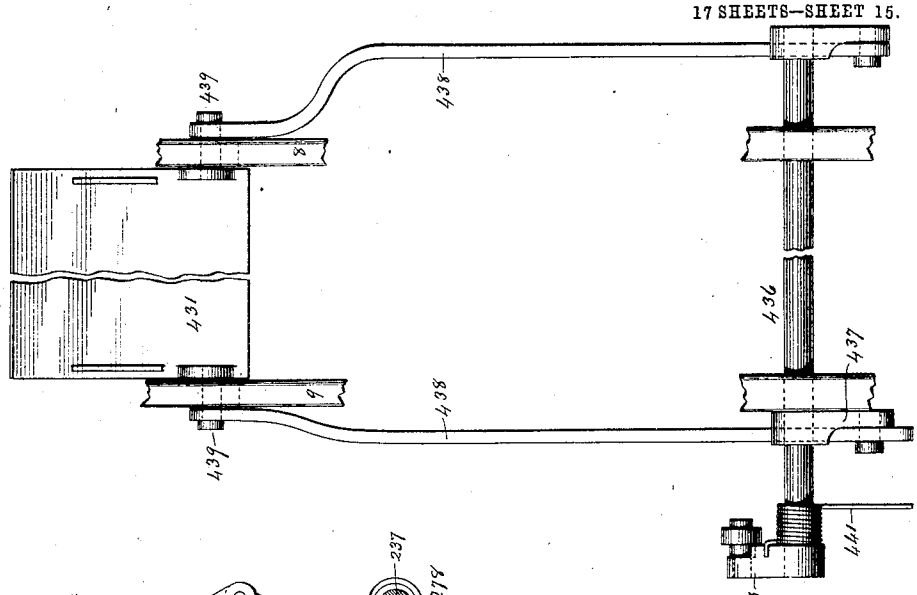
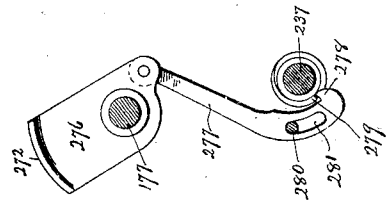


Fig. 34



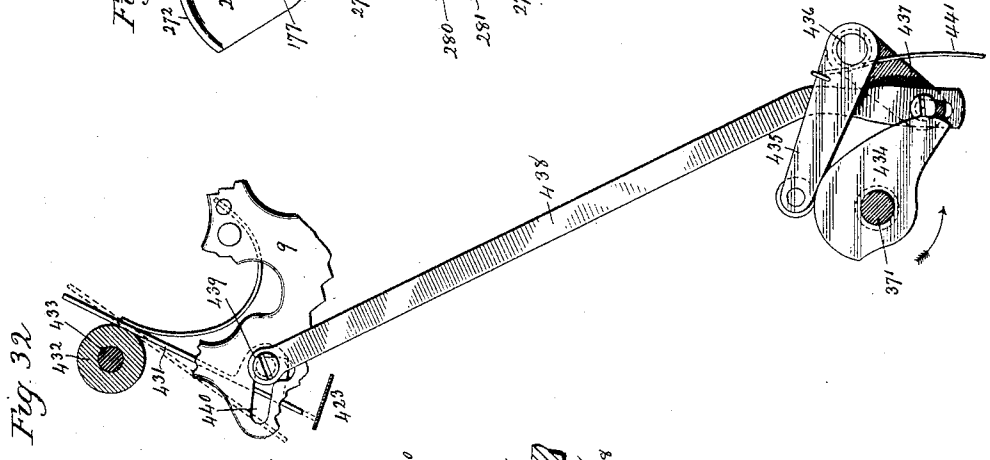


Fig. 34a

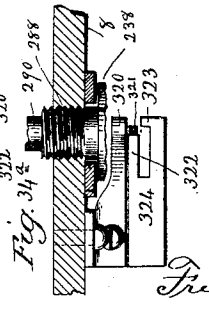


Fig. 34b

Witnesses.
J. N. Shumway.
Lillian D. Kelsey

Fred M. Carroll
Inventor

By Atty's Seymour & Carr

No. 789,408. PATENTED MAY 9, 1905.

F. M. CARROLL.

COMPUTING MACHINE.

APPLICATION FILED MAR. 18, 1901.

17 SHEETS—SHEET 16.

Fig. 37

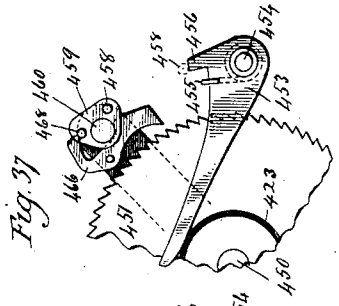


Fig. 36

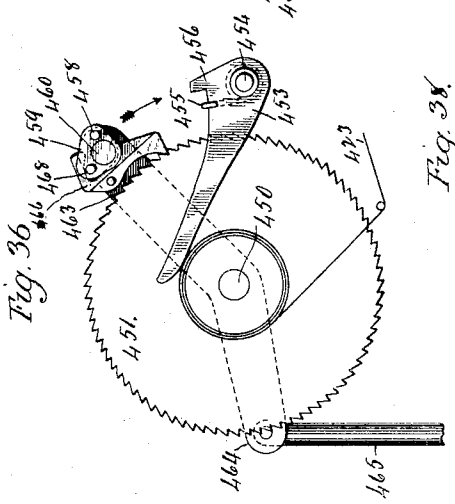


Fig. 38.

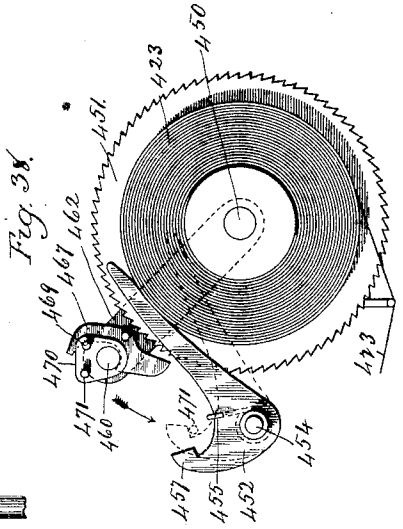
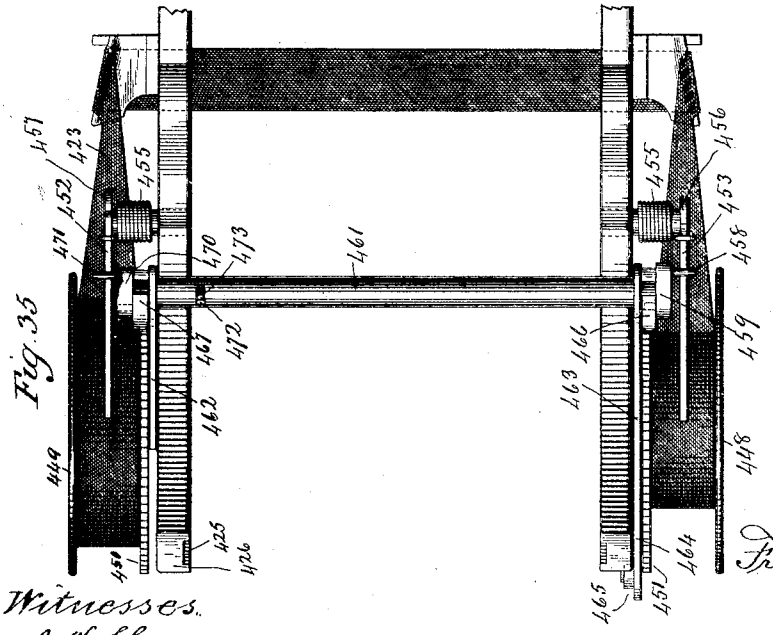


Fig. 35



Witnesses.

J. H. Shumway.

Lillian D. Kelsey.

Fred M. Carroll.

Inventor.

By attys Seymour & Earle

No. 789,408. PATENTED MAY 9, 1905.

F. M. CARROLL.

COMPUTING MACHINE.

APPLICATION FILED MAR. 18, 1901.

17 SHEETS—SHEET 17.

Fig. 41

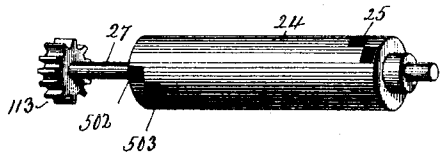


Fig. 42

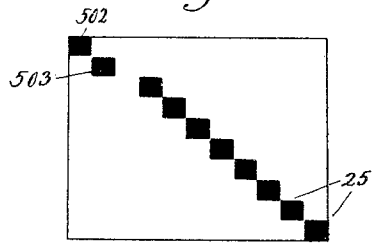


Fig. 39

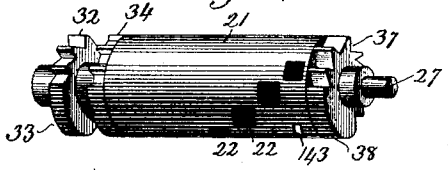


Fig. 40

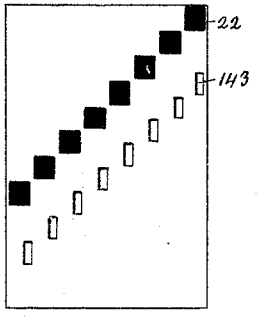


Fig. 44

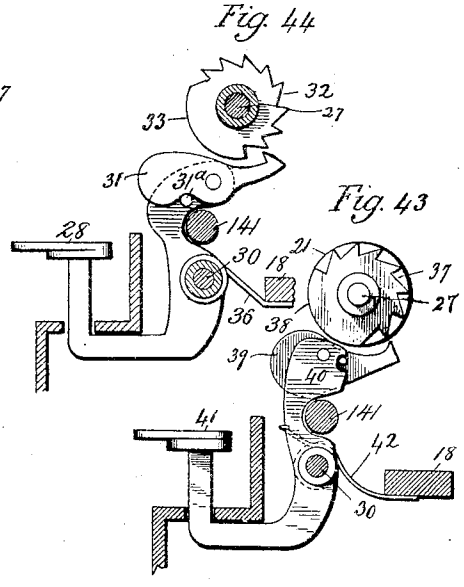


Fig. 43

Witnesses.

J. H. Shumway.

Lillian D. Kelley.

Fred. M. Carroll.

Inventor

By attys. Seymour & Earle

No. 789,408. Patented May 9, 1905.

UNITED STATES PATENT OFFICE.

FRED MERCHANT CARROLL, OF NEW HAVEN, CONNECTICUT, ASSIGNOR TO EDWARD S. SWIFT, TRUSTEE, OF NEW HAVEN, CONNECTICUT.

COMPUTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 789,408, dated May 9, 1905.

Application filed March 18, 1901. Serial No. 51,765.

To all whom it may concern:

Be it known that I, FRED MERCHANT CARROLL, of New Haven, in the county of New Haven and State of Connecticut, have invented a new Improvement in Computing-Machines; and I do hereby declare the following, when taken in connection with the accompanying drawings and the characters of reference marked thereon, to be a full, clear, and exact description of the same, and which said drawings constitute part of this specification, and represent, in—

Figure 1, a view in front elevation of a computing-machine constructed in accordance with my invention, the case being removed and the upper portion of the sight-plate being broken away; Fig. 1^a, a broken plan view of the machine; Fig. 2, a view of the machine in side elevation, taken from the right-hand side thereof with some of the number-keys broken away; Fig. 2^a, a broken perspective detail view showing the connection of the total-printing key with the printing mechanism; Fig. 2^b, a broken detail view, in side elevation, showing the safety-stop of the total-printing mechanism; Fig. 2^c, a detail view, in side elevation, of the thumb-lever constituting an automatic stop for the operating-handle, which is shown by broken lines; Fig. 3, a view of the machine in side elevation from the left-hand side thereof with portions of its printing mechanism broken away as well as the rear end of the frame of the machine; Fig. 4, a broken perspective view showing the means employed for cutting in and cutting out the printing mechanism; Fig. 4^a, a detail view, in inside elevation, of the fixed disk, the cam-like driving-head, the coupling-pawl, and the pawl-operating cam of the mechanism shown in the preceding figure. Fig. 4^b is an enlarged broken view, in front elevation, of the tally-wheels of the computing mechanism; Fig. 4^c, a detail view, in inside elevation, of one of the tally-wheels, showing its stop-pins, its spring-detent, and the pawl, which, according to its position, operates all of the wheels; Fig. 4^d, a detail view, in outside elevation, of one of the tally-wheels, showing the resetting-pawl in the groove on the shaft upon which the tally-wheels are mounted; Fig. 5, a view of the machine in vertical longitudinal section on the line *a b* of Fig. 1, with a portion of the keys broken away and showing the case of the machine which is not shown in any other figure of the drawings; Fig. 5^a, a detached perspective view of one of the pivotal sliding rack-bar stop members; Fig. 5^b, a broken sectional view of a portion of the locking mechanism of the item-wheels with the locking-bar thereof in its locked position; Fig. 6, a view of the machine, partly in plan and partly in horizontal section, on the line *c d* of Fig. 5; Fig. 7, a perspective view showing the principal elements of the selecting mechanism of the machine; Fig. 7^a, a detail view, in side elevation, showing one pair of the dogs interposed between the selecting-drum and the normally stationary column-indicating drum; Fig. 7$^{a'}$, a detail view showing the dog coacting with the selecting-drum in date-printing and controlled by the date-printing handle; Fig. 7^b, a view in front elevation of the sight-plate, which is broken away to show the item-wheels, the normally stationary column-indicating drum, and the traveling column-indicating drum, which indicates the progress of the computation; Fig. 7^c, a detached front view of the sight-plate; Fig. 8, a broken detail view, partly in side elevation and partly in vertical section, showing the main features of the mechanism employed for operating the item-wheels. Fig. 8^a, a less comprehensive broken detail view showing the item-wheel yoke swung into its upper position to bring the item-wheels into operative engagement with the totalizing-wheels; Fig. 8^b, a detached perspective view of one of the item-wheels, with particular reference to showing its locking-teeth; Fig. 8^c, a broken perspective view of the item-wheel-locking bar; Fig. 8^d, a broken detail view, in outside elevation, showing in their normal and locked positions the two mutilated driving-wheels employed for driving the item-wheels; Fig. 8^e, a detached plan view of the composite driving-wheel of the two wheels shown in the preceding figure; Fig. 8^f, a detail view, in side elevation, of the hub and arm through the medium of which the item-wheel-unlocking hook

is operated by the unlocking-cam; Fig. 8^{g}, a detail view, in side elevation, showing the unlocking-cam in its normal position when it is moved from, which it permits the item-wheel-unlocking hook to move so as to release the locking-bar and allow the locking-spring to act in moving the said bar into its locking position; Fig. 8^{h}, a plan view of the same parts with the exception of the cam; Fig. 9, a detached plan view of the item-wheels and the item-wheel yoke, showing the provision for the longitudinal movement of the yoke for the purpose of changing the relations of the item-wheels to the totalizing-wheels and also showing parts of the means employed for reversing the rotation of the tens-carrying shaft, as required for shifting from addition to subtraction, and vice versa; Fig. 9^{a}, a broken plan view showing the two item-wheel yoke-lifting cams and the tens-carrying shaft driving and reversing pinions, as well as the other cams and the gears on the main shaft; Fig. 9^{b}, a broken detail view, in side elevation, of the tens-carrying driving and reversing pinions, showing their relation to the mutilated gear-wheel on the main shaft which drives them; Fig. 9^{c}, a broken sectional view on the line *e f* of Fig. 9^{a}, showing the movable tens-carrying pinion intermeshed with the main driving-pinion, which directly effects the rotation of the tens-carrying shaft when the machine is adjusted for subtraction and also showing the connection of the shipper upon the shipper-rod with the movable reversing-pinion, and the lug formed integral with the lifting-arm coacting with the two lifting-cams which control the position of the item-wheel yoke; Fig. 9^{d}, a detail plan view showing the movable tens-carrying pinion intermeshed with the intermediate pinion, which effects the rotation of the tens-carrying shaft when the machine is adjusted for addition; Fig. 9^{e}, a detached detail view, partly in plan and partly in section, of the devices employed for shifting the item-wheel yoke laterally, as required for multiplying and dividing; Fig. 10, a broken view in perspective of the mechanism employed for locking and unlocking the tens-carrying wheels by power transmitted from the operating-handle of the machine and also showing one of the triggers used to support the pivotal carriers of the locking-dogs of the said wheels; Fig. 11, a broken view, partly in side elevation and partly in vertical section, showing the connection of one of the key-levers with the rocking driving-frame and the rocking stop-frame which control the action of the sliding rack-bars through the medium of the pivotal stop member; Fig. 12, a similar view showing the positions of the parts when the depression of the key has swung the stop-frame to release the sliding rack-bar. In this figure the stop member is shown in its highest position, in which it will be lifted only when the number-key 9 is operated; Fig. 13, a broken perspective view of the left-hand end of the rocking driving-frame looking from the right-hand side thereof; Fig. 14, a detached perspective view of the composite totalizing-wheels mounted upon the totalizing-wheel shaft, and showing also the "tell-tale," which visually indicates whether the machine is set for addition or subtraction; Fig. 15, a view showing in perspective the three members of each of the totalizing-wheels—namely, the chambered number-disk, which is loosely mounted on the shaft, the washer-like hook, which is fixed on the shaft, and the gear member, which is loosely mounted on the shaft and provided with pins which enter the flange of the chambered number-disk and couple the disk and wheel together; Fig. 16, a broken plan view showing the composite tens-carrying wheels, the locking-dogs thereof, and the pivotal carriers upon which the said dogs are pivotally mounted. This view also shows one of the spring-detents with which each of these wheels is provided, the other detents having been removed for clearness; Fig. 17, a broken detail view, partly in side elevation and partly in vertical section, showing one of the pivotal locking-dog carriers in its released position in which the locking-dog carried by it is engaged with the pinion of one of the composite tens-carrying wheels; Fig. 18, a similar view showing the locking-dog held in its retracted position by the engagement of its pivotal carrier by a trigger. This view also shows by broken lines a secondary position of the parts, illustrating how the locking-dog is still held in its retracted position after the trigger has been disengaged from the pivotal carrier by means of a wing depending from a rock-shaft and engaging with the upper end of the carrier; Fig. 19, a detached perspective view of one of the locking-dogs and its coacting ram; Fig. 20, a detached view of the ram-spring; Fig. 21, a detached perspective view of one of the pivotal locking-dog carriers; Fig. 22, a perspective view showing the two members of one of the tens-carrying wheels—namely, the hub and pinion thereof; Fig. 23, a view comprising the hubs of all of the tens-carrying wheels and designed with particular reference to showing their differentiation in the matter of the location upon them of their operating-teeth; Fig. 24, a detail view, partly in side elevation and partly in vertical section, of the means employed for resetting the sliding rack-bars and also for repeating without the manipulation of the several keys of a line of figures already set up on the totalizing-wheels. This view also shows the means employed to prevent the use of the repeating function of the device when item-wheels are adjusted for multiplication or division; Fig. 25, a detail view showing the pivotal resetting-hook and the fixed resetting hook in their normal positions by full lines and in their operated positions by broken

lines. This figure also shows the repeating-pin in its retired or inoperative position; Fig. 26, a corresponding but less comprehensive view showing the repeating-pin in its operative position in which it holds the pivotal resetting-hook out of engagement with the fixed resetting-hook secured to the resetting rock-shaft; Fig. 27, a detail broken plan view of the parts shown in Figs. 25 and 26; Fig. 28, a detached partial plan view of the printing mechanism, with particular reference to showing the means employed for printing ciphers to the right of any digit and to omitting to print ciphers to the left of any digit. This view also shows the devices used to cut out of action the date-printing hammers; Fig. 28[a], a broken detail plan view designed to show the resetting of the printing-hammers; Fig. 29, a view in front elevation of the parts shown in Fig. 8, but somewhat less comprehensive than the same; Fig. 29[a], a view in vertical section on the line *x y* of Fig. 29, looking outward and showing the slotted collar 412; Fig. 30, a view comprising perspective representations of the two members of each of the printing-wheels—namely, the type member and the pinion member; Fig. 31, a detail view in side elevation, showing the dog carried by the type member of one of the printing-wheels in engagement with one of the lugs of the pinion member thereof, as occurs in printing totals; Fig. 32, a detail view in side elevation, showing part of the means employed for feeding the paper; Fig. 33, a view in rear elevation of the said mechanism; Fig. 34, a detail view, in side elevation, of the telltale and the mechanism for the operation thereof from the shipper-rod, which is operated to set the machine for addition or subtraction; Fig. 34[a], a detail plan view showing the means employed for limiting the rotation of the shipper-rod; Fig. 34[b], a view thereof partly in outside elevation and partly in vertical section; Fig. 35, a detail plan view showing the devices employed for feeding the inking-ribbon in either direction; Fig. 36, a detail view, in side elevation, from the left-hand side of the machine, showing details of the ribbon-reversing mechanism; Fig. 37, a similar but less comprehensive view of the same parts, showing the disengagement of the pawl from the ratchet-wheel of the left-hand ribbon-spool by means of the pivotal switch-arm, which is moved by the ribbon itself; Fig. 38, a view in elevation of the right-hand ribbon-spool, together with its coacting reversing devices, the operation of which is concurrent with but opposite to the reversing devices coacting with the left-hand ribbon-spool; Fig. 39, a detached perspective view of the normally stationary column-indicating drum; Fig. 40, a developed surface of the said drum, showing the arrangement of its locating spots and notches; Fig. 41, a detached perspective view of the traveling column-indicating drum; Fig. 42, a developed surface of the said drum, showing the arrangement of its locating-spots; Fig. 43, a broken detail view, partly in elevation and partly in section, showing the right-hand drum-setting key; Fig. 44, a broken detail view, in inside elevation, showing the connection with the drum of the left-hand drum-setting key.

My invention relates to an improved computing and printing machine, the object being to produce a machine constructed with particular reference to compactness, to ease, rapidity, and accuracy of performance, to simplicity of comprehension as to its mode of manipulation, and to the visual indication of the progress of each computation, so as to guide its user step by step and relieve his memory of the burden of carrying figures.

A further object of my invention is to provide such a machine with a printing mechanism adapted to be cut into or cut out of operation at will and when cut into operation to print items and totals and to date them.

With these ends in view my invention consists in a computing-machine having certain details of construction and combinations of parts, as will be hereinafter described, and particularly recited in the claims.

As herein shown, the machine is designed to be used for adding, subtracting, multiplying, and dividing, printing items, printing totals, and printing dates. In describing the machine and its operation I shall consider the mechanisms for performing these functions in the order in which they are above given. I may, however, state here that for use in certain situations the machine may be simplified by leaving out its printing mechanism. It may also be simplified by omitting the features which provide for subtracting, multiplying, and dividing, though it is probable that any form that the machine may assume will be adapted for subtraction as well as addition, which is the main purpose for which computing-machines are used and upon the principle of which they all rest.

In the drawings many duplicate parts have been omitted for the sake of clearness.

As shown, the machine is provided with a series of eight item-wheels 2, Figs. 8[b] and 9, mounted so as to turn independently of each other upon a horizontal item-wheel shaft 3, the ends of which are journaled in the respective arms 4 and 5 of a vertically-swinging and laterally-movable item-wheel yoke or cradle 6, Fig. 9, one end of which receives and turns and slides upon a shaft 7, journaled in the frame-piece 9 of the machine. The other end of the said yoke 7 receives a shaft 290, which is rigidly secured to it and which is actuated in rocking and sliding movement for imparting corresponding movement to the yoke, as will be described later on.

Each item-wheel 2 is provided upon its pe-

riphery with a series of figures running from "0" to "9"—thus, "0 1 2 3 4 5 6 7 8 9." Each item-wheel is also formed, Fig. 8[b], with external actuating-teeth 10 and with an external peripheral clearance-space 11, extending between one end of the series of teeth 10 and the adjacent end of the segment 12, on which the figures aforesaid are placed. Each item-wheel is also formed with a transverse clearance-opening 13, located between the segment 12 and the hub 14 of the wheel and allowing access to a series of internal locking-teeth 15.

The figures upon the item-wheels 2 are exposed through an item-wheel opening 16, formed in a sheet-metal sight-plate 17, Fig. 7[c], secured to the inner frame 18 of the machine and located just within the lower end of an inclined glass plate or panel 19, Fig. 5, mounted in the case 20 of the machine and exposing so much of the mechanism thereof as is necessary for the guidance of its operator.

Each item-wheel 2 stands for a column of figures. Thus the machine shown, being provided with eight of these wheels, is adapted for computing sums in eight columns. For the guidance of the operator these columns are identified by means of a column-indicating drum 21, Figs. 39, 40, 43, and 44, which is normally stationary. This drum carries upon its surface a spirally-arranged series of spots 22, Fig. 40, of which there are eight, to correspond to the number of item-wheels 2 and arranged upon the drum so as to fall in the vertical planes of those wheels. These spots 22 are exposed through a horizontal series of small rectangular openings 23, Fig. 7[c], formed near the lower edge of the sight-plate 17, the spots appearing one at a time through these openings, according to the position of the drum 21.

For the purpose of indicating the consecutive operation of the machine from left to right I also employ what I have chosen to call a "traveling column-indicating drum" 24, Figs. 41 and 42, which is provided with a spirally-arranged series of spots 25, of which there are eight, to correspond to the number of item-wheels 2, in the vertical planes of which they are arranged, and therefore in the vertical planes of the respective spots 22 upon the normally stationary drum 21. These spots 25 are exposed through a horizontally-arranged series of openings 26, Fig. 7[c], formed in the sight-plate 17 at a point about midway between the openings 16 and 23 thereof. The purpose of the said traveling drum 24 is to follow the operation of the item-wheels from left to right, so as to temporarily indicate every operation of the machine and to show to its user what item-wheel is to be operated next. Every operation of the machine leaves the proper spot 25 in a vertical line under the item-wheel 2 to be operated next.

The drum 21 is loosely journaled upon a shaft 27, the ends of which are supported in the inner upright frame 18. The said drum is rotated step by step through a partial revolution sufficient in extent to bring all of its spots 22 into view through the holes 23 in the sight-plate 17 by means of a drum-setting key 28, Fig. 6, mounted upon the outer end of a lever 29, Fig. 44, hung upon a rod 30, Fig. 43, the ends of which are also mounted in the frame 18. The inner end of the lever 29 extends upward and carries a pawl 31, Fig. 44, the outer end of which is enlarged to form a weight, while its inner end engages with the teeth of a ratchet-wheel 32, a portion of the periphery of which is left blank to form a segmental stop 33, which limits the rotation of the wheel in one direction. The left-hand end of the drum 21 is provided with a step-by-step stop-wheel 34, Fig. 39, the teeth of which are engaged by a spring 35, Fig. 5, which holds the said drum in each of its set positions. A coiled spring 36, Fig. 6, encircling the rod 30, coacts with the lever 29 to restore the drum-setting key 28 after its operation and to bring the pawl 31 into position for reëngagement with the teeth of the wheel 32. For reversing the drum 21 I provide it at its right-hand end with a ratchet-wheel 37, Fig. 39, having a segmental stop 38 and coacting with a gravity-pawl 39, mounted upon the inner end of a lever 40, Fig. 43, rocking upon the right-hand end of the rod 30, the outer end of the lever being provided with a drum-setting key 41, Figs. 6 and 43. A coiled spring 42, Fig. 43, encircling the rod 30, restores the key 41 to its normal position.

It will be understood from the foregoing that by means of the drum-setting key 28 the column-indicating drum 21 may be rotated step by step, so as to bring its spots 22 successively into view, beginning at the left, through the openings 23 in the stationary sight-plate 17. When the last right-hand spot 22 has been exposed through the extreme right-hand opening 23, the drum 21 is prevented from further revolution by the segmental stop 33 of the wheel 32, the said stop 33 operating to cut the pawl 31 out of action. A pin 31[a], located below the pawl 31, is provided for holding it out of engagement with the teeth of the wheel 32 when the key 28 is in its normal or retired position. By means of the drum-setting key 41 the drum 21 may be reversely operated step by step to successively bring its spots 22 into view through the sight-openings 23 from right to left. When the last spot 22 has been exposed through the extreme left-hand opening 23, the rotation of the drum is prevented from further revolution by the segmental stop of the ratchet-wheel 37. In using the machine the drum-setting keys 28 and 41 are used to rotate the drum 21 in one direction or the other for the purpose of bringing into view the spot on the drum which is located in the

same vertical plane as the item-wheel corresponding to the first left-hand figure in the number to be added. When so set, the drum 21 remains sationary until it is reset for the next computation, and therefore is normally stationary. The said traveling column-indicating drum 24 is automatically shifted, however, every time one of the number-keys, Fig. 6, is depressed, as will be described later on. It is enough to say at this time that in the use of the machine the drum 24 begins the automatic step-by-step exposure of its spots 25 with the spot 25 in the vertical plane of that one of the spots 22 upon the drum 21 which is at the time exposed, after which the drum 24 is automatically returned to its starting position, which was determined by the setting of the drum 21, all as will more fully appear hereinafter. The said drum-setting keys 28 and 41 are located between a repeating-key 43 and a totalizing-key 44, Fig. 6, the functions of which will be described later on. These four keys constitute the "upper bank" of keys of the machine.

The "lower bank" of keys of the machine comprises ten number-keys, which for convenience I shall not designate by figures, but hereinafter speak of them by their numbers, including the "0" key, which is the "spacing-key." The lower bank of keys also includes a "shifting-key" 45, with which a date-printing handle 494 is associated. Each of the said lower-bank keys is located upon the outer end of a long horizontally-arranged lever 47, Fig. 5, hung upon a knife-edge 48 and provided at its rear end with an extension 49, carrying adjusting-screws 50 and 51. The screws 50 impinge upon a universal bar 52, Figs. 11 and 12, passing through three heads 53, 54, and 55, Fig. 6. These heads are rigidly secured to a rock-shaft 56, the ends of which receive screw-pivots 57, mounted in the frame of the machine. In the upper ends of the heads 54 and 55, which are alike, I mount a universal tongue-driving bar 58, coacting with tongues 59, Fig. 11, one at a time. The parts just described, exclusive of the tongues, constitute what for convenience I shall hereinafter describe as a "rocking driving-frame," which is actuated by the operation of any one of the number-keys. The said tongues 59 correspond innumber to the number of item-wheels 2, and are pivoted to pivotal sheet-metal rack-bar stop members 60, Fig. 5[a], swinging in vertical planes on a rod 61. Each of the stop members 60 is provided with a rearwardly-extending stop-arm 61[a], furnished at its extreme rear end with a stop-lug 62. These stop-lugs coact with steps 63, Fig. 5, formed in the rear ends of the longitudinally-movable rack-bars 64, which also correspond in number to the item-wheels 2. Each bar 64 is formed, as shown, with ten steps 63. Through their connection with the key-levers 47 each of the stop members 60 may be lifted into any one of the nine different positions which determine the rearward movement of the sliding rack-bars 64. The stop members 60 are prevented from swinging too freely by their provision with forwardly-projecting springs 65, Fig. 5[a], the ends of which have frictional engagement with the walls of vertical slots 66, Fig. 6, formed for their reception in a cross-piece 67 of the machine-frame. Each stop member 60 is also furnished with a depending setting-finger 68, the rear edge of which is engaged by a universal resetting-bar 69, Fig. 12, at or near the limit of the forward movement thereof for swinging the stop members 60 back into their normal positions, in which their stop-lugs 62 are opposite the lowest step but one 63 of the rack-bars 64. During the main part of the forward movement of the resetting-bar 69 it is engaged in restoring the rack-bars to their normal positions against the tension of their springs 70, Fig. 5. For the purpose of this restoration the rack-bars are furnished with depending resetting-arms 71, Figs. 11 and 12, to which the forward ends of the springs 70 are attached and with the rear edges of which the resetting-bar 69 is normally engaged. This bar is mounted at its ends in two corresponding arms 72, Fig. 12, with which it forms a yoke. The said arms 72 are rigidly secured to a rock-shaft 73, provided with a spring 74, Fig. 6, which restores the resetting rock-shaft 73, and hence the arms 72 and bar 69, to their normal positions after the performance of their resetting functions, which will be fully set forth in connection with the subject of resetting the machine.

The screws 51, Figs. 1 and 12, mounted in the extensions 49 of the key-levers 47, impinge upon the universal bar 75 of what I shall call a "rocking stop-frame," which comprises three heads 76, 77, and 78, Fig. 6, of which the heads 77 and 78 are alike. All of these heads are rigidly secured to a rock-shaft 79, the ends of which receive screw-pivots 80, Fig. 2. The heads 77 and 78 carry a universal stop-bar 81, which coacts with the inner edge of the upper member of the fork 82 of each of the tongues 59 for preventing the stop members 60 from swinging too far under the impulse communicated to them through their tongues 59, which are acted upon by the rocking driving-frame, which is actuated by the keys, which may at times be struck very sharp blows.

The sliding rack-bars 64 are furnished at their forward ends with racks 83, Fig. 5, meshing into the actuating-teeth 10 of the item-wheels 2, which will be rotated more or less, dependent upon the rearward movement of the rack-bars 64, which is controlled by the degree to which the rack-bar stop member 60 is lifted, which in turn is measured by the "value," as I may say, of the respective number-keys, which is determined and differ-

entiated by the screws 50 and 51, before mentioned.

The pivotal tongues 59 are normally out of operation and selected and lifted into position for being acted upon by the universal bar 52 of the rocking driving-frame by means of a series of selecting-levers 84, Figs. 5 and 7, of which there is one for each tongue. These selecting-levers are mounted upon a rod 85 and extend rearwardly under the forward ends of the said tongues and also forwardly for coaction with the spirally-arranged selecting fingers or tappets 86 of a selecting drum or shaft 87, fixed on a shaft 88 and also provided at its left-hand end with two date-selecting fingers 89 and 90, forming a continuation of the series of fingers 86, but coacting with the dating mechanism of the machine. The said shaft 88 is provided at its left-hand end with a pinion 91, Fig. 7, meshing into a large gear-wheel 92, mounted on a stud 93, mounted in the frame 18, Figs. 3 and 6, and formed with an outwardly-projecting hub 94, Fig. 6, furnished with a pinion 95, Figs. 3 and 6, meshing into gear-teeth 96, formed upon the inner edge of a spring-barrel 97, to which the outer end of its contained coiled spring 97^a is attached. The barrel 97 is mounted upon the short stud 97^b, Fig. 6, supported by the said frame 18. This spring is automatically wound by the attachment of its inner end to the hub (not shown) of a ratchet-wheel 98, journaled upon the outer end of the said stud 97^b, Fig. 6, the teeth of which are engaged by a pawl 99, Fig. 3, which ratchet-wheel holds the wheel against rotation in the direction of unwinding. The said wheel is rotated from right to left, which is the direction required for winding the spring 97^a, by means of a pawl 100 engaging with its teeth and located upon the inner face of the lower end of an arm 101, depending from and swinging upon the projecting outer end of the hub (not shown) of the ratchet-wheel 98, which thus supports the arm 101. The said arm 101 is swung back and forth by means of the connection of its lower end with the forward end of a pitman 102, the rear end of which is connected with a crank-arm 103, secured to the left-hand end of a rock-shaft 104, having its right-hand end furnished with a crank-arm 105, Fig. 2, connected with a pitman 106, eccentrically attached to a driven gear-wheel 107, meshed into by a driving-gear 108^a, Figs. 8^d and 8^e. The said driving-gear 108^a is made independently of but virtually affixed to a corresponding wheel 108, which is intermittently actuated by being meshed into by the segmental series of teeth 109, formed upon the main driving-wheel 110, which is one of the several wheels and cams mounted upon a sleeve 111, Fig. 9^a, turning upon a stud (not shown) and carrying the operating-handle 112. The wheels 108 and 108^a correspond to each other in size and in the number of their teeth; but the wheel 108 is formed with a stop-face 108^e for coaction with the smooth portion of the edge of the main wheel 110, whereby the same intermittently actuates the wheel 108, and therefore the wheel 108^a. Through the connections above described the arm 101 is caused to be swung forward every time the handle 112 is passed through a complete revolution. As the said arm moves forward its pawl 100 rotates the ratchet-wheel 98, and hence winds the spring 97^a. During this rotation of the wheel 98 its teeth ride under the pawl 99, which when the wheel 98 stops rotating engages with one of the teeth thereof and prevents the reverse rotation of the wheel and the spring 97^a from unwinding. In this way the spring 97^a is kept wound automatically for the actuation of the selecting-drum 87 and also for the actuation of the traveling column-indicating drum 24, the shaft 27 of which is furnished at its left-hand end with a pinion 113, Figs. 3, 7^a, and 41, meshing into the large gear-wheel 92, which is driven, as already explained, by the intermittent step-by-step rotation of the spring-barrel 97.

I may here state that the spots 25 of the drum 24 are arranged spirally in conformity with the spiral arrangement of the selecting-fingers 86 on the selecting-drum 87. I may further state that the gearing just described is such that the drum 24 and selecting-drum 87 will have a synchronous rotation. It follows from this that the spots 25 in their exposure through the openings 26 of the sight-plate 17 will visually indicate to the user of the machine what item-wheel 2 will be turned the next time he depresses one of the number-keys, because the spot 25 exposed has a definite relation to one of the selecting-lugs 86, and that particular lug 86 has a definite relation to one of the tongues 59 of one of the stop members 60, which coacts with one of the sliding rack-bars 64 of one of the item-wheels 2. Suppose, for instance, that after operating one of the number-keys the operator's attention should be distracted from his work and he should forget in what column of figures he was working. In that case he has only to glance at the openings 26 in the sight-plate 17 and observe the spot exposed through one of them, which gives him the clue again and indicates certainly in what column the figure next to be computed must fall.

The spring 97^a exerts a constant effort to rotate the drums 87 and 24, but is normally restrained by escapement mechanism, Fig. 2, by means of which the drums are allowed to have synchronous step-by-step rotation when thereto released by the depression of any one of the number-keys. This escapement mechanism comprises an escapement-wheel 114, Figs. 2 and 7^a, located upon the right-hand end of the selecting-drum shaft 88 and normally engaged and held against rotation by an escapement-pawl 115, located in front of it and

mounted upon the upper arm of a swinging plate 116, loosely mounted upon a stud 117, carried by the frame 18, Figs. 2 and 6, and swung forward for disengaging the pawl 115 from the wheel 114 by means of its rearwardly-projecting shoulder 118, which is engaged for this purpose by a pin 119, located just below the pawl-like upper end 120 of a rocking escapement-lever 121, also hung on the stud 117. The projecting forward end of this lever 121 terminates in a fork 122, receiving a universal bar 123, extending under all of the key-levers 47 in position to be operated by the depression of any one of them, this bar being mounted in the ends of two arms 124 124 of a rock-sleeve 125, mounted upon a fixed shaft 126. Normally the pawl-like end 120 of the lever 121 clears the teeth of the escapement-wheel 114. When, however, any one of the key-levers is depressed, the accompanying depression of the universal bar 123 will rock the lever 121 and enter its pawl-like end 120 between two teeth of the wheel 114. At the same time the pin 119 in the lever 121 will push against the shoulder 118 of the plate 116 and swing the same forward so as to clear the escapement-pawl 115 from the teeth of the wheel 114 with which it was engaged. A spring 127, connected with the pawl 115 and with the plate 116, immediately acts to enter the nose of the pawl between the next succeeding teeth of the wheel 114. As soon now as the pressure which depressed the key-lever is removed its actuating-spring 47ª, Fig. 5, restores it to its normal position and permits the spring 128 of the rock-sleeve 125 to rock the same back into its normal position, whereby the escapement-lever 121 will be rocked backward with sufficient force to withdraw its pawl-like end 120 from engagement with the teeth of the escapement-wheel 114, which will thus be released and allowed to move through an arc of a circle represented by the distance between two of its teeth under the power of the spring 97ª. In this way the drums 87 and 24 are synchronously actuated in partial rotation by power "tapped," so to speak, from the spring 97ª.

It will be understood from the foregoing that the operation of any one of the number-keys releases the escapement mechanism and permits the rotation of the selecting-drum 87, so as to bring its spirally-arranged selecting-fingers successively into action from left to right. This in effect produces spacing by moving the vertical plane in which the machine operates from left to right through the item-wheels 2, one of which will be operated by any one of the number-keys except the "0" key, which does not operate any of the item-wheels, but which releases the escapement mechanism and is used as a spacing-key pure and simple. The said spacing or "0" key can act, however, only in doing step-by-step spacing, which is comparatively slow. If rapid spacing is desired, as in moving from the dating to the adding planes of action, I employ the shifting-key 45, Fig. 6, the functions of which I propose to describe at length when I treat of the subject of printing. At present, however, I will point out that when this key 45 is depressed a lug 129, Fig. 7, formed upon the lower edge of its lever 130, engages with a pin 131 in a crank-arm 132, formed on the left-hand end of a tubular rock-shaft 133, mounted on a fixed shaft 134, and provided at its opposite end with a crank-arm 135, connected by a link 136 with the lower end of the rocking-plate 116, which is normally held with its pawl 115 in engagement with the escapement-wheel 114 by the action of a spiral spring 137. When the shifting-key 45 is depressed, the parts last mentioned retract the pawl 115 from the escapement-wheel 114, which being unrestrained by the pawl-like end 120 of the rocking-lever 121, which requires for its operation a stroke upon one of the number-keys, leaves the selecting-drum 87 free to be revolved by the spring 97ª in the spring-barrel 97 until stopped by means independent of the wheel 114. These means consist of a series of eight double-ended dogs 138, Fig. 7ª, arranged to rock upon a shaft 139 in the vertical planes of the respective selecting-fingers 86, to which they correspond in number and location, and therefore to the item-wheels 2, there being eight item-wheels, eight fingers, and eight dogs. The shaft 139 is supported in the frame 18. The inner ends of these dogs are adapted to engage with the said fingers 86, which in their coaction with these dogs are stop-fingers, while the opposite ends of the said dogs have pin-and-slot connections with the lower ends of a corresponding series of double-ended dogs 140, swinging upon a shaft 141 and having their upper ends formed with noses 142, each adapted to enter one of a series of spirally-arranged notches 143 formed in the drum 21 and corresponding in spiral arrangement to the arrangement of the spots 22 thereon. The notches 143 being arranged spirally only one can be entered at any one time by the nose 142 of one of the dogs 140, as the noses of all of the dogs are located in line with each other and with the axis of the drum 21. The entrance of the nose 142 of one of the dogs 140 into its appropriate notch 143 in the drum 21 permits the inner end of its coacting dog 138 to be lifted into the position shown in Fig. 7ª, in which it is engaged by the selecting-finger 86, turning in the plane of this pair of dogs. At this time the noses 142 of the remaining dogs 140 ride upon the surface of the drum 21, whereby their coacting dogs have their inner ends cleared from the paths in which their corresponding selecting-fingers 86 rotate. It follows, then, that when the pawl 115 is disengaged from the escapement-wheel 114 at a time when the

pawl-like end 120 of the rocking-lever 121 is out of action the selecting-drum 87 will revolve until one of its fingers 86 has been brought into engagement with the inner end of its corresponding dog 138, which must be the dog coacting with the dog 140, which has its nose 142 entered into one of the notches 143 in the drum 21. That drum, as has been explained, is a stationary drum, except for its manual actuation in step-by-step rotation by means of the keys 28 and 41, which are manipulated in getting the machine ready to do any piece of work, so as to locate the column in which the work is to be begun. In other words, the drum 21 is rotated until its notch 143, corresponding to the column in which the work is to be begun, is brought into position to receive the nose 142 of the corresponding dog 140. The entrance of the nose into that notch permits the corresponding dog 138 to be swung by its spring 144 into position for being engaged by the selecting-finger 86, which on the selecting-drum 87 corresponds to the item-wheel 2 now under consideration. This dog 138 being now the only dog of its series in acting position will always be ready until the machine is reset to stop the rotation of the selecting-drum 86 in the same position when the said drum is released by the depression of the shifting-key 45, and this position will always be "duplicated," so to speak, by the position of the synchronously-actuated traveling column-indicating drum 24, which will then always be stopped so as to expose that one of its spots 25 which indicates the column in which the work is begun, which will be the column to the extreme left. These dogs 138 and 140 may thus be regarded as a part of the setting mechanism of the machine. Only one pair of them is in operation at any one time, and that pair is selected in setting the machine with reference to the column in which the work is to be begun. Once set, the dog 138 of the pair acts as a stop for arresting the rotation of the selecting-drum when the same is released by the shifting-key 45. The end walls of notches 143 are beveled for lifting the noses 142 of the dogs 140 out of them when the drum is rotated in one direction or the other in being set by the action of the keys 28 and 41.

In order that the selecting-drum 87 may be released for step-by-step rotation every time a number-key is depressed, I provide for the temporary retirement of the particular dog 138 coacting with the selecting-drum 87. For this purpose I employ a universal bar 145, Figs. 7[a] and 5, arranged to engage with the lower edges of the forward ends of all of the dogs 138. This bar 145 terminates in arms 146, carried by a rock-shaft 147, having a depending arm 148, engaged by a lug 149, located upon the rock-shaft 125, which carries the universal bar 123, which is acted upon by the levers 47 of all of the number-keys. When any one of these keys is depressed, the bar 145 will be lifted against the particular dog 138 which is in action and which on that account has its forward end moved downward out of line with the forward ends of the other dogs 138. This particular dog 138 will then be lifted by the bar 145, with the effect of having its inner end moved out of the path of its selecting-finger 86 long enough to permit the selecting-drum to be rotated by the spring 97[a] through one step, after which the said drum will be stopped by the action of the escapement mechanism. Of course the particular dog 138 thus operated upon will not coact with its particular selecting-finger 86 in the performance of its function of arresting the selecting-drum in position to properly stop the drum 24 but once during every rotation of the selecting-drum 87. Having operated that once, it will thereafter be idly operated on account of the character of the mechanism connected with it until the drum 87 has been carried through another entire movement and brought its corresponding selecting-finger into range with it again. In other words, one of these dogs 138 is rocked every time any one of the number-keys is depressed; but such operation is idle or ineffective except once during every complete rotation of the selecting-drum.

The extreme left-hand dog 138 is furnished, as shown in Fig. 7[a'], with a depending lug 499, which provides for connecting the dog with the dating-handle 494; but this feature, as well as the date-selecting fingers 89 and 90, will be discussed with the subject of the printing mechanism.

The item-wheels 2, as before described, are independently rotated more or less upon the item-wheel shaft 3 by the spring-actuated sliding rack-bars 64, which are moved longitudinally under the action of their springs 70 to a greater or less degree, according to the action of the pivotal stop members 60, which are rocked more or less, according to the values of the respective number-keys, which are predetermined in value, as aforesaid, by the adjustment of the screws 50, mounted in the key-levers 47.

After one or more of the item-wheels has been independently rotated and set up all of them are coupled together for oscillation and movement together or *en bloc* by means of a locking-bar 150, Fig. 8[c], passing through their openings 13 and shaped in cross-section so as to have its outer edge entered between any two of the locking-teeth 15. The left-hand end of the locking-bar 150 passes through the left-hand item-wheel head 151, Fig. 3, and is mounted in a carrier-arm 152, secured by a pivot 153 to the said head. The other end of the bar 150 projects through an opening formed in the right-hand item-wheel head 154, Fig. 8[a], and is mounted in a carrier-arm 155, secured to the said head by a pivot 156, which

is in line with the said pivot 153. The arm 155 is furnished with a finger 156[a], engaged by a spring 157, secured to the outer face of the right-hand item-wheel head 154 and exerting a constant effort to move the locking-bar 150 radially outward into engagement with the locking-teeth 15 of the item-wheels 2. Normally the locking-bar 150 is retired to permit the independent rotation of the item-wheels by means of an unlocking-hook 158, Fig. 8, the long nose 159 of which coacts with the outer face of the projecting right-hand end of the bar. This hook, which is located in a vertical plane, moves in a slotted guide 160, formed on the inner frame 18, and is connected with and actuated by a depending arm 161, Fig. 8[f], formed at the inner end of a hub 162, turning upon a shaft 163. The outer end of the hub 162 is formed with a hook-like arm 164, located in the plane of an unlocking-cam 165, Fig. 8[g], mounted on the sleeve 111 aforesaid. A spring 166, Fig. 8, connected with an arm 167, depending from the inner end of the hook 158, operates to move the hook upward and forward away from the projecting right-hand end of the locking-bar 150, so as to permit the locking-spring 157 to act in moving the locking-bar into its locking position. The said cam 165 is constructed so that it releases the hook 158 to the action of its spring 166 in the manner just described at the very beginning of the movement of the handle-arm 112, which shortly before it reaches the completion of a revolution and as it approaches its home position brings the cam 165 into play for drawing the hook 158 downward and rearward against the power of the spring 166, whereby the nose 159 of the hook draws the locking-bar 150 rearward against the action of the spring 157 and unlocks all of the item-wheels.

Just as soon as the item-wheels have been locked for rotation together by the initial movement of the handle-arm 112 they are lifted by an upward and rearward swinging movement imparted to the yoke 6 by means of a lifting-arm 168, Fig. 8, which coacts with an inner lifting-cam 169 and with an outer lifting-cam 170, both of which are located upon the inner end of the sleeve 111, and therefore rotated by the handle 112. The lifting-arm 168 is formed with a coupling-arm 171, receiving a coupling-pin 172, Fig. 9, which forms a sliding connection between the item-wheel yoke 6 and the lifting-arm 168 and permits the lateral movement of the said yoke which is effected in connection with multiplying and dividing and will be considered later on. This sliding connection between the lifting-arm 168 and the yoke 6 also provides for the movement of the lifting-arm 168 independent of the yoke 6 in conjunction with the operations of adding and subtracting.

The totalizer.—The lifting of the item-wheels 2 as described brings the actuating-teeth 10 of any of them that have been set up or positioned into position to coact with the teeth of the gear members 173 of the corresponding composite or compound totalizing-wheels, Fig. 15, each of which also comprises a number-disk 174 and a washer-like hook 179. There are nine of these totalizing-wheels—eight to complement the eight item-wheels 2 and an extra one at the left to take care of the amounts carried from the eight to the nine column. Each of the gear members 173 has twenty teeth and each of the number-disks 174 two sets of figures located upon its periphery and running from "0" to "9." These wheels are mounted upon a totalizing-wheel shaft 177, which is normally stationary, but which is capable of rotation for resetting the wheels to "0." The inner face of each of the number-disks 174 is formed with a recess 178 for the reception of the washer-like hook 179 and for the reception of two coacting gravity-pawls 180 and 181, pivoted to the disk in its said recess. The said hooks 179 are feathered to the shaft 177, to which, through the medium of the pawls 180 and 181, they couple the number-disks 174, and hence the gear members 173, the rims of said disks being formed with holes 175 for the reception of the coupling-pins 176, carried by the gear members 173. In the normally stationary position of the shaft 177 the hook 179 extends directly downward, so that it is not engaged by either of the pawls 180 and 181 when the gear member 173 and the number-disk 174 are rotated by the item-wheels. In resetting the machine, however, by turning the resetting-knob 182, Figs. 1 and 3, secured to the projecting left-hand end of the shaft 177, the hook 179 is engaged with one or the other of the pawls 180 and 181, whereby the gear-wheel 173 and disk 174 are temporarily coupled with the shaft 177, so as to be rotated rearward thereby and brought into their zero position. The said knob 182 is furnished with a stop-notch 183, which receives a stop-spring 184, entering it to limit the reversing movement of the shaft 177, which is stopped in its normal position by the entrance into the notch of another stop-spring, 185. The rotation of the shaft 177 in one direction or the other is therefore limited by these springs.

When in the movement of the handle 112 the item-wheels 2 have been lifted as described, the teeth 109, Figs. 2 and 8[d], of the main wheel 110 take into the driving-gear 108, which is mounted on a stud 186 and formed with a hub 187, the inner end of which carries a crank 188, to which the rear end of a bowed connecting-arm 189 is pivoted. The forward end of this arm receives a connecting-pin 190, Fig. 8, mounted in the right-hand item-wheel head 154 and adapted to slide back and forth in the arm 189 without breaking connection therewith to accommodate the lateral movement of the item-wheels

2 for the purposes of multiplying and dividing, as will be described hereinafter. A fork 191, pivoted at its lower end to the frame of the machine so as to swing in a plane parallel with the plane in which the arm 189 swings, extends upward between the same and the head 154 and enters a groove (not shown) formed in a sleeve 191ª, carried by the said arm 189 and constituting a bearing for the pin 190, which is thus prevented from deflecting the arm 189 when the item-wheels 2 are laterally moved. As the handle 112 is turned, the connecting-arm 189 is drawn rearward, with the effect of turning all of the item-wheels together and with the further effect of turning the totalizing-wheels complementary to the item-wheels set up. The totalizing-wheels will be turned earlier or later during the turning movement of the item-wheels, according to the amount the same were turned in being positioned, which depends upon their value, as already described. By the time the totalizing-wheels have been fully operated upon, the lifting-arm 168 falls into a depression 192, Fig. 8, in the inner lifting-cam 169, which permits the item-wheel yoke 6 to descend into an intermediate position, in which, as it may be said, the item-wheels are suspended between the totalizing-wheels and the racks 83 of the sliding rack-bars 64. In the descent of the item-wheels into this position such of them as have been intermeshed with the totalizing-wheels will be disengaged therefrom and those wheels left in their newly-taken positions. A continuation of the movement of the operating-handle 112 causes, through the now-changed position of the crank-arm 188, the connecting-arm 189 to move forward, whereby the item-wheel heads 154 and 151 and the item-wheels 2 are turned back into the positions which they had when their turning movement in the opposite direction began. A continuation of the movement of the operating-handle 112 permits the lifting-arm 168 to fall into the depression 193, Fig. 8, of the cam 169, which permits the item-wheel yoke 6 to descend into its lowest position and to bring the item-wheels into engagement with their respective racks 83. The handle 112 now brings the unlocking-cam 165, Figs. 8ᵉ and 9ª, into play for moving the hook 158 rearward, so as to draw the locking-rod 150 rearward against the tension of the spring 157, whereby all of the item-wheels are unlocked with respect to each other and left free to be independently rotated by the racks 83 of their respective rack-bars 64 when the same are reset through the medium of the universal resetting-bar 69, at which time the respective springs 70 of the bars are placed under the tension required to pull the bars rearward when the same are again released by the manipulation of the number-keys. The resetting of the rack-bars is effected just as the handle 112 is completing its revolution by means of a resetting-cam 194, Fig. 24, mounted upon the mutilated driving-wheel 195 and engaging with an antifriction-roll 196, carried by the short arm 197 of a resetting-lever hung upon a stud 198 and having its long arm 199 provided at its lower end with a pivotal resetting-hook 200, pressed downward by a spring 201 and normally engaging with a fixed resetting-hook 202, rigidly secured to a resetting rock-shaft 73, carrying the two arms 72, which support the universal resetting-bar 69, which is located in position to engage with the rear edges of all of the resetting-arms 71, which depend from the rear ends of the rack-bars 64. At the beginning of the resetting operation the bar 69 has the position in which it is shown in Fig. 12, and the depending resetting-arms 71 will, according to the extent of their rearward movement, which is differentiated by the action of the stop members 60, as described, be located in different positions in front of it. Under the action of the cam 194 the pivotal hook 200, through the medium of the fixed hook 202, rocks the resetting-shaft 73 forward, and thus swings the universal resetting-bar 69 forward through an arc represented by the broken line 69ª in Fig. 12. During this forward movement of the bar 69 the rack-bars 64 are picked up one by one, so to speak, and positively shoved forward against the tension of their springs 70. Near the end of the forward movement of the bar 69 it also engages with the fingers 68 of the respective stop members 60, which are thus positively swung downward, so as to bring their stop-lugs into engagement with the lowermost step but one of the steps 63 at the rear ends of the rack-bars. After the universal resetting-bar 69 has been moved through the arc 69ª to the position of the broken circle 69ᵇ in Fig. 12 the heel 203 of the fixed hook 202 engages with the flat outer end of the pivotal hook 200 and lifts the same upward and out of engagement with the beak of the fixed hook 202, whereby the spring 74 is allowed to act to rock the resetting-shaft 73 rearward, and thus restore the bar 69 to its normal position, in which it will remain until nearly the end of the next revolution of the handle-arm 112, when the antifriction-roller 196 falls off the cam 194 and permits the spring 204 of the bell-crank resetting-lever to operate in swinging the arm 199 thereof backward, whereby the pivotal resetting-hook 200 is reengaged with the fixed resetting-hook 202, as shown by full lines in Fig. 25.

In case it is desired to repeat an item the resetting function of the machine must be temporarily suspended, which permits an item to be repeated without reoperating the number-keys. For this purpose I employ a repeating-pin 205, Figs. 24, 25, and 26, arranged to engage with the pivotal resetting-hook 200 and mounted in a crank-arm 206, carried by a repeating rock-shaft 207, provided at its opposite end with a crank-arm 208, connected

with the rear end of a long pitman 209, the forward end of which is pivotally connected with the lever 210 of the repeating-key 43, Fig. 6, which coacts with a pivotal repeating-key lock 211, provided with a spring 212, which exerts a constant effort to throw the lock into a notch 213, formed in the upper end of the lever 210. When the repeating-key 43 is depressed, the lock 211 immediately acts to lock it in that position, in which it will maintain it and cause the machine to repeat the item set up as long as the operating-handle 112 of the machine is turned. To release the repeating-key 43, the repeating-key lock 211 must be manually operated to disengage its nose from the notch 213 in the lever of the key, at which time a spring 214 upon the repeating rock-shaft 207 will rock the same forward, so as to depress the repeating-pin 205 sufficiently to permit the pivotal resetting-hook 200 to normally engage with the fixed resetting-hook 202. The depression of the repeating-key 43 lifts the pin 205 into engagement with the hook 200 and holds the same so much above the beak of the hook 202 that when the hook 200 is drawn forward by the action of the cam 194 it rides over the hook 202.

For the purpose of locking all of the number-keys against being operated when the repeating-key 43 is in use the lever 210 of that key is provided with a depending rearwardly-turned stop-arm 215, which when the key is depressed is moved rearward, so as to engage with the under face of the universal bar 123, which is thereby locked, so as to support all of the key-levers 47 in their elevated or normal positions, so that during the repeating operation of the machine none of the number-keys can be accidentally operated.

Having described the operation of the composite totalizing-wheels by the item-wheels 2, it now remains to explain the operation of the totalizing-wheels by the tens-carrying wheels, of which there are nine to correspond to the number of totalizing-wheels. Each of these tens-carrying wheels comprises a tens-carrying pinion 216 and a tens-carrying hub 217, Fig. 22. The hubs 217 are rigidly secured to the tens-carrying shaft 218, and each is provided with two teeth 219. All of these hubs 217 are differentiated from each other in the arrangement of their teeth 219, Fig. 23, which are located upon them so that they successively coact from right to left (or from the outer ends inward toward the center) with the respective locking-dogs 220, Fig. 19, which are arranged in a horizontal line, Fig. 16, back of the tens-carrying wheels. The tens-carrying pinions 216 are loosely mounted upon shoulders 221, formed upon the hubs 217, and each has twenty teeth, and therefore corresponds in that respect to the gear members 173 of the totalizing-wheels. Each of the pinions is also provided at diametrically opposite points with two pins 222.

The tens-carrying-wheel shaft 218 is provided at its left-hand end with a driving-pinion 223, Figs. 9[b] and 16, which when the machine is set for adding meshes into an intermediate driving-pinion 224, located upon a sleeve 25, mounted on a stud 226. The sleeve 225 also carries a pinion 227, Fig. 9[a], meshed into by a driving-pinion 228, located upon a hub 229, mounted on a stud 230 and also carrying a pinion 231, meshed into by the segmental series of teeth 195[a], Fig. 24, located upon the periphery of the mutilated driving-wheel 195. The connection thus established between the handle 112 and the tens-carrying shaft 218 causes the same to be rotated forwardly when the handle is turned, that motion of the shaft being necessary in adding. In subtracting, however, it is necessary that the tens-carrying shaft should rotate in the opposite direction—that is, rearwardly. For this purpose the driving-pinion 223 instead of being rigidly secured to the shaft 218 is located upon a hub 232, feathered upon the shaft so as to rotate the same in either direction, but so as to slide longitudinally thereupon, whereby the pinion 223 is made axially movable.

For the purpose of setting the machine for subtraction the hub 232 is moved, by means which will be described later on, outwardly upon the shaft 218, so as to disengage the pinion 223 from the pinion 224 and bring it into direct engagement with the pinion 228, beneath which it is located and with which it was not before connected except through the medium of the pinions 224 and 227. Now when the handle 112 is rotated the tens-carrying shaft 218 will be turned rearwardly, as required for the process of subtraction.

Fig. 9[b] shows that the pinion 231 is formed with a stop-face 233, which rides upon the periphery of the wheel 195 and normally holds the train leading to the tens-carrying-wheel shaft 218 still, locking them from movement in either direction.

Once during every complete revolution of the handle 112 the short series of teeth 195[a] mesh into the pinion 231 and actuate the same and the pinion 228 through one complete revolution, which takes place shortly before the handle completes its cycle.

For the purpose of shifting the pinion 223 on the tens-carrying shaft 218 so as to revolve that shaft either forwardly or rearwardly as necessary for addition or subtraction by causing the said pinion 223 to mesh into the intermediate pinion 224 or directly into the pinion 228 I provide the hub 232 of the pinion 223 with a groove 234, receiving a fork 235, formed at the upper end of a shipper 236, mounted upon a shipper-rod 237, provided on its opposite end with an operating-knob 238, Fig. 9. The shipper 236 is formed at its lower end with a finger 239, entering a slot formed in a lug 240, Fig. 9[c], formed inte-

gral with the lifting-arm 168, which coacts with the lifting-cams 169 and 170, which control the position of the item-wheel yoke. The said knob 238, Figs. 9, 34ª, and 34ᵇ, is formed with a hub 241, provided with an external thread 242, taking into a thread of an opening 243, formed in the frame 8 of the machine. The said knob is formed with an internal thread 244, taking into an external thread 245, formed upon the left-hand end of the shipper-rod 237, which is thus shifted longitudinally in one direction or the other by the corresponding rotation of the knob 238.

After the totalizing-wheels have been operated by the item-wheels during the first part of the movement of the handle 112 the tens-carrying shaft 218 is started in rotation for the secondary or tens-carrying operation of the totalizing-wheels by means of the tens-carrying wheels, the gear members 173 of the totalizing-wheels having the same number of teeth—that is to say, twenty teeth—as the pinions 216 of the tens-carrying wheels.

The operating-pins 222, mounted in the pinions 216 at points diametrically opposite each other, are located so as to correspond to and in a sense stand for the division between the double series of figures on the totalizing number-disks 174. In other words, the said pins stand in positions which represent the spaces between the figures "9" and "0" on the said disks. Now during the operation of the totalizing-wheels by means of the item-wheels 2 the tens-carrying wheels are correspondingly rotated, whereby one or the other of the two pins 222 of the tens-carrying pinions thus operated will be brought into engagement with the forward ends of the complementary triggers of a series of triggers 246, Figs. 5, 10, 17, and 19, of which there is one for each tens-carrying wheel, with the exception of the extreme left-hand tens-carrying wheel. These triggers are mounted to rock upon the trigger-shaft 247, and their rear ends are shaped to enter notches 248, formed in the forward edges of the locking-dog carriers 249, loosely mounted upon a locking-dog-carrier shaft 250 and each formed at its upper end with an operating-finger 251. The forward edges of all of the fingers 251 are engaged by a resetting-plate 252, Figs. 5 and 10, depending from a rock-shaft 253, the right-hand end of which is provided with a crank-arm 254, carrying a crank-pin 255, entering a slot 256, formed in the end of a longer crank-arm 257, mounted upon the inner end of a sleeve 258, turning upon a stud 259, and having its outer end provided with an operating-arm 260, which coacts with a cam 261, mounted upon the sleeve 111, turned by the handle 112. Each of the carriers 249 has pivoted to it a locking-dog 220, formed at its forward end with an operating-finger 262 and with two locking-teeth 263 263, located in a plane parallel with the plane of the finger 262, but to the left thereof. The fingers 262 of the dogs 220 are located in the vertical planes of the teeth 219 of the hubs 217, while the teeth 263 263 of the said dogs are located in the vertical planes of the tens-carrying pinions 216. When the pins 222 of the pinions 216 trip the triggers 246, the carriers coacting with those particular triggers are released so far as the triggers are concerned and are permitted to immediately move forward into a position in which they cannot be reëngaged and relocked by the triggers by a slight preliminary forward movement of the resetting-plate 252, which through the medium of the carriers holds the dogs out of engagement with the tens-carrying wheels when the same are being operated upon and positioned by the totalizing-wheels. Soon after that the arm 260 drops off from the cam 261, which allows the resetting-plate 250 to move forward, as shown in Fig. 17, into its extreme forward position, which permits all of the carriers to be pushed forward by the action of the springs 264, surrounding the stems 265 of the rams 266, which engage with the rear ends of the dogs 220. The stems 265 and the springs 264 of the said plungers are located in individual sockets formed for their reception in a cross-head 267, Fig. 17, of a frame of the machine. When the locking-dogs are thus moved forward, their teeth 263 are engaged with the teeth of the tens-carrying pinions 216, while the operating-fingers 262 of the dogs are brought into the paths of the teeth 219 of the tens-carrying wheel-hubs 217. The parts now being described coact progressively from right to left, which is necessary in the nature of the case, as their function is to carry the tens. Therefore the pins 222 of the respective tens-carrying pinions are arranged to coact with the trigger which releases the carrier of the locking-dog, which coacts with the tens-carrying pinion next to the left of it. From this arrangement it follows that the operation of the pins of any one of the tens-carrying pinions will always secure the secondary or tens-carrying movement of the carrying-wheel next to the left of it and that in turn may effect the operation of one or more of the tens-carrying wheels to the left of it progressively, according to the nature of the computation. Obviously there will be no need of providing the pinion of the tens-carrying wheel to the extreme left of the series with a pair of pins 222.

As the shaft 218 is rotated the teeth 219 of its hubs engage with the operating-fingers 262 of such of the locking-dogs 220 as have been brought into play and according to the direction in which the shaft is rotated deflect those dogs upward or downward, Fig. 17ª, causing the dogs through the medium of their teeth 263 to positively rotate the tens-carrying pinions, with which they are engaged and which are to the left of them, through an arc

represented by one tooth. This secondary or tens-carrying rotation of the tens-carrying wheels will be communicated to the totalizing-wheels in accordance with the arithmetical carrying of the tens.

In the case of adding one to nine hundred and ninety-nine the pins 222, carried by the tens-carrying pinions, are in position to operate the triggers by a movement of one tooth. In this case "1" is added to the units-column. This movement being accomplished by the accumulating-wheels, a continuation of the movement of the cycle-performing devices operates the shaft 253 to allow the teeth 263 of the released locking-dog 220 to come into engagement with the teeth of its respective tens-carrying wheel. As the cycle progresses the hub 217 is revolved, bringing one of its teeth 219 into engagement with the finger 262, thereby moving it and the tens-carrying pinion a distance representing one point on the accumulating-wheel next to the left of the wheel upon which "1" was previously added. This movement of the second wheel causes its pin to pass the trigger adjacent to it with a like result, the engagement between the locking-dog and the next (or third) tens-carrying wheel taking place instantaneously and before the teeth of its corresponding hub 217 (by reason of the spiral arrangement of the series) has passed, thereby giving it a movement as above described. This is repeated as many times as there are nines on the accumulator-wheels.

In the case of adding nine hundred and ninety-nine to nine hundred and ninety-nine all of the pins 222 pass the point of the trigger simultaneously and before the carrying function takes place. Thus the carrying movement of the operating-fingers is derived from the first tooth (of either series of spirally-arranged teeth) which presents itself for engagement with the locking-dogs, there being in this case no tripping of the triggers by the tens-carrying movement of the parts.

It is believed that the foregoing description will now have made clear the necessity of differentially arranging the teeth 219 of the tens-carrying hubs 216, so as to operate progressively from right to left upon the operating-fingers of the locking-dogs 220, which operate the tens-carrying wheels, and hence the totalizing-wheels. When the totalizing-wheels have thus been operated upon by the tens-carrying wheels, as described, the action of the cam 261, Fig. 10, rocks the shaft 253 rearward and swings the resetting-plate 252 rearward, so as to simultaneously retract all of the carriers 249 that have been operated, as well as their locking-dogs 220. When they have been retracted into their normal positions, their notches 248 will be reëntered by the rear ends of the triggers 246 and the resetting-plate 252 will resume its normal position, as shown in Fig. 18. The retraction of the carriers permits the ram-springs 264 to push the rams 266 against the upper or lower corners of the rear ends of the dogs 220 (according to whether the dogs have been deflected upward or downward, which depends on the direction in which the shaft 218 has been rotated) and restore the dogs to their operating positions, in which they are alined with the rams, as shown in Fig. 18. The springs 264 thus have the twofold function of forcing the carriers and dogs forward when the carriers are released by the triggers and by the resetting-plate and of restoring the dogs to their normal positions after they have been deflected upward or downward.

In order to prevent the totalizing-wheels from being accidentally displaced, I provide each of the tens-carrying wheels with a detent, consisting of a small roller 268, Figs. 5 and 16, adapted to engage with the teeth of their pinions 216 and mounted in the forward ends of arms 269, mounted upon a shaft 270 and constantly pressed downward toward the said pinions by springs 271, which are not so stiff but what they permit the easy rotation of the tens-carrying pinions under the rollers.

It will thus be seen that one complete revolution of the handle 112 puts the machine through, so to speak, one complete "cycle" of movements in which the totalizing-wheels are first operated upon by the item-wheels and then secondarily operated upon by the tens-carrying wheels, which are thereto positioned by the primary operation of the item-wheels, so as to be operated by the rotation of the tens-carrying shaft successively from right to left to impart that necessary secondary rotation to the totalizing-wheels required by the mathematical necessity of carrying the tens.

In order that the user of the machine may be visually notified whether it is set for adding or subtracting, I provide it with a telltale 272, Fig. 14, having a concave outer surface carrying "Add" and "Sub," which it exposes through an opening 273, Fig. 1, located in line with an opening 274, exposing one number upon each of the totalizing-wheels. The said openings 273 and 274 are formed in a transversely-arranged member 275 of the frame of the machine provided for masking, as it were, the totalizing-wheels and the telltale and reducing the exposure thereof to a single number. The said telltale is secured to an arm 276, Fig. 34, pivotally mounted upon the totalizing-wheel shaft 177. The lower end of the arm 276 is pivotally connected with an operating-lever 277, formed at its lower end with a lug 278, which is engaged by a shoulder 279 upon the extreme inner end of the hub 241 of the knob 238. A pin 280, passing through a slot 281, formed in the lower end of the lever 277, guides the same.

Normally the telltale is maintained by gravity in position to expose the word "Add"

through the opening 273. When, however, the knob 238 is turned from left to right for the purpose of setting the machine for subtracting, the shoulder 279 is brought into engagement with the lug 278 of the lever 277, which is drawn downward, so as to rock the arm 276 upon the shaft 177, whereby the abbreviation "Sub" is brought into view through the opening 273 and is maintained in this position until the reverse rotation of the knob 238 for setting the machine for adding removes the shoulder 279 from the path of the projection 278 and allows the action of gravity to rock the arm 276 back into its normal position, in which the abbreviation "Add" is exposed through the opening.

To set the machine for subtracting, the knob 238 is turned from left to right, whereby the gearing connecting the handle 112 with the tens-carrying shaft 218 is shifted so as to cause the said handle to effect the rearward rotation of the said shaft 218, whereas when the machine is set for adding the said shaft is rotated forward. The turning of the knob 238 from left to right also effects the longitudinal movement of the shipper-rod 237, whereby the lifting-arm 168 is shifted from position to coact with the lifting-cam 169 to coact with the lifting-cam 170, which is shaped so that during the first portion of the movement of the handle 112 the item-wheels are lifted and arrested in their intermediate positions, after which they are turned forwardly into their totalizing-wheel-operating positions, and then lifted into their extreme elevated positions, in which they engage with the gear members 173 of the totalizing-wheels, after which they are rotated rearwardly, with the effect of turning the gears 173, and hence the totalizing number-disks 174, forwardly. After that has been done the cam 170 allows the item-wheels to descend into their extreme depressed positions, in which they coact with the racks of the rack-bars. The difference between this operation and that of adding is that for adding the item-wheels are immediately raised from their depressed to their elevated positions and take the intermediate position after their operation of the totalizing-wheels. In subtracting they take their intermediate position before their operation of the totalizing-wheels. The difference, in effect, is that the totalizing-wheels are rotated in opposite directions. For adding they are rotated rearwardly, so that their numbers progress in regular order "1," "2," "3," "4," &c., while in subtracting the numbers descend in the opposite direction, "4," "3," "2," "1," &c. All this is accomplished by the suitable differentiation of the cams 169 and 170; but the user of the machine has nothing more to do in setting it from adding to subtracting and from subtracting to adding than to turn the knob 238 through one revolution.

We now come to consider the adaptation of the machine to be used for multiplying, which, mathematically considered, is a series of additions, and in correspondence with the mental addition of the totals secured by the use of the several figures of the multiplier from right to left all of the item-wheels are moved one point from right to left from the positions which they occupied when the machine was set for adding as the successive figures of the multiplier are used. To effect this movement, I provide the machine with a multiplying and dividing knob 282, Fig. 9, mounted on the outer end of a short shaft 283, carrying a gear-wheel 284, meshing into a wide pinion 285, formed on the inner end of a hub 286, provided with external threads 287, taking into corresponding threads 288, formed within an opening in the frame 8 of the machine. This hub is formed with internal threads 289, Fig. 9ᵉ, engaging with external threads formed upon the adjacent end of the member 290 of the yoke-shaft, which is fixed to the item-wheel yoke 6, the opposite end of which is "sleeved over," so to speak, the inner end of the other member 7 of the yoke-shaft, which is moved back and forth in the yoke without disturbing the position of the same when the shipper-rod 237 is moved by the knob 238 for the purpose of shifting the arm 168 from the cam 169 to the cam 170, and vice versa, the outer end of the member 7 of the shaft being rigidly connected with the said lifting-arm. When the knob 282 is turned forwardly, the gear-wheel 284 rotates the pinion 285, which through its internal threads 289 and the external threads of its hub 286 draws the entire yoke 6 from left to right, at which time the opposite end of the yoke slides, so to speak, over the member 7 of the yoke-shaft. This movement of the yoke causes the item-wheels to be moved from right to left with respect to the totalizing-wheels. These parts are constructed so that half a revolution of the knob 282 moves the item-wheels one point to the left or right, as the case may be. When the machine is being used for multiplying, the knob will be operated for moving the item-wheels one point to the left between the use of every consecutive figure of the multiplier. When ciphers occur, the knob will be turned consecutively a half-revolution for each cipher until the next digit is reached. For instance, if the sum were being multiplied by two the handle 112 would be rotated twice in succession. Then the knob 282 would be turned a half-rotation to move the item-wheels one point to the left. Supposing the next figure in the multiplier were three, the handle-arm would now be turned through three complete revolutions, after which the knob would be turned a half-revolution to move the item-wheels another point to the left, and so on. It will be understood, of course, that when the machine is used for multiplying it will be otherwise set as for add-

ing, because, as already stated, multiplication is a series of additions.

To use the machine for dividing, it will be set in the usual way for subtracting, inasmuch as division represents a series of subtractions. Therefore to use the machine for division the knob 238 is turned forward to bring the abbreviation "Sub" into view and to effect the corresponding shifting of the parts of the machine. The knob 282 is also operated to move the item-wheels to the right, for the reason that in dividing they are moved point by point from left to right instead of point by point from right to left, as in multiplication.

To assist the user of the machine in multiplying and dividing, I provide it with a number of tally-wheels 291, Figs. 1 and 4[b], mounted for independent rotation upon the inner end of a short shaft 292, the outer end of which is furnished with a tally-wheel button 293. Each tally-wheel is provided upon its periphery with a series of numbers running from "1" to "0"—thus, "1 2 3 4 5 6 7 8 9 0"—and each is provided with ten stop-pins, Fig. 4[c], 294, coacting with a stop-spring 295, of which there is one for each wheel. Each wheel is also provided in one face with a recess 296, Fig. 4[d], receiving a resetting-pawl 297, engaged by a spring 298, which forces the nose of the pawl into a longitudinal groove 299, formed in the shaft 292, so that when the button 293 is turned forward the pawls 297 of all of the wheels enter the groove 299, whereby the wheels are coupled with the shaft and rotated therewith for being reset.

The tally-wheels are independently operated by means of the machine through the medium of a tally-wheel pawl 300, pivoted in a bracket 301, Fig. 9, secured in the left-hand arm 4 of the yoke 6 and adapted to engage with the tally-wheel pins 294 every time the yoke is lifted, which will be once for every revolution of the handle 112. This movement of the yoke effects the revolution of the tally-wheel operated upon through the arc of a circle required to bring a new figure upon it into view through its aperture 302 in the tally-wheel sight-plate 303, Fig. 1. The tally-wheel will be held in its shifted position by the spring-detent 295. As the item-wheel yoke is moved from right to left by turning the knob 282 the tally-wheel pawl 300 will be moved from one tally-wheel to the other. Prior to beginning to subtract or divide these tally-wheels are turned by means of the tally-wheel button 293, so that the ciphers of the respective wheels are brought into line to be exposed through the aperture 302 in the plate 303 for the purpose of producing or showing on the tally-wheels the remainder in the case of subtraction or the quotient in case of division. Now as the handle 112 is turned in operating the machine one of the tally-wheels will be turned to keep tally of the number of times the handle is turned. Of course the particular tally-wheel turned will depend upon the position of the yoke, which is moved from right to left, or vice versa, according as the problem is one of multiplication or division.

It will be understood, too, that in multiplying and dividing the repeating-key 43 must be maintained in its depressed position, so as to prevent the operation of the resetting instrumentalities of the machine, and therefore the movement of the item-wheels, which must be left undisturbed in their set-up positions until the operation is completed.

In order to prevent the disturbance of the machine during the rotation of the handle 112, I locate upon the sleeve 111 a safety-cam 304, Figs. 1 and 2, which coacts with a safety-pawl 305, hung on a shaft 163 and connected by a link 307 with a crank-arm 308, mounted upon the right-hand end of a shaft 309, the opposite end of which is provided with a crank-arm 310, Fig. 6, to which are pivotally attached the lower ends of two plunger-like locking-bars 311 312, Fig. 3. A spring 313, encircling the shaft 309, exerts a constant effort to turn it, so as to keep the pawl 305 in engagement with the cam 304. The locking-bar 311, Fig. 3, is provided with a locking projection 314, Fig. 3, which enters a locking-notch 315, Figs. 34[a] and 34[b], formed in the flange of the knob 238 and serving the additional purpose of receiving the spring-detent 320. The bar 311 is also formed with a locking projection 316 to enter a locking-notch 183, formed in the flange of the knob 182. The locking-bar 312 is formed with a locking projection 317 for entrance into either one of the two diametrically opposite locking-notches 318, formed in the base of the knob 282, which performs its function in a half-rotation. One or the other of these notches is always entered by a detent-spring 319. A detent-spring 320, Fig. 34[b], is provided for entering the locking-notch 315 of the knob 238.

In order to limit the rotation of the knob 238 to one full rotation in either direction, I provide it with a stop-lug 321, which engages, after the knob has completed a forward rotation, with a stop-finger 322, Fig. 34[a], and, after the knob has completed a rearward rotation, with a stop-finger 323, both of these fingers being formed in a stop-plate 324, secured to the frame of the machine. The bars 311 and 312 are respectively slotted for coaction with the hubs of the knobs 328 and 282, whereby the bars are guided in their reciprocatory locking and unlocking movements. It will be noted that the cam 304, Figs. 1 and 2, is a perfect disk except for the notch 325, formed in it for the reception of the nose of the safety-pawl 305, and, further, that the notch 325 is placed so that the nose of the pawl rides out of it and up onto the edge of the cam just as soon as the handle 112 is

turned, whereby the safety-pawl is depressed, with the effect of rocking the shaft 309 and lifting the locking-bars 311 312 into the positions in which they positively hold against rotation the knob 182, which resets the totalizing-wheels, the adding and subtracting knob 238, which shifts the mechanism of the machine from its adding to its subtracting adjustments, and vice versa, and the multiplying and dividing knob 282, which shifts the mechanism of the machine for multiplying and dividing, and vice versa. All of these knobs are held positively locked by the riding of the pawl 305 upon the surface of the cam 304 until just as the handle 112 reaches its home position, when the pawl snaps into the notch 325, which permits the spring 313 to act in retracting the bars 311 312 and unlocking the knobs. The safety-cam 304 is also employed for positively locking all of the number-keys of the machine when the handle 112 is being turned. For this purpose the pawl 305 and the link 307 are also utilized, the latter being furnished with a locking-pin 326, Fig. 2, coacting with a locking-shoulder 327, formed upon a key-locking plate 328, the rear end of which is slotted to fit over a guide-pin 329 and the forward end of which is pivoted to the upper end of a crank-arm 330, secured to the right-hand end of the tubular rock-shaft 125, Fig. 7, provided, as already described, with arms 124 124, carrying the universal key-bar 123, on which the key-levers 47 operate. Under this construction every time one of the key-levers 47 is depressed the key-locking plate 328 will be drawn forward by the crank-arm 330, its shoulder 327 moving under the pin 326 if the same is in its elevated or unlocked position. Just as soon, however, as the pin 326 is pushed downward into its locked position in front of the shoulder 327 by the downward movement of the link 307, caused by the riding of the nose of the safety-pawl 305 out of the notch 325 in the cam 304, the said pin will be brought into position to block and positively stop any forward movement on the part of the plate 328, which thus prevents any of the number-keys from being depressed until the handle 112 has completed a revolution, and the notch 325 of the cam 304 is brought into position to permit the pawl 305 to be lifted into it, and thus lift the link 307 and clear the locking-pin 326 from the shoulder 327.

The safety-cam 304 and the safety-pawl 305 are also utilized for automatically performing the work which is manually done by the shifting-key 45, the depression of which provides for the operation of the escapement mechanism controlling the quick return of the traveling drum 24 to its starting position. For doing this same work automatically I employ an escapement-link 331, connected at its upper end with the pawl 305 and at its lower end with the plate 116, carrying the escapement-pawl 115. The link 331 operates at the very beginning of the movement of the handle 112 to release the escapement mechanism, which permits the traveling drum 24 to be shifted to its starting position.

For the purpose of preventing the operation of the resetting mechanism of the machine at the time when the item-wheels are not locked at the limit of their movement to the right, and therefore at a time when they are not engaged with their complementary racks, I employ safety mechanism connected with the repeating-key 43. This mechanism comprises a locking-head 332, Fig. 24, secured to the outer end of the hub 286, Fig. 9, of the pinion 285, the rotation of which effects the lateral movement of the item-wheels. The said head 332 is formed with a notch 333, receiving the beveled nose 334 of a bell-crank locking-lever 335, the lower arm of which is formed with a slot 336 to receive a pin 337, located in the connecting-bar 209, the longitudinal movement of which swings the lever 335, so as to enter its nose 334 into and withdraw it from the notch 333 of the locking-head 332. This safety mechanism for preventing the untimely operation of the resetting mechanism is thus placed under the control of the repeating-key 43. When the said key is in its elevated position, the nose 334 of the lever 335 will also be in its elevated position and entered into the notch 333. In the elevated position of the key, however, the resetting mechanism is free to operate; but at this time the item-wheels are positively locked against lateral movement by the locking of the head 332, which cannot be unlocked for the lateral movement of the item-wheels except by depressing the repeating-key; but the depression of that key operates in the way already described to cut the resetting mechanism out of action, at which time the item-wheels may be moved laterally without endangering the machine.

For the purpose of automatically stopping and locking the handle 112 in its normal position I employ a thumb-lever 338, Fig. 2°, located to the right of the machine and mounted upon a rocking spindle 339, Fig. 1, encircled by a controlling-spring 340. This lever is provided at its rear end with a cam-faced locking-lug 341, containing a locking-notch 342 and coacting with a pin 343, projecting inwardly from the extreme outer end of the handle, which as it is swung forward engages the pin 343 with the said cam-face of the lug 341, whereby the thumb-lever is rocked against the tension of its spring and the pin 343 allowed to enter the said notch 342, after which the spring reasserts itself to turn the thumb-lever 338 and automatically lock the handle 112, which at this time has reached its normal position. To release the handle 112 for starting it, the thumb-lever is

pressed down upon by the thumb, while the handle is lifted by the fingers applied to its grip 112ª. The said pin is thus released from the notch and the handle left free to be lifted and turned. As the handle is started the pin moves upward between the forward extension of the thumb-lever and the rearwardly-extending locking-lug 341 thereof.

For the purpose of printing the items set up, the totals computed by the machine, and the dates I employ a printing mechanism constructed and arranged to print the items and totals and dates, so that each line of printing is exposed to view from the front of the machine as soon as it is printed. In carrying out this part of my invention I employ a number of composite type-wheels, Figs. 30 and 31, of which there is one for each of the composite totalizing-wheels. Each type-wheel comprises a type member 344 and a gear-wheel 350. Each type member 344 has upon its periphery a type-segment 344ª, containing ten types 345, arranged as follows: "0, 1, 2, 3, 4, 5, 6, 7, 8, 9." Each type member has its periphery formed at a point opposite the said type-segment 344ª, with oppositely-beveled alining teeth 346. Each type member carries a pawl 347, the nose of which coacts with any one of three lugs 348, located at equal distances apart in a recess 349, formed in the complementary gear-wheel 350, having thirty teeth which are virtually divided into blocks of ten teeth by the said lugs 348. The type-gears 350 are loosely mounted upon a type-wheel shaft 351, the left-hand end of which is provided with a knob 352, by which it is manually rocked back and forth for the purpose of bringing into play the type-faces 353, Fig. 1, of a date-segment 354, which is rigidly secured to the said shaft 351. The type-faces 353, Fig. 3, of which there are twelve, are engraved or otherwise adapted to print abbreviations of the months of the year. The segment 354 is also formed with a shoulder 355, provided for visual display, with abbreviations of the months of the year arranged in correspondence with the type-faces 353, so that the user of the machine is guided for setting it to do date-printing. The said shoulder is normally covered by a sight-plate 356, secured to the frame of the machine and having a sight-opening 357, through which one of the divisions of the shoulder is always exposed.

The type-wheels are guided at the top by their entrance into transverse grooves 357, Figs. 5 and 28, formed in a guide 358 at the bottom by the entrance of their lower edges into transverse grooves 359ª, formed in the body of a universal justifying-dog 359, mounted upon a rock-shaft 360, and at the front by the entrance of their edges between the fingers 361, Fig. 2ª, of a pivotal guide 362. The types 345 must be presented for printing in harmony with the setting up of the item-wheels—that is to say, the type-wheel corresponding to any one of the item-wheels must be actuated to present for printing a type corresponding to the number presented to view on the item-wheel. For this purpose I utilize the steps 63, formed in the rear ends of the rack-bars 64, which when the number-keys are operated are released and drawn rearward more or less, according to the value of the key. For coaction with these steps I employ a series of vertically-arranged type-wheel plungers 363, Fig. 5, the lower ends of which are entered into vertical slots formed in a guide-bar 364. These plungers are located in the vertical planes of the stepped rear ends of the rack-bars, so that when the plungers descend they will engage with the steps 63 thereof and be limited in their descent. Each plunger is pivotally connected at its upper end to one of a corresponding series of rocking plates 365, having independent rocking movement upon a rock-shaft 366. Each of these rocking plates 365 is in turn connected with one of a series of links 367, the forward ends of which are connected with the members 344 of the type-wheels. Plunger-springs 368, connected with the upper ends of the respective plungers 363, exert a constant effort to pull the same down into engagement with the steps 63 of the rack-bars. Normally the plungers are sustained in their elevated positions against the tension of the springs 368 by means of a universal type-wheel-resetting bar 369, mounted at its ends in crank-arms 370, secured to the rock-shaft 366, which is rocked so as to clear the bar 369 from engagement with the fingers 411 of the plates 365 very soon after the handle 112 begins its movement.

To actuate the rock-shaft 366, I utilize the wheels 107, 108, 108ª, and 109, already described in another connection. The wheel 107 is mounted on a shaft 371, Fig. 2, provided at its opposite end with a fixed disk 372, Figs. 3 and 4, formed with a peripheral notch 373, Fig. 4ª, receiving the nose 374 of a coupling-dog 375, located in the plane of the disk upon the inner face of a cam-like driving-head 376, loosely mounted upon the shaft 371, with which it is connected through the medium of the coupling-pawl 375 and the disk 372. The said pawl 375, which is hung in the head 376 upon a pin 377, is normally cut out of action by the engagement of its tail by a cam 378, located at the inner end of a sleeve 379, furnished at its outer end with an operating-button 380 and mounted on a stud 380ª in the frame 18, Figs. 3 and 3ª. When the cam 378 is thus engaged with the tail of the pawl, the nose 374 thereof clears the notch 373 in the fixed disk 372. When, however, the cam is turned to release the pawl, the spring 381 immediately throws the nose thereof into position to enter the notch 373. When the head 376 is not coupled to the disk 372 by the pawl 375, it is locked to the frame of the

machine through the medium of the pawl, which for that purpose is formed with an exterior notch 382, which receives a pin 383, mounted in the frame of the machine.

The rotation of the shaft 371 is transmitted through the disk 372 and head 376 to a pitman 384, connected with a segmental driving-wheel 385, meshing into a pinion 386, fixed to the shaft 366, which is rocked back and forth and first from its normal position, in which it is shown in Fig. 5, to the limit of its forward position, in which it is shown by broken lines in the same figure. When the shaft is rocked forward, the plunger-springs 368 act to pull down the plungers 363 and rotate the type-wheels, which will be turned until the lower ends of their plungers engage with the steps 63 of the rack-bars. When this engagement takes place, the printing-wheels will present for printing types corresponding to the figures set up on the corresponding item-wheels at the time.

As soon as the plungers 363 have operated the type-wheels the same are alined or justified by the long slotted nose 387 of the universal justifying-dog 359, Figs. 5 and 31, the said nose simultaneously coacting with the justifying-teeth 346 of the type members 344 of all of the type-wheels. Normally the said nose is disengaged from the said teeth; but immediately after the type-wheels have been positioned by the plungers it is lifted into engagement with the said teeth by the rocking of the shaft 360, on which the dog is mounted, by means of a spring 388, attached to a head 389, secured to the projecting end of the shaft 360 and operated upon by the lower end of the pitman 390, which is connected at its lower end with the pinion 386 and which operates to depress the said spring 388 when it reaches the limit of its rearward motion. When the nose of the dog is lifted into engagement with the justifying-teeth 346, their opposite bevels will cause the type-wheels to be rotated forward or back enough to bring the types into exact alinement.

For the printing of decimal-points or punctuation-marks I employ small pins 521, Figs. 5 and 28, which are mounted in the ribs 522 of the pivotal comb-like guide-frame 358. These pins are located under the faces of the hammers 391, as shown in Fig. 5, and of course will print when the hammers fall upon them. It is not necessary that each rib shall be provided with a pin; but preferably every rib will be provided with a pin-hole in which the pins may be shifted according to the character of the computation.

The type-wheels having been positioned and justified the printing is done by means of a series of hammers 391, Fig. 5, of which there is one for every type-wheel. These hammers are mounted for independent movement upon a hammer-shaft 392, and each hammer is provided with a hammer-spring 393. The hammers, Fig. 28[a], are normally held in retired positions by means of a series of triggers 394, mounted upon a shaft 395 and having their lower and rearwardly-extending ends adapted to enter cocking-notches 396, formed in the upper ends of the hammers, while their upper ends are adapted to be engaged by a universal trigger-plate 397, Fig. 29, provided at its ends with upwardly-extending arms 398 399, by means of which it is suspended from a rock-shaft 400, with respect to which it is laterally movable, at which time the arms 398 399 slide upon the shaft.

If all of the type-wheels were always used in printing, all of the triggers would be simultaneously operated and there would be no occasion for moving the trigger-plate 397 endwise with respect to the triggers; but that is made necessary because all of the type-wheels are not used, at least commonly, making it necessary to restrict the hammer released to the hammers of the type-wheels positioned, for otherwise the hammers of the unpositioned wheels would fall on the cipher-types thereof and print ciphers to the left of the sum being printed by the positioned wheels. I provide, therefore, for normally moving the trigger-plate so far from left to right that its left-hand end shall clear all of the triggers to the left of the trigger of the left-hand wheel positioned for printing a digit. The type-wheels positioned for digit-printing are utilized to themselves control the longitudinal movement of the trigger-plate through the instrumentality of a trigger-selector 401, rigidly secured to a longitudinally-movable rod 402, located directly above the type-wheels in position for the selector to engage with the outer edges of the type-segments 344[a]. This rod is supported and guided in a guide-arm 403, loosely connected at its right-hand end with an operating-arm 404, the extreme upper end of which is loosely connected to the arm 399, before mentioned, so that the rod and trigger-plate are moved together and to the same extent in either direction under the influence of the arm 404.

After the type-wheels have been positioned the selector 401 moves from left to right and engages with the segment 344[a] of the left-hand wheel of the type-wheels set up, whereby the movement of the selecting-rod is stopped, and therefore the movement of the trigger-plate, the left-hand end of which will be stopped in position to operate the trigger of the hammer complementary to the wheel upon which the stop engaged, and therefore upon the triggers of the hammers of all of the wheels to the right of that wheel. All of the triggers now within the range of the trigger-plate may be said to be "selected" for operation, while all of the triggers which lie to the left of the extreme inner end of the plate may be said to be cut out of operation.

The operating-arm 404, Fig. 28, is secured to a swinging frame 405, turning on centers 406 and furnished with an operating-spring 407, which tends to swing the frame outward. This frame carries a segmental cam 408, upon the outer edge of which an antifriction-roller 409 rides, this roller being mounted in the outer end of an arm 410, secured to the rock-shaft 366, the opposite end of which carries the pinion 386, which, as stated, is operated in partial rotation from the segmental gear-wheel 385. When the shaft 366 is rocked rearward, the resetting-bar 369 moves forward to the position shown by broken lines in Fig. 5, and thus releases the plungers 363 to the action of their springs 368, which operate to position the type-wheels. When, however, the shaft 366 is rocked forward, the bar 369 engages the rearwardly-projecting fingers 411 of the rocking plates 365. The trigger-plate 397, having been moved into position under the control of the selector 401, is now swung forward to operate the triggers 394 through the medium of a slotted collar 412, Fig. 29[a], mounted on the rock-shaft 400, the upper edge of the plate being free to move back and forth in the slot in the collar, which, however, moves the plate forward and back when the shaft is rocked, for which purpose the shaft is provided with a crank-arm 413, connected with a connecting-rod 414, the lower end of which is connected to the frame of the machine by a link 415, having attached to it a spring 416, which exerts a constant effort to lift the rod 414 and rock the shaft 400, so as to swing the trigger-plate 397 into its retired position. The extreme lower end of the rod 414 is furnished with an operating-pin 417, which coacts with a pin 418, projecting from the edge of the coupling-head 376, through the medium of which the rod is drawn downward for rocking the shaft 400 to swing the trigger-plate 397 forward to operate the triggers 394, which after their operation fall back by gravity into positions to automatically reëngage the hammers 391 when the same are reset. The resetting of the hammers is effected by means of a universal hammer-resetting bar 419, Figs. 5 and 28[a], mounted at its ends in crank-arms 420, secured to the ends of the rock-shaft 392, on which the hammers are loosely hung. This shaft 392 is rocked by means of a crank-arm 421, connected by the link 390, already referred to, with the pinion 386. When the shaft 392 is rocked rearwardly, the bar 419 is lifted against the inner edges of all of the tripped hammers, which are then raised against the tension of their springs 393 until they are engaged and cocked by the triggers 394, after which the shaft 392 rocks forwardly and moves the bar 419 forward clear of the hammers, so that the same are given room enough to fall and do their work. As the hammers fall they force the paper 422, Fig. 5, against a narrow inked ribbon 423, which extends laterally across the machine in line with the line occupied by the positioned types of the type-wheels. The paper 422 is wound upon a spindle 424, Fig. 5, the ends of which rest in the bottoms of grooves 425, Fig. 25, formed in rearwardly-inclined arms 426, Fig. 35. A tension-plate 427, Fig. 5, mounted in a rocker-bar 428, encircled by a tension-spring 429, Fig. 5, rides upon the surface of the roll of paper and prevents the same from unrolling too freely. The paper is passed down from the back of this roll over a small guide-roller 430, from which it is carried forward under the lower edge of a rearwardly-inclined feed-plate 431, which is moved not only up and down but at its lower end forward and back. The paper also passes under a rubber-faced take-up roll 432, mounted upon a shaft 433, to which step-by-step rotation is imparted, as will be set forth later on.

The compound movement of the feed-plate 431 is effected by means of a cam 434, Fig. 32, mounted upon the shaft 371 and acting upon a crank-arm 435, secured to a rock-shaft 436, carrying two crank-arms 437, connected with two rods 438, the upper ends of which are secured to pins 439, projecting from the ends of the feed-plate and passing through L-shaped guide-slots 440, formed in the frame of the machine, whereby the paper is drawn off the roll, after which the lower end of the plate is drawn rearward into its normal position, leaving the paper slack in front of the plate. This slack in the paper is then taken up by the action of the take-up roll 432, the shaft 433 of which is provided with an operating-knob 442, Figs. 1 and 3, by means of which the take-up roll may be operated manually, and also with a ratchet-wheel 443, engaged by a pawl 444, hung from the upper end of a pawl-plate 445, which swings on the shaft 433 and is operated back and forth by its connection with the upper end of a rod 446, the lower end of which is connected by a stud 447 with the oscillating segmental driving-wheel 385.

The ends of the long inked ribbon 423 are wound upon spools 448 and 449, Fig. 35, mounted on studs 450, secured to the frame and for convenience in the same axial line as the spindle 424, upon which the paper is wound. The inner head 451 of each spool is toothed to form a ratchet-wheel, whereby the spools are alternately driven in step-by-step movement, so as to wind the ribbon back and forth from one spool to the other. This is automatically accomplished by utilizing the reduction of the diameter of the coil upon the spool from which the ribbon is being unwound at any one time. For this purpose I employ two pivotal switch-arms 452, 453, Figs. 36, 37, and 38, respectively located at the right and left hand sides of the machine. These switch-arms are pivotally mounted upon studs 454 and

are furnished with springs 455, arranged to exert a constant effort to pull the rearwardly-projecting ends of the arms down upon the coiled ribbon. The arm 453 is furnished with an upwardly-projecting switch-lug 456, while the arm 452 is furnished with a correspondingly-located hook 457. The lug 456 coacts when in the right position with a switch-pin 458, projecting outwardly from a small head 459, mounted upon the left-hand end of a rock-shaft 460, which extends through a tubular shaft 461, mounted in the ends of carrying-arms 462 and 463, swung upon the centers 450 of the ribbon-spools. The arm 463 is formed with an extension 464, connected with the upper end of a rod 465, attached at its lower end to the oscillating segmental gear-wheel 385. The shaft 461 constitutes, in effect, the main member of a yoke of which the arms 462 and 463 are the other members. The said arms 462 and 463 are provided near their outer ends with pawls 466 and 467, respectively, engaging with the ratchet-wheels 451. The pawl 466 is turned on its pivot and held out of engagement with the teeth of its ratchet-wheel 451 by means of a cut-out pin 468, projecting inward from the inner face of the small head 459, while the pawl 467 is cut out of operation by means of a pin 469, projecting inwardly from the inner face of a head 470, mounted upon the projecting right-hand end of the rock-shaft 460, passing through the tubular shaft 461 and corresponding to the head 459. The said head 470 is provided with an outwardly-projecting switch-pin 471 corresponding to the switch-pin 458 and coacting with the hook 457 of the switch-arm 452. The pin 472, mounted upon the rock-shaft and passing through a slot 473 in the tubular shaft 461, limits the movement of the said rock-shaft. In the swinging movement of the yoke-arms 462 and 463 the switch-pins 458 and 471 are swung forward and downward close to the lug 456 of the arm 453 and to the hook 457 of the arm 452. Every time the said yoke-arms are swung forward one spool or the other will be rotated by the action of one of the pawls 466 or 467, only one of which can operate at any time, for when one pawl is free for operation the other is retired from operation by the action of one of the two cut-out pins 468 and 469. One pin or the other will be in operation, according to the way the shaft 460, carrying the two heads 459 470, is rocked, and the direction in which that is rocked will depend upon the position of the switch-arms 452 and 453, and their position will in turn depend upon the size of the respective coils. For instance, when the coil on the left-hand spool is nearly run out it will allow the left-hand switch-arm 453 to rock so far rearward and downward as to bring the lug 456 of the said pawl directly into the path of the switch-pin 458, so that the next time the yoke-arms 462 and 463 are rocked forward and downward the pin 458 will be engaged with the lug 456, causing the rocking of the shaft 460. The described rocking of that shaft will move the pin 468 out of contact with the tail of the pawl 466, which is now left free to engage with the teeth of the ratchet-wheel 451 of the left-hand spool, while the cut-out pin 469 in the head 470 at the right-hand end of the rock-shaft 460 will be engaged with the tail of the right-hand pawl 467, which will be moved and held out of engagement with the teeth of the ratchet-wheel 451 of the right-hand spool. Now the left-hand pawl 466 will operate to turn the left-hand spool until the ribbon has been run off from the right-hand spool to such an extent that the switch-arm 452 has pulled rearward and downward far enough to present its hook 457 in position to coact with the cut-out pin 471 of the head 470 at the right-hand end of the rock-shaft 460, whereby the said shaft will be rocked again, with the effect of releasing the pawl 467 and cutting out the pawl 466, so that the right-hand spool will be positively actuated to unwind the ribbon from the left-hand spool, and this will go on until the switch-arm 453 has been brought into position to present its lug 456 to the cut-out pin 458 again, and so on. I wish to call particular attention to the fact not only that the act of reversing the winding of the ribbon from one spool to the other, and vice versa, is purely automatic, but also that this automatic reversing takes place not when the coil has been built up to a predetermined size, but when it has been unwound to a predetermined degree, so that the action of this mechanism is not made dependent upon the number of coils or the length of the ribbon.

To provide for printing totals as well as items, I employ a total-printing key 44, Figs. 6 and 2ª, mounted upon the outer end of a lever 474, hung upon the extreme right-hand end of the rod 30. The said lever has connected with its upwardly-projecting inner end a long bar 475, the upper end of which is connected with a crank-arm 476, mounted upon a stud 477 and furnished with a lug 478, entering a slot 479, formed in the outer end of an arm 480, mounted upon the outer end of the right-hand trunnion 481 of the guide-frame 362. This frame is provided with a series of guide-forks 482, extending rearwardly and upwardly and spaced so as to receive the respective composite type-wheels between them. The outer ends of these forks are formed with deep notches 483, Fig. 31, for coaction with operating-pins 484, mounted in the coupling-pawls 347, Fig. 30, and projecting to the right through clearance-slots 485, formed in the type members of the type-wheels. Under this construction the respective forks coact with the pawls of the type-wheels immediately to the left thereof. The pawls themselves act under such frictional re-

straint that they will not shift except when positively moved.

Normally the pawls 347 occupy positions in which their noses clear the total-printing lugs 348 of the type-gears 350, so that the type-wheels are turned backward and positioned under the control of the plungers 363 and reset in their normal positions without any reference to the said type-gears 350. When, however, it is desired to print the totals, the depression of the total-printing key 44 will effect the inward movement of the guide-forks 482, causing the upper edges of the slots 483 therein to bear downward upon the pins 484 of the pawls 347, which will be turned so as to bring their noses into the paths of the total-printing lugs 348 of the type-gears 350, which are constantly in mesh with the respective gear members 173 of the totalizing-wheels which operate to position the wheels 350 for total-printing, for these wheels are not utilized for positioning the type-wheels 354 ordinarily, but only when the coupling-pawls 347 are brought into play by the rearward movement of the guide-forks, as described. It should now be noted that the total-printing lugs 348 have predetermined relations with respect to the numbers on the number-disks 124 of the totalizing-wheels and that the pawls 347 are arranged with reference to the types 345 of the type-wheels 344, so that when the nose of any pawl of any type-wheel is brought into contact with any one of the lugs 348 the type-wheel will be stopped in position to present to its printing-hammer the type corresponding to the figure exposed by the number-disk of the corresponding totalizing-wheel. In total-printing the type-wheels are rotated rearwardly by the action of the plunger-springs 368 and reset by the universal resetting-bar 369, as described for item-printing; but the plungers 363 have in total-printing nothing to do with positioning the type-wheels, as their total-printing positions are determined by the total-printing lugs 348 acting through the coupling-pawls 347, which are operated by the total-printing key 44, which must be maintained depressed during the operation of total-printing against the tension of the coiled spring 486 upon the rod 30.

In order to preclude the possibility of an attempt on the part of the operator to print items and totals at the same time, I provide safety mechanism comprising a rod 487, Fig. 2, connected at its forward end with a key-lever 474 and at its rear end with a crank-arm 488, mounted upon a rock-shaft 489, carrying a forwardly-projecting locking-bar 490, Fig. 2^{b}, extending so near to the rear ends of all of the rack-backs 64 that if any one of them is released and allowed to move back one point, or, in other words, the distance represented by one of their steps 63, the rear end of the rack-bar will extend over the locking-bar 490, which will be locked down thereby, with the effect of locking the total-printing key 44 against depression. It will thus be seen that the total-printing key, and therefore the total-printing mechanism, cannot be operated except when all of the rack-bars are in their normal or reset positions. On the other hand, when the total-printing key is depressed for total-printing all of the number-keys are locked against depression for item-printing or for any other purpose by the movement of the locking-arm 491 of the key-lever 494 under the rod 123.

My machine is constructed so that the mechanism connected with the printing of dates may be cut out of action, except when it is desired to do such printing. With this end in view I locate the date-printing slide 46, Figs. 6 and 7, upon the inner face of the lever 130 of the shifting-key 45. The said slide is formed at its ends with slots 492, receiving pins 493 in the lever 130, and furnished at its forward end with a date-printing handle 494. Its inner end is connected with a crank-arm 495, mounted upon a rock-shaft 496, having a crank-arm 497, connected through a link 498 with a lug 499, formed on the left-hand dog 500, Fig. 7^{w}, mounted upon the shaft 139 and constituting, in effect, a continuation of the series of dogs 138, from which it is chiefly distinguished by function. This dog 500 operates only in connection with date-printing. The dog 500 coacts with the date-selecting finger 89 of the pair of date-selecting fingers 89 90 on the sliding drum 87. Normally the dog 500 is cut out of action by the slide 46, which is normally pushed rearward. When, however, it is desired to print dates, the date-printing handle 494 is drawn forward, whereby the dog 500 is allowed to coact with the finger 89 in stopping the rotation of the selecting-drum 87, so that the traveling drum 24 will be stopped in position to expose its dating-spots 502 and 503, Figs. 41 and 42, through the sight-openings 504, Fig. 7^{c}, in the sight-plate 17. After the initial performance of the finger 89 in stopping the rotation of the traveling drum 24, so as to expose its dating-spots, this finger 89 and its companion finger 90 operate in precisely the same way that the fingers 86 of the selecting-drum 87 operate upon the selecting-levers 84. I also utilize the date-printing handle 494 for cutting into and out of action the trigger-plate 505, Fig. 29, which trips the triggers 394 of the date-printing hammers 391. For this purpose the slide 46 has connected with it a rod 506, Fig. 3, attached to a bell-crank lever 507 and connected with the lower end of a rod 508, the upper end of which is attached to the arm 509 of a sleeve 510, turning loosely on the shaft 400, from which the trigger-plate 505 is suspended. The sleeve 510 is formed at its inner end with a cam 511, which acts against the frame of the machine to move the sleeve from right to left, and is also formed with a flange 512,

which coacts with a small button 513, Fig. 28, located upon a coupling-rod 514, arranged to slide back and forth in the arm 413, before mentioned, and in an arm 515, secured to the rock-shaft 400. The said rod 514 is encircled by a spring 516, which exerts a constant effort to move the rod from left to right and so project its inner end through the arm 515 into position to engage with the rearwardly-projecting lug 517, formed upon the left-hand suspension-arm 518 of the plate 505, the right-hand end of which is formed with a suspension-arm 519. The said trigger-plate 505 is free to swing back and forth upon the rock-shaft 400 within narrow limits, being held in its normal position by means of a pin 520, mounted in the arm 518 and engaging with the frame of the machine. When the date-printing handle 494 is drawn forward, the sleeve 510 is rotated and moved from left to right by the spring 516, which also projects the inner end of the rod 514 through the arm 515 into position to engage with the lug 517. Now when the rock-shaft 400 is rocked rearwardly by the action of the rod 414 the projecting end of the rod 514 bears down upon the lug 517 and rocks the trigger-plate 505, with the shaft, whereby the triggers of the dating-hammers are released. On the other hand, by pushing the date-printing handle 494 inward the cam 511 causes the movement of the sleeve 510 from right to left, so as to retract the rod 514 from over the lug 517, so that thereafter the rocking of the shaft 400 will leave the trigger-plate 505 undisturbed.

The operation of the machine and the mode of operating it have been so fully described in connection with the description of its detailed construction that it will be unnecessary to describe its operation as a machine except briefly and in a general way.

Suppose it be used for adding, for which it will chiefly be used, and that the largest sum in the column of figures to be added is composed of five figures, the operator will then step around the normally stationary column-indicating drum 21 by the use of one of the two drum-setting keys 28 and 41 until one of the spots 22 on that drum is exposed through the fifth sight-opening 23 in the plate 17, counting from right to left. The spot thus exposed will now be found to be located in the same vertical plane as the fifth item-wheel 2, counting from right to left. The drum 21 may be set by the same means to afford different starting-points for the computations, depending upon the work to be done and the skill and personal equation of the operator; but the foregoing example will answer the purpose of illustration. If after the spot 22 has been brought into position, as described, the corresponding spot 25 of the traveling column-indicating drum 24 has not been exposed through the corresponding opening 26 of the sight-plate, the drum 24 is released, either by turning the handle 112 through one revolution or by pressing the shifting-key 45, which latter will probably be the most convenient way. The drum 24, being released will be stopped, with its corresponding spot 25 exposed through the fifth sight-opening 26 in the plate 17, counting from right to left. Now let it be assumed that the item at the head of the column of figures to be added is nine thousand five hundred and sixty-seven. As this item contains only four figures, the spacing-key, which is also the cipher-key, must be depressed to shift the plane of operation one point from left to right, and therefore into the vertical plane of the fourth item-wheel, counting from the right. This change is recorded in the machine by the movement of the traveling drum 24, so as to expose the locating-spot thereon one point to the right, which shows the operator where he is working. The number-keys are now operated in the following order, "9 5 6 7," causing the item-wheels 2 to be correspondingly set up. The handle 112 is now passed through one complete revolution, whereby the item-wheels 2 are caused to correspondingly operate the totalizing-wheels, and whereby the item-wheels are reset, and whereby also the traveling drum 24 is restored to the position in which one of its locating-spots is exposed through the fifth sight-opening 26 in the plate 17, counting from the right. The items in the column of figures to be added are transferred to the machine one after the other in this way, the handle being turned through one revolution after each item has been set up on the item-wheels by the operation of the number-keys. In case any item contains a cipher located between two digits the spacing or cipher key is operated to step the parts of the machine along one point to the right, but no item-wheel is moved. In case, however, the item set up has one or more ciphers to the right of its last digit to the right, they are ignored. When all of the items have been transferred to the machine in this manner, the total amount of them will be found upon the totalizing-wheels, for, as I may further explain, the items are successively added to the first item set up on the totalizing-wheels by the successive revolutions of the handle 112, so that the amount added at any time during the process of adding the entire column may be readily ascertained by consulting the totalizing-wheels.

If desirable, as it probably will generally be, to print the items as they are successively set up on the machine, the printing-button 380 is turned to cut in the printing mechanism, after which it will operate to print the successive items. If it is desired to print the total amount in addition to printing the successive items, the total-printing key 44 will be

depressed and held depressed while the handle 112 is revolved once, whereby the total amount will be printed at the foot of the items. In case it is not desired to print the items, but only the total, the printing mechanism is cut out by rotating the button 380 until after the items are set up, when the button is turned to cut in the printing mechanism. Then the total-printing key is depressed and the handle revolved for printing the total amount.

If it is desired to print a date with any or all of the items, the date-printing handle 494 is pulled out to cut the date-printing mechanism into action. After the date-printing mechanism has been cut into action it will be found that the traveling column-indicating drum will not be stopped when the handle 112 is restored to its normal position so as to expose one of the spots 25 through the fifth sight-opening 26 to the left, but that it will be stopped so as to expose its spot 502 through the left-hand sight-opening 504 in the sight-plate 17, thus notifying the operator that the plane of operation has been temporarily shifted from the item-wheels to the date-printing mechanism. The date is then transferred to the machine by striking the proper number-keys, whereby the rack-bars belonging to the date-printing wheels are operated. These rack-bars belong to the systems coacting with the date-printing selecting-lugs 89 and 90. They have no racks, for the reason that they coact with no item-wheels; but it is necessary that they should be provided with steps at their rear ends for coaction with the plungers 363, which are utilized for positioning the date-printing wheels, in which respect the operation is the same as for any of the type-wheels. After the date has been set up the shifting-key 45 will be operated to release the traveling drum 24, which will then be quickly rotated to expose the spot upon it corresponding to the spot exposed by the normally stationary drum 21. Preparatory to printing the date the knob 352, Figs. 1 and 3, is grasped and manually turned for bringing the right month type-face 353 into position for printing.

In case a mistake has been made in transferring any item to the machine and the mistake has been discovered before the item-wheels have coacted with the totalizing-wheels the mistake can be rectified, so to speak, by reversing the operating-handle 112 about a quarter-turn, whereby the item-wheels will be restored to their normal positions without disturbing the totalizing-wheels. This is possible because the mechanism for resetting the item-wheels is brought into play during the last quarter of the forward operation of the handle 112, so that if the handle is reversed from its normal position for about a quarter-turn and then moved forward again the same mechanism will be brought into play without resetting the wheels or disturbing the machine otherwise. In case, however, that the mistake is not discovered until after the item-wheels have transferred the incorrect number to the totalizing-wheels, but before the handle has been turned far enough to bring the resetting mechanism into play for resetting the item-wheels, then the mistake may be corrected by depressing the repeating-key, which prevents the resetting of the item-wheels as the depression of that key cuts out the resetting mechanism. The knob 238 is then turned to set the machine for subtraction, after which the handle is turned once around, with the effect of subtracting the incorrect amount from the amount now set up on the totalizing-wheels, thus rectifying the error. The knob 238 is then again turned to reset the machine on addition and the repeating-key is released, after which the operator continues to add the items as before. Here it may be said that if any one item occurs two or more times in the column of items to be set up it will be found simpler to repeat the item by the depression of the repeating-key and revolving the operating-handle than to set the item up separately every time by the use of number-keys.

The use of the machine in subtracting is the same as in adding, with the exception that the knob 238 is turned to set the machine for causing the totalizing-wheels to turn rearwardly instead of forwardly, as in addition; but the subtracting function of the machine will be chiefly utilized in rectifying errors, as already described, although, of course, it may be of use in subtracting credits, to show balances, &c.

In using the machine for multiplying the multiplicand is set up on the item-wheels just the same as an item is set up on them for addition. Before the handle is operated at all the repeating-key 43 is depressed and locked, so as to cut out the resetting mechanism and prevent the disturbance of the multiplicand as now set up on the item-wheels. The operating-handle is now turned through as many complete revolutions as there are units in the right-hand figure of the multiplier, whereby the multiplicand is transferred to and added upon the totalizing-wheels a corresponding number of times on the principle that multiplication is really a series of additions. If, however, the right-hand figure of the multiplier should be a cipher, the knob 282 will be turned forward to move the item-wheels one point from right to left. The second figure of the multiplier is now considered and the operating-handle rotated as many times as there are units in it, whereby the multiplicand on the item-wheels is repeatedly transferred to and added upon the totalizing-wheels. The knob 282 is now turned forward to move the item-wheels another point from right to left, after which the third figure of the multiplier is taken up, and then the fourth figure of the multiplier is taken up

in the same manner. At the conclusion of this operation the total will be indicated upon the totalizing-wheels and printed if the printing mechanism is cut into operation at this time. As the process of multiplication goes on the tally-wheels 291 keep tally of the rotation of the operating-handle 112, so that if the attention of the operator is distracted he can at any time tell how many times the operating-handle has been rotated in any position of the item-wheels by simply consulting the tally-wheels, which when the operator has finished will therefore reproduce the multiplier.

In using the machine for division the dividend is set up on the item-wheels the same as in addition and transferred to the totalizing-wheels in the usual manner. The knob 238 is then turned to its subtracting position, which shifts the gearing connecting the operating-handle with the totalizing-wheels, so that they will be rotated rearward instead of forward. The divisor is now set up on the item-wheels the same as for addition and the repeating-key 43 depressed to cut out the resetting mechanism. The knob 282 is then rotated forwardly to move the item-wheels from right to left until the left-hand figure in the divisor set up upon them is brought into the vertical plane of one or the other of the two left-hand figures of the divisor set up on the totalizing-wheels, as will appear to the operator, who at a glance compares the totalizing and operating wheels. The operating-handle is now turned one or more times until the rotation of the totalizing-wheels has brought into view a figure or figures in the corresponding column or columns of less value than the figure or figures on the item-wheels, which is now being used as a divisor. When this takes place, the knob 282 is turned to move the item-wheels one or more points from left to right and the same procedure goes on. The tally-wheels meanwhile keep track of the revolutions of the operating-handle in different planes, so that when the operation of dividing is complete the quotient will be found upon the tally-wheels and the remainder, if there be any, will be found on the totalizing-wheels. In the machine shown the quotient can have but four figures.

It will be understood, of course, that these several processes of computation upon the machine may or may not be accompanied by printing, at the will of the operator, who can cut in or cut out the printing mechanism by simply turning the button 380; but the printing mechanism will chiefly be used in adding.

It is apparent that in carrying out my invention numerous modifications of the devices herein shown and described may be made. Thus, if desired, the printing mechanism may be dispensed with entirely, as well as the attachments for adapting the machine to subtract, multiply, and divide, or any one or more of these may be retained to the exclusion of the others, the main use of the invention being for adding. I would therefore have it understood that,

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

1. In a computing-machine, the combination with item devices on which items are set up and visually displayed, of totalizing devices for accumulating the items and continuously displaying the respective totals thereof, means for bringing the said item devices and totalizing devices into operative relations with respect to each other after an item has been set up on the item devices, and automatically-operated means for the visual indication of the progress of any computation, such indications traveling transversely with respect to the figures disulayed by the said item and totalizing devices.

2. In a computing-machine, the combination with a series of number-keys, of item devices on which items are set up and visually displayed under the control of the said number-keys, totalizing devices for accumulating the items and continuously displaying the respective totals thereof, means for bringing the said item devices and totalizing devices into operative relations with respect to each other after an item has been set up on the item devices, and means automatically controlled by the said keys for the visual indication of the progress of any computation such indications traveling transversely with respect to the figures displayed by the said item devices and totalizing devices.

3. In a computing-machine, the combination with the computing mechanism thereof, of automatically-operated means for the direct visual indication of the progress of any computation being done on the machine, the said means including a column-indicating drum operating synchronously with the operation of the machine and carrying indications which travel transversely with respect to the figures carried by the said computing mechanism.

4. In a computing-machine, a normally stationary column-indicating drum adapted to be manually set with respect to the number of columns of figures in a given computation, and a traveling column-indicating drum operating synchronously with the operation of the machine to visually indicate the progress of the computation and starting in its traveling action from a point dependable upon the setting of the other drum.

5. In a computing-machine, the combination with the computing mechanism thereof, of a selecting-drum having a spirally-arranged series of fingers, a column-indicating mechanism for the direct visual indication of the progress of any computation, and means interposed between the said drum and the said

column-indicating mechanism, whereby the position of the selecting-drum at any given time, as well as the progress of the computation, is visually indicated by the said mechanism the indications of which travel transversely with respect to the figures carried by the said computing mechanism.

6. In a computing-machine, the combination with a selecting-drum having a spirally-arranged series of selecting-fingers, of a normally stationary column-indicating drum, and means interposed between the two drums, whereby the column-indicating drum is utilized to determine the starting position of the selecting-drum.

7. In a computing-machine, the combination with a manually-operable, normally stationary column-indicating drum, of a traveling column-indicating drum automatically released for step-by-step operation by the number-keys of the machine, whereby it indicates at any time the progress of the computation.

8. In a computing-machine, the combination with a manually-operable, normally stationary column-indicating drum, of a traveling column-indicating drum, means for rotating the latter, a series of keys, and escapement mechanism operated by the said keys for releasing the said traveling drum for step-by-step rotation to indicate the progress of the computation, and for releasing the drum for its quick return to its starting position.

9. In a computing-machine, the combination with the computing mechanism thereof, of a series of number-keys, selecting mechanism between the said computing mechanism and keys, including a selecting-drum provided with a spirally-arranged series of selecting-fingers and released for step-by-step rotation by the keys the operation of any one of which releases the drum for a partial revolution thereof, and means coacting with the said selecting-fingers of the selecting-drum for arresting the same in any of its several positions.

10. In a computing-machine, the combination with the computing mechanism thereof, of a series of number-keys, selecting mechanism including a series of selecting-levers, a selecting-drum released for step-by-step rotation by any one of the said keys and provided with a spirally-arranged series of selecting-fingers complementary to and acting progressively upon the said selecting-levers for the operation thereof, and means coacting with the selecting-fingers of the said selecting-drum for arresting the same in any of its several positions.

11. In a computing-machine, the combination with the computing mechanism thereof, of a series of number-keys, a selecting mechanism including a series of selecting-levers, and a selecting-drum having a spirally-arranged series of selecting-fingers complementary to the said levers which they progressively operate; and locating mechanism operating synchronously with the selecting-drum and visually indicating the position thereof at any given time, and including means for arresting the same in any of its several positions.

12. In a computing-machine, the combination with the computing mechanism thereof, of a series of number-keys, selecting mechanism including a series of connecting-tongues, a series of complementary selecting-levers for moving the said tongues into operating positions, and means controlled by the said keys for operating the said levers for bringing the said tongues into play.

13. In a computing-machine, the combination with a selecting-drum having a spirally-arranged series of selecting-fingers, of a manually-operable, normally stationary column-indicating drum, a traveling column-indicating drum operating synchronously with the selecting-drum for visually indicating its position and the progress of the computation, and connections between the said stationary drum and the selecting-drum, whereby the starting position of the selecting-drum is determined.

14. In a computing-machine, the combination with a selecting-drum having a spirally-arranged series of selecting-fingers, of a manually-operable, normally stationary column-indicating-drum, a traveling column-indicating drum operating synchronously with the selecting-drum for visually indicating the position thereof and the progress of the computation, a series of dogs engaging with and set by the said normally stationary drum, and a series of dogs operated by the said dogs in being moved into position to coact with the selecting-fingers of the selecting-drum for determining the starting position thereof.

15. In a computing-machine, the combination with the computing mechanism thereof, of a series of number-keys, selecting mechanism including a selecting-drum provided with a spirally-arranged series of selecting-fingers released for step-by-step rotation by the said keys the operation of any one of which releases the drum for the partial revolution thereof, the drum being returned to its starting position by a quick turning movement in the same direction as its step-by-step movement.

16. In a computing-machine, the combination with a series of keys, of a series of levers upon the outer ends of which the said keys are mounted, a rocking driving-frame adapted to be operated upon by the inner ends of the said levers which are differentially related to the said frame which is thus differentially operated by the said keys according to their value, a series of item-wheels controlled in being differentially set up by the said rocking driving-frame, a series of totalizing-wheels, and means

for moving the item-wheels, *en bloc*, into operative relations with the said totalizing-wheels.

17. In a computing-machine, the combination with a series of keys, of a series of levers upon the outer ends of which the said keys are mounted, a driving-frame adapted to be operated upon by the inner ends of all of the said levers the action of which upon the said driving-frame is differentiated according to the value of the keys, means differentially connected with the inner ends of the said levers for limiting the movement of the said driving-frame, a series of item-wheels controlled in being differentially set up by the said frame, a series of totalizing-wheels, and means for moving the item-wheels, *en bloc*, into operative relations with the said totalizing-wheels.

18. In a computing-machine, the combination with the keys thereof, of a rocking driving-frame the movement of which, under the action of the keys, is differentiated according to their value, and a rocking stop-frame the movement of which, under the action of the keys, is also differentiated according to their value, and which operates to positively limit the movement of the said driving-frame.

19. In a computing-machine, the combination with the computing mechanism thereof, of a series of keys, a rocking driving-frame arranged to be operated upon by any one of the said keys, and a series of tongues connected with the computing mechanism and independently brought into position for coaction with the said frame, under the control of the said keys.

20. In a computing-machine, the combination with a series of key-levers, of a series of normally retired tongues, selecting means for independently bringing those tongues into operative positions, and driving means coacting with the said tongues when in their operative positions and differentially moved by the keys according to the value thereof.

21. In a computing-machine, the combination with the keys thereof, of a series of normally retired tongues, driving means coacting directly with the said tongues when the same are in their operative positions and differentially operated by the said keys according to the value thereof, and selecting mechanism operated under the control of the said keys and including a series of selecting-levers coacting with the said tongues to bring the same into their operative positions.

22. In a computing-machine, the combination with the computing mechanism thereof, of a series of number-keys, a series of stop members differentially operated by the keys, according to the value thereof and correspondingly controlling the movement of the elements of the computing mechanism and means whereby any stop member may be operated by any key.

23. In a computing-machine, the combination with the computing mechanism thereof, of a series of number-keys, a series of differentially-operated stop members controlling the action of elements of the computing mechanism, a series of movable tongues carried by the said stop members and forming temporary connection between the said stop members and the keys, and selecting mechanism controlled in operation by the keys and coacting with the said tongues to bring any one of the tongues into position to establish a connection between any one of the keys and any one of the stop members.

24. In a computing-machine, the combination with the computing mechanism thereof, of a series of keys, a series of pivotal stop members which control the positioning of elements of the computing mechanism, tongues pivoted to the said stop members, driving mechanism operated by the keys which are differentially connected with it according to their respective values, and selecting mechanism also controlled in operation by the respective keys and selecting and bringing into play the said tongues, which, when brought into play, establish connection between the driving mechanism and the stop members.

25. In a computing-machine, the combination with a series of keys, of a series of rack-bars, selecting mechanism interposed between the said keys and rack-bars, whereby the rack-bars are differentially operated according to the value of the respective keys, and whereby any one rack-bar of the entire series of rack-bars may be operated by any one key of the series of keys, a series of item-wheels differentially operated by the said rack-bars, a series of totalizing-wheels, and means for moving the item-wheels, *en bloc*, into operative relations with the totalizing-wheels.

26. In a computing mechanism, the combination with the computing mechanism thereof, of a series of sliding rack-bars formed at their rear ends with steps and coacting through their racks with elements of the said computing mechanism, a series of stop members coacting with the steps of the said bars to limit the rearward movement of the same in positioning the elements of the computing mechanism coacting with them, a series of keys, and selecting mechanism interposed between the keys and the said stop members which are differentially operated by the keys according to the value thereof, and so that any one stop member may be operated by any one of the keys which is thus rendered capable of controlling any of the rack-bars of the series of rack-bars.

27. In a computing-machine, the combination with the computing mechanism thereof, of a series of keys, a series of rack-bars connected by their racks with elements of the said computing mechanism, a series of stop members differentially operated by the said keys, any one of which will operate any one

stop member, and resetting mechanism for restoring the operated rack-bars and stop members to their normal positions.

28. In a computing-machine, the combination with the computing mechanism thereof, of a series of keys, a series of rack-bars connected through their racks with elements of the computing mechanism, a series of stop members differentially operated by the said keys any one of which will operate any one stop member, and a universal resetting-bar for restoring the rack-bars and stop members to their normal positions.

29. In a computing-machine, the combination with the computing mechanism thereof, of a series of sliding rack-bars provided with steps, a series of keys, connections between the keys and rack-bars, whereby any bar may be released for operation by any key for positioning an element of the computing mechanism, and printing mechanism including members coacting with the steps of the rack-bars in being positioned in accordance with the positioning of the computing mechanism.

30. In a computing-machine, the combination with the computing mechanism thereof, of a series of keys, a series of sliding rack-bars connected through their racks with elements of the computing mechanism and formed at their rear ends with steps, mechanism differentially operated by the keys according to their value for releasing the said rack-bars, and printing mechanism including type-wheels and plungers connected with the said type-wheels and coacting with the said steps of the said rack-bars for positioning the said wheels in accordance with the positioning of the computing mechanism.

31. In a computing-machine, the combination with a series of item-wheels on which items are initially set up, of a series of totalizing-wheels, and means for locking the item-wheels when set up and radially moving them, *en bloc*, into operative relations with respect to the totalizing-wheels for the transference thereto of the items so set up.

32. In a computing-machine, the combination with a series of keys, of a series of item-wheels on which items are set up and visually displayed under the control of the said keys, totalizing-wheels for accumulating the items and continuously displaying the respective totals thereof, and means for locking the item-wheels when differentially set up and radially moving them, *en bloc*, when locked, into operative relations with respect to the totalizing-wheels for the transference thereto of the items so set up.

33. In a computing-machine, the combination with computing mechanism including a series of item-wheels each having an external segmental rack for coaction with means for mechanically positioning the wheel, a segment displaying a series of figures or characters, and a peripheral clearance-space between one end of the said segmental rack and one end of said segment of figures or characters; of means for initially setting up the item-wheels when they are virtually disconnected from the other elements of the computing mechanism and for bodily moving the said item-wheels when so set up, into operative relations with such other elements of the computing mechanism.

34. In a computing-machine, the combination with computing mechanism including item-wheels, of a series of keys, means for independently positioning the said wheels under the control of the said keys, locking means for fixing the wheels after they have been positioned, and means for moving the item-wheels bodily after they have been locked together for the transference of the items set up on them to other elements of the said computing mechanism.

35. In a computing-machine, the combination with computing mechanism including a series of item-wheels each formed with a clearance-opening, of locking mechanism passing through the said openings of the wheels for locking them together preparatory to the transference of the items set up on them to other elements of the said computing mechanism.

36. In a computing-machine, a series of item-wheels each of which has an external rack, a segment displaying a series of figures or characters, a peripheral clearance-space between one end of the said rack and one end of the said segment, a clearance-opening, and an internal rack facing the said opening.

37. In a computing-machine, the combination with a series of keys, of a series of independently-movable item-wheels displaying upon their peripheries a series of figures or characters corresponding to the values of the keys and visually indicating the positioning of the item-wheels, means for locking the item-wheels together after one or more of them have been positioned, means for unlocking the item-wheels to permit their restoration to their normal positions, and means for moving them together with the axis on which they are mounted, from the positions in which they are set up or positioned to their transferring positions and vice versa.

38. In a computing-machine, the combination with a series of independently-rotatable externally-toothed item-wheels, of a series of differentially-operable sliding rack-bars the racks of which coact with the external teeth of the item-wheels for positioning the same, a series of keys, connections between the keys and the racks, whereby the differential operation of the racks, and hence of the wheels, is effected by any of the keys in accordance with its value, and means for bodily moving the item-wheels after they have

been initially set up, into operative relations with the other elements of the computing mechanism of the machine.

39. In a computing-machine, the combination with a series of independently-rotatable item-wheels, of means for locking the said wheels together after one or more of them have been rotated and positioned, means for oscillating the wheels on their axes after they have been positioned and locked together, and for moving them together into different operating positions.

40. In a computing-machine, the combination with a series of item-wheels, of means for moving them together into a positioning and resetting position, a transferring position, and an intermediate position.

41. In a computing-machine, the combination with a series of item-wheels, of a series of totalizing-wheels, and means for moving the item-wheels from the position in which they were set up into position for engagement with the totalizing-wheels which they rotate.

42. In a computing-machine, the combination with a series of item-wheels, of a series of totalizing-wheels, a series of keys, connections between the item-wheels and keys, whereby the item-wheels are positioned in correspondence with the values of the keys, and means for lifting the item-wheels out of their positioning position into an intermediate position, for oscillating them together in one direction in that position, for then lifting them into their upper position in which by a reverse oscillation together they transfer their set-up values to the totalizing-wheels, and for returning them to their positioning or lower position in which they were set up and in which they are now reset.

43. In a computing-machine, the combination with a series of item-wheels, of means for positioning the same to express an item, and means for moving them bodily to the right or left as required for multiplication and division.

44. In a computing-machine, the combination with a series of totalizing-wheels, of a series of item-wheels, and means for moving the item-wheels *en bloc* radially toward and away from the totalizing-wheels and for oscillating them to transfer their set-up values thereto.

45. In a computing-machine, the combination with a series of totalizing-wheels, of a series of item-wheels, and means for moving the item-wheels bodily toward and away from the totalizing-wheels, and for rotating the item-wheels when applied to the totalizing-wheels so as to turn the latter in one direction for effecting addition and in the opposite direction for effecting subtraction.

46. In a computing-machine, the combination with a series of totalizing-wheels, of a series of item-wheels, and means for bodily moving the item-wheels toward and away from the totalizing-wheels, and for oscillating the item-wheels and for causing the item-wheels to coact with the totalizing-wheels either during the oscillation of the item-wheels in one direction or during their return oscillation in the other direction, whereby the totalizing-wheels are turned in one direction or the other as required for addition or subtraction.

47. In a computing-machine, the combination with a series of totalizing-wheels, of a series of item-wheels temporarily applied to the totalizing-wheels for rotating the same, a series of tens-carrying wheels, and means for rotating the same for the tens-carrying rotation of the totalizing-wheels after the same have been rotated by the item-wheels.

48. In a computing-machine, the combination with a totalizing-wheel shaft, of a series of totalizing-wheels mounted thereupon, each of the said totalizing-wheels comprising a totalizing gear-wheel loosely mounted on the shaft, a totalizing number-disk loosely mounted on the shaft, two pawls carried by the said number-disk, and a normally depending hook feathered upon the said shaft and engaged when the said shaft is turned and then only by one or the other of the said pawls for coupling the gear-wheel and number-disk with the shaft with which they are rotated in being reset whereby the totalizing-wheels are normally free to turn in either direction and are only coupled with the said shaft for rotation thereby when the same is turned to reset the machine.

49. In a computing-machine, the combination with totalizing-wheels, of a tens-carrying-wheel shaft, tens-carrying hubs non-rotatably mounted upon the said shaft, tens-carrying pinions loosely mounted upon the said hubs, means coacting with the said hubs for rotating the said tens-carrying pinions and thus imparting supplemental motion to the totalizing-wheels, and means for rotating the said shaft, whereby the hubs thereon are caused to operate the means aforesaid in turning the said pinions.

50. In a computing-machine, the combination with totalizing-wheels, of a tens-carrying-wheel shaft, a series of tens-carrying hubs non-rotatably mounted thereupon and, considered as a series, provided with a series of differentially-arranged teeth, tens-carrying pinions loosely mounted upon the said hubs and meshing into the said totalizing-wheels, means for rotating the said shaft, and means interposed between the said teeth of the hubs and the said pinions for turning the latter to impart tens-carrying rotation to the totalizing-wheels.

51. In a computing-machine, the combination with a series of totalizing-wheels, of a shaft, tens-carrying hubs non-rotatably mounted thereupon and, considered as a series, provided with a series of differentially-arranged teeth, pinions loosely mounted upon

the said hubs and meshing into the said totalizing-wheels, means for rotating the said shaft, and a series of dogs operated upon by the teeth of the said hubs and in turn operating upon the said pinions for turning the same and imparting tens-carrying rotation to the totalizing-wheels.

52. In a computing-machine, the combination with a tens-carrying-wheel shaft, of a series of tens-carrying wheels each comprising a hub mounted upon the shaft and a pinion mounted upon the hub, the said hubs being provided with differentially-arranged teeth, and the said pinions being provided with trigger-tripping pins or projections, a series of locking-dogs operated upon by the said teeth, and a series of triggers operated upon by the said projections or pins for releasing the dogs.

53. In a computing-machine, the combination with a series of totalizing-wheels, of a series of tens-carrying wheels meshing thereinto, and a series of locking-dogs pivotally mounted and arranged to oscillate in a plane perpendicular to the axis of the said tens-carrying wheels, for causing the tens-carrying rotation of the tens-carrying wheels in either direction, as may be necessary in effecting addition or subtraction.

54. In a computing-machine, the combination with a series of totalizing-wheels, of a shaft, a series of tens-carrying hubs non-rotatably mounted thereupon and, considered as a series, provided with a series of differentially-arranged teeth, tens-carrying pinions loosely mounted upon the said hubs, a series of locking-dogs for actuating the said pinions in either direction for turning the totalizing-wheels in either direction as may be required for addition or subtraction, means operated by the tens-carrying pinions for independently releasing the said dogs, and means for retiring the dogs collectively, out of engagement with the tens-carrying hubs and pinions.

55. In a computing-machine, the combination with a series of totalizing-wheels, of a shaft, a series of tens-carrying hubs non-rotatably mounted thereupon and, considered as a series, provided with a series of differentially-arranged teeth, a series of tens-carrying pinions loosely mounted upon the said hubs and meshing into the totalizing-wheels, a series of locking-dogs coacting with the said teeth and the said pinions for causing the rotation of the latter and hence effecting the tens-carrying actuation of the totalizing-wheels, means for collectively holding the said dogs in their retired positions in which they are disengaged from the said teeth and pinions, and means for holding the said dogs in intermediate positions until after the totalizing-wheels have ceased to operate upon the tens-carrying wheels in the idle rotation thereof.

56. In a computing-machine, the combination with a series of totalizing-wheels, of a shaft, a series of tens-carrying hubs non-rotatably mounted thereupon and, considered as a series, provided with a series of differentially-arranged teeth, a series of pinions loosely mounted upon the said hubs and meshing into the totalizing-wheels, a series of locking-dogs coacting with the said teeth and with the said pinions for causing the rotation of the latter in their tens-carrying movement, means for supporting the said dogs, a series of triggers controlled in operation by the said pinions and arranged to release the said dogs to permit them to engage with the said teeth and with the said pinions, and means for collectively moving the said dogs out of engagement with the said teeth and pinions.

57. In a computing-machine, the combination with a series of totalizing-wheels, of a series of tens-carrying wheels operated thereby, a series of dogs for causing the rotation of the said tens-carrying wheels in their tens-carrying movement, a series of carriers for the said dogs, a series of triggers operated by the said tens-carrying wheels and coacting with the said carriers to hold the said dogs in their retired positions, and means for holding the said carriers and dogs in intermediate positions after the carriers have been released by the action of the triggers, whereby the triggers are prevented from reëngaging with the carriers until after the totalizing-wheels have ceased to operate upon the tens-carrying wheels.

58. In a computing-machine, the combination with a series of item-wheels, of a series of rack-bars coacting therewith and formed with steps, a series of type-wheels, and means interposed between the said type-wheels and the stepped portions of the rack-bars, whereby the type-wheels are positioned in accordance with the positioning of the item-wheels when the same are set up by the movement of the rack-bars.

59. In a computing-machine, the combination with a series of item-wheels, of a series of rack-bars coacting therewith, a series of type-wheels, and a series of plungers connected with the type-wheels and coacting with the rack-bars to position the type-wheels in accordance with the positions of the item-wheels when set up by the movement of the rack-bars.

60. In a computing-machine, the combination with a series of item-wheels on which the items are initially set up, of a series of totalizing-wheels with which the said item-wheels are brought into operative relations after the items have been set up on them, and a series of type-wheels controlled for total-printing by the said totalizing-wheels.

61. In a computing-machine, the combination with a series of item-wheels on which the items are initially set up, of a series of totalizing-wheels with which the said item-wheels are operatively connected after the items have been set up upon them, and a series of type-

wheels each comprising an independently-rotatable type member and gear-wheel, the gear-wheels of the type-wheels being intermeshed with the totalizing-wheels which rotate them while they, in turn, control the positioning of the type members for total-printing.

62. In a computing-machine, the combination with a series of type-wheels each comprising an independently-rotatable type member and gear-wheel, the latter being provided with lugs or projections, of a series of dogs pivoted to the said type members for engagement with the lugs or projections of the said gear-wheels, and means for operating the said dogs for uncoupling and coupling the type members and gear-wheels, whereby the gear-wheels control the position of the type members in total-printing.

63. In a computing-machine, the combination with a series of type-wheels each comprising a type member and a gear-wheel, the former acting alone for printing items, and in combination with the gear-wheel for printing totals.

64. In a computing-machine, the combination with a series of type-wheels each comprising an independently-rotatable type member and a gear-wheel, and means for coupling the said type member and gear-wheel so that the latter controls the positioning of the type member for printing totals.

65. In a computing-machine, the combination with a type-wheel, comprising an independently-rotatable type member and a gear-wheel, of a coupling-dog pivoted to one of the said members the other of which is provided with projections or lugs for coacting with the said dog, and means for operating the said dog, whereby it is engaged with, and disengaged from the said lugs or projections.

66. In a computing-machine, the combination with a type-wheel comprising an independently-rotatable type member and gear-wheel one of which is furnished with a pivotal coupling-dog and the other with lugs or projections for coaction therewith, whereby the type member is positioned by the gear-wheel for printing totals, a totalizing-key, and connections between the said key and the said dog; whereby the same is brought into position for coacting with the said lugs or projections, the said connections also insuring the return of the dog to its normal position.

67. In a computing-machine, the combination with item-wheels and totalizing-wheels, of a series of type-wheels each comprising an independently-rotatable type member and gear-wheel, means for positioning the said type members in accordance with the positions of the item-wheels for printing items, means for coupling the type members of the type-wheels with their complementary gear-wheels which are actuated in rotation and positioned by the totalizing-wheels, whereby the type members are controlled in position for total-printing, and means for operating the said coupling instrumentalities.

68. In a computing-machine, the combination with a series of type-wheels, of a corresponding series of hammers, a corresponding series of triggers, and trigger-selecting means initially controlled by the type-wheels.

69. In a computing-machine, the combination with a series of type-wheels, of a corresponding series of hammers, a corresponding series of triggers, a longitudinally-movable trigger-plate coacting with the triggers according to its longitudinal position to operate the triggers and release one or more of the said hammers, and means connected with the said plate for controlling its position by the type-wheels.

70. In a computing-machine, the combination with a series of type-wheels, of a corresponding series of hammers, a corresponding series of triggers, a longitudinally-movable trigger-selecting plate for operating one or more triggers according to its position, and a trigger-selector, connected with the said plate and engaging directly with the type-wheels for limiting the longitudinal movement of the trigger-selecting plate.

71. In a computing-machine, the combination with a series of type-wheels, of impression devices coacting therewith, and a longitudinally-movable member carrying a trigger-selector coacting directly with the type-wheels and controlling the action of the impression devices.

72. In a computing-machine, the combination with dating instrumentalities, of impression devices coacting therewith, a key, a sliding dating-handle mounted upon the said key, and means connecting the said handle and impression devices, whereby they are cut into and out of action.

73. In a computing-machine, the combination with a series of type-wheels each comprising an independently-rotatable type member and gear-wheel, which latter coacts with the former in total-printing, of dating type-wheels, and manually-operable means for causing the dating type-wheels to print or not to print.

74. In a computing-machine, the combination with a key system, of computing mechanism operated by the keys of the said system, printing mechanism for printing the items and totals set up by the computing mechanism, including type-wheels which are positioned through the medium of the key system, and dating mechanism also operated by the said key system for printing dates in conjunction with the items and totals.

75. In a computing-machine, the combination with a key system, of computing mechanism operated by the keys of the said key system, printing mechanism including type-wheels which are set up through the medium

of the keys of the key system, and dating mechanism also set up by the keys of the key system and dating the computations as printed.

76. In a computing-machine, the combination with a key system, of computing mechanism operated by the keys of the said key system, printing mechanism including type-wheels which are set up by the keys of the said system, dating mechanism including dating-wheels also set up by the said keys, and means for cutting the dating mechanism into and out of operation at will.

77. In a computing-machine, the combination with the computing mechanism thereof, of printing mechanism for printing the computations of the computing mechanism, dating mechanism for dating the printed computations, and keys common to the computing and dating mechanisms so that the keys employed for computing are also utilized for dating.

78. In a computing-machine, the combination with an inclined feed-plate, of means for moving the said plate downward, whereby the paper which passes under its lower edge is depressed into position for receiving an impression, and for then moving the lower edge of the plate forward, whereby the paper is fed.

79. In a computing-machine, the combination with types and a paper-holding device, of a feed-plate under the lower edge of which and over the outer face of which a strip of paper is passed, and mechanism for moving the plate edgewise, whereby the paper is brought into close proximity with the types, and for moving its lower edge laterally, whereby the paper is caused to be fed off from the paper-holding device.

80. In a computing-machine, the combination with a feed-plate, of means for imparting a compound movement to the plate, whereby the paper is brought into position to receive an impression and fed, and a friction-roll located in front of the said plate and engaging with the paper for taking up the slack of the paper produced by moving the lower edge of the plate forward and then back.

81. In a computing-machine, the combination with a feed-plate, of pins secured to the ends thereof, and passing through L-shaped guide-slots, and means connected with the projecting ends of the said pins for moving the plate up and down and forward and back in conformity with the shape of the said slots.

82. In a computing-machine, the combination with computing mechanism having item-wheels and totalizing-wheels, of resetting devices for resetting the said item-wheels, and means for cutting the said resetting devices out of operation while an item set up on the item-wheels is repeatedly transferred to the totalizing-wheels.

83. In a computing-machine, the combination with computing mechanism comprising item-wheels rotatable independently of each other and collectively movable axially for the purpose of multiplication and division, of resetting devices for resetting the item-wheels after they have been positioned in setting up an item, and means for cutting the said resetting devices out of action, so that an item set up on the item-wheels may be repeatedly transferred to the totalizing-wheels, the item-wheels being collectively moved axially between every such repetition.

84. In a computing-machine, the combination with item-wheels adapted to be individually rotated and collectively moved axially, of totalizing-wheels, means for resetting the item-wheels, devices for cutting out the said resetting mechanism so that an item set up on the item-wheels may be repeated on the totalizing-wheels, and means for recording and visually displaying the number of times any item set up on the item-wheels is repeated in each of their axially-movable positions.

85. In a computing-machine, the combination with computing mechanism including item-wheels and totalizing-wheels, means for setting up items on the item-wheels when the same are virtually isolated from the totalizing-wheels and then moving them bodily into operative relations therewith for the transference of the items set up on them thereto, resetting mechanism for resetting the item-wheels after they have been positioned in setting up an item, and means for reversing the motion of parts of the machine to bring such resetting mechanism into play for resetting the item-wheels before the same have been coacted with the totalizing-wheels in case a mistake has been made in setting up the item-wheels.

86. In a computing-machine, the combination with item-wheels and totalizing-wheels, of resetting mechanism whereby the item-wheels are reset after having been positioned in setting up an item, and a handle connected with the item-wheels and the said mechanism, whereby the item-wheels are caused to coact with the totalizing-wheels, and then retired therefrom after which the resetting mechanism is brought into play, the said handle being adapted to be reversed in its movement to bring the resetting mechanism into play before it moves the item-wheels into engagement with the totalizing-wheels, for the correction of mistakes.

87. In a computing-machine, the combination with a selecting-drum moving step by step and having a series of selecting-fingers including dating-fingers, of a traveling column-indicating drum containing indicating-spots corresponding to the said fingers, and moving synchronously with the step-by-step movement of the said drum, a dog coacting with one of the said dating-fingers, and means for manually cutting the said dog into or out of operation.

88. In a computing-machine, the combination with computing mechanism, including item-wheels and rack-bars coacting therewith, of printing mechanism for printing items and totals, and safety mechanism coacting with the rack-bars and precluding the operation of the total-printing mechanism except when the item-wheels are reset, so that total-printing and item-printing cannot be attempted at the same time.

89. In a computing-machine, the combination with the computing and printing mechanisms thereof, including manual knobs coacting with the said mechanisms, an operating-handle, and means brought into play by the said handle for locking and unlocking those knobs at the beginning and close of the cycle of one operation of the machine.

90. In a computing-machine, the combination with computing mechanism, including item-wheels and totalizing-wheels with which latter the item-wheels are cut into and out of action, of a series of keys by which items are set up on the item-wheels before the same are cut into operative relations with the totalizing-wheels, an operating-handle by which the said computing mechanism is operated to cause the item-wheels to move bodily into and out of operative relations with the totalizing-wheels, and key-locking instrumentalities thrown into and out of action at the ends of each cycle of the operation of the machine.

91. In a computing-machine, the combination with the computing mechanism thereof, of a series of keys, key-levers therefor, column-selecting means including a selecting-drum having a spirally-arranged series of selecting-fingers, a series of item-wheels on which the items are set up, an operating-handle by which the computing mechanism is operated to utilize the items so set up, and interlocking means between the said key-levers and operating-handle, whereby the said key-levers are locked during the operation of the said handle and vice versa.

92. In a computing-machine, the combination with a series of item-wheels on which the items are initially set up, of a series of totalizing-wheels, means for bringing the item and totalizing wheels into operative relation, the one with the other, after the items have been set up on the item-wheels, and a series of type-wheels controlled for total-printing by the said totalizing-wheels.

93. In a computing-machine, the combination with a series of item-wheels on which the items are initially set up, of a series of totalizing-wheels, means for bringing the item and totalizing wheels into operative relation, by a radial movement of one of the series of wheels, after the items have been set up on the item-wheels, and means for accumulating the items in the totalizer by reversely rotating the item-wheels.

94. The combination of a rotary tappet-drum, having a plurality of spirally-arranged tappets, key-controlled step-by-step drum-operating spring-power mechanism, a series of adding-wheels, means controlled by the keys and said tappet-drum, for determining the setting of the adding-wheels, and manually-operated mechanism for effecting the setting of said adding-wheels.

95. In a computing-machine, the combination with a series of item devices for displaying the items, means for initially setting up items on said devices, a series of totalizing-wheels, means for bringing the item devices and totalizing-wheels into operative relations, the one with the other, after the items have been set up on the item devices, and a series of type-wheels controlled for item-printing by the item devices, and for total-printing by the totalizing-wheels.

96. In a computing-machine, the combination with a series of number-keys, of item devices on which items are set up and visually displayed under the control of the said keys, a series of totalizing devices, means for bringing the said item devices and totalizing devices into operative relations with each other after an item has been set up and visually displayed on the former, and a series of type-wheels controlled for item-printing by the item devices and for total-printing by the totalizing devices.

97. In a computing-machine, the combination with item devices on which the items are initially set up and visually displayed, of a totalizer, means for transferring an item to the totalizer from the said item devices after it has been set up and visually displayed in the same, and a series of type-wheels controlled for item-printing by the item devices, and for total-printing by the totalizer.

98. In a computing-machine, the combination with item devices on which items are set up and visually displayed, of a totalizer for accumulating the items and continuously displaying the respective totals thereof, means for bringing the said item devices and the said totalizing devices into operative relations with each other after an item has been so set up, and means actuated to restore the item devices to normal after the items have been introduced into the totalizer.

99. In a computing-machine, the combination with item devices on which items are initially set up, of a series of number-keys, a spring-actuated selecting drum or shaft, means controlled by the said keys for releasing the said drum or shaft to the action of its spring, and means coacting with the said item devices for arresting the drum or shaft in any one of its several positions.

100. In a computing-machine, the combination with a series of number-keys, of a spring-actuated selecting drum or shaft, means for releasing the said drum or shaft upon the depression of any one of the said number-keys

to the action of its spring, a series of stops coacting with the said drum or shaft to arrest it in any one of its several positions, means to cut out the active stop of the said series of stops by the depression of any one of the number-keys, and means for restoring the said drum or shaft to its starting position.

101. In a computing-machine, the combination with a spring-actuated selecting drum or shaft, of a traveling column-indicator having a spirally-arranged series of spots and operating synchronously with the said drum or shaft for visually indicating the position thereof and the progress of setting up each item in the machine.

102. In a computing-machine, the combination with a selecting drum or shaft, of a traveling column-indicator operating synchronously therewith for visually indicating the position thereof and the progress of setting up each item in the machine, and means for automatically restoring the said drum or shaft and indicator to their starting positions.

103. In a computing-machine, the combination with a selecting drum or shaft, of a traveling column-indicator operating synchronously therewith for visually indicating the position thereof and the progress of setting up each item in the machine, and means for manually restoring the said drum or shaft and indicator to their starting positions.

104. In a computing-machine, the combination with a selecting drum or shaft having a spirally-arranged series of selecting fingers or tappets, of a traveling column-indicator having a spirally-arranged series of spots and operating synchronously with the said drum or shaft for visually indicating the position thereof and the progress of setting up each item, item devices on which the items are set up, number-keys controlling the said item devices, and mechanism interposed between the selecting fingers or tappets of the drum or shaft and the said item devices, whereby the latter are selected for operation by the keys.

105. In a computing-machine, the combination with a selecting drum or shaft, of a traveling column-indicator operating synchronously therewith for visually indicating the position thereof and the progress of setting up each item, and a normally stationary column-indicator adapted to be manually set to determine the position of the first column in starting any computation.

106. In a computing-machine, the combination with a stationary column-indicator adapted to be manually set to determine the starting-point of the computation, of a selecting drum or shaft, a series of item devices respectively selected for operation by the said drum or shaft, a traveling column-indicator operating synchronously with the selecting drum or shaft for visually indicating the position thereof and the progress of setting up each item, and means interposed between the said stationary indicator and the said selecting drum or shaft, whereby the position of the former determines the starting position of the latter at the beginning of each computation.

107. In a computing-machine, the combination with a series of item devices on which items are set up and visually displayed, of means for differentially setting the said devices and for locking them after being thus differentially set, a totalizer, and means for moving the said item devices, *en bloc* while locked, into operative relations with the said totalizer.

108. In a computing-machine, the combination with a series of item-wheels on which items are initially set up and visually displayed, of means for differentially setting the said wheels and for locking them after they have been thus differentially set, a series of totalizing devices, and a cam for moving the said item-wheels, *en bloc* while locked, into and out of operative relations with the totalizing-wheels.

109. In a computing-machine, the combination with a series of segmental item-wheels on which items are initially set up and visually displayed, of a swinging yoke or cradle in which the said wheels are coaxially arranged, means for differentially setting the said wheels, means for locking the said wheels when thus differentially set, a series of totalizing-wheels, and means for swinging the said yoke or cradle for moving the said item-wheels, *en bloc* while locked, into operative relations with the said totalizing-wheel.

110. In a computing-machine, the combination with a series of segmental item-wheels, of a swinging yoke or cradle in which the said wheels are coaxially arranged, a series of totalizing-wheels, and means for swinging the said yoke or cradle to bring the said item-wheels into and out of engagement with the totalizing-wheels.

111. In a computing-machine, a series of segmental item-wheels on which items are initially set up and displayed, a series of totalizing-wheels, number-keys which control the differential setting of the item-wheels, means for locking the said item-wheels after they have been differentially set and for moving them, *en bloc* while locked, into operative relations with the said totalizing-wheels, item-printing devices controlled by the said keys and total-printing devices controlled by the said totalizing-wheels.

112. In a computing-machine, the combination with a series of number-keys, of item devices on which, under the control of the said keys, items are set up and visually displayed, a totalizer means for bringing the item devices and the totalizer into operative relations with each other, preparatory to the transference of an item from the former to the latter, and printing devices controlled for item-printing by the said item devices and for total-printing by the said totalizer.

113. In a computing-machine, the combination with a series of number-keys, of item devices on which, under the control of the said keys, items are set up and visually displayed, a totalizer, means for bringing the said item devices and totalizer into operative relations with each other preparatory to transferring an item from the former to the latter, printing devices controlled for item-printing by the item devices and for total-printing by the totalizer, word-printing and date-printing devices, and means for controlling the same.

114. In a computing-machine, the combination with a series of item devices on which items are initially set up and visually displayed; totalizing and tens-carrying devices, and means for reversing the action of the said devices to provide for the process of subtraction.

115. In a computing-machine, the combination with item devices on which items are initially set up and displayed, of a series of totalizing and tens-carrying devices, means for reversing the action of the said totalizing and tens-carrying devices to provide for the process of subtraction, and type-wheels controlled for item-printing by the item devices and for total-printing by the totalizing devices.

116. In a computing-machine, the combination with item devices on which items are initially set up, of totalizing and tens-carrying devices, means for reversing the action of the said totalizing and tens-carrying devices to provide for the process of subtraction, and a device for indicating whether the machine is set for addition or subtraction.

117. A type-wheel for use in computing-machines, the said wheel having upon its periphery a type-carrying segment, a segment of justifying-teeth, and a clearance-segment between the "0" type on the type-segment and the adjacent end of the segment of justifying-teeth.

118. In a computing-machine, the combination with a series of number-keys, of item devices on which, under the control of the said keys, items are set up and visually displayed, of a totalizer for accumulating the items and continuously displaying the respective totals thereof, means for bringing the item devices and the totalizer into operative relations with each other preparatory to transferring an item from the former to the latter, type-wheels controlled for item-printing by the said item devices for total-printing by the said totalizer, word and date printing wheels, and means for operating the same.

119. In a computing-machine, the combination with item devices on which items are set up and visually displayed, of a totalizer, means indicating the number of times any one item has been successively introduced into the totalizer, and type-wheels controlled for item-printing by the said item devices, and for total-printing by the totalizer.

120. In a computing-machine, the combination with item devices on which items are set up and visually displayed, of a totalizer, a series of tally-wheels for indicating the number of times any one item is successively introduced into the totalizer, and type-wheels controlled for item-printing by the said item devices and for total-printing by the said totalizer.

121. In a computing-machine, the combination with a series of number-keys, of item devices on which items are initially set up and visually displayed under the control of the said keys, a totalizer for accumulating the items and continuously displaying the respective totals thereof, and printing devices controlled for item-printing by the said number-keys and for total-printing by the said totalizer.

122. In a computing-machine, the combination with a series of number-keys, of item devices on which items are initially set up and visually displayed under the control of the said keys, a totalizer for accumulating the items and continuously displaying the totals thereof, printing devices controlled for item-printing by the said number-keys and for total-printing by the said totalizer, and column-indicating devices.

123. In a computing-machine, the combination with a series of item-wheels each having a segment of external gear-teeth, an external segment displaying figures or characters, and an external segment of peripheral clearance; of number-keys by which the setting of the said item-wheels is controlled.

124. In a computing-machine, the combination with a series of item-wheels each having a segment of external gear-teeth, an external segment displaying figures or characters, an external segment of peripheral clearance, and an internal segment of locking-teeth; of number-keys by which the setting of the said item-wheels is controlled.

125. In a computing-machine, the combination with item devices, number-keys under the control of which the said item devices are set up, column-indicating devices, totalizing devices, and type-wheels controlled for item-printing by the said item devices, and for total-printing by the said totalizing devices.

126. In a computing-machine, the combination with a series of item-wheels, of a series of totalizing-wheels, the complementary item-wheels and totalizing-wheels being located in the same vertical plane, and column-indicating devices arranged to operate in a plane at a right angle to the planes in which the said wheels are located.

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

FRED MERCHANT CARROLL.

Witnesses:

EDWARD S. SWIFT,

GEORGE DUDLEY SEYMOUR.