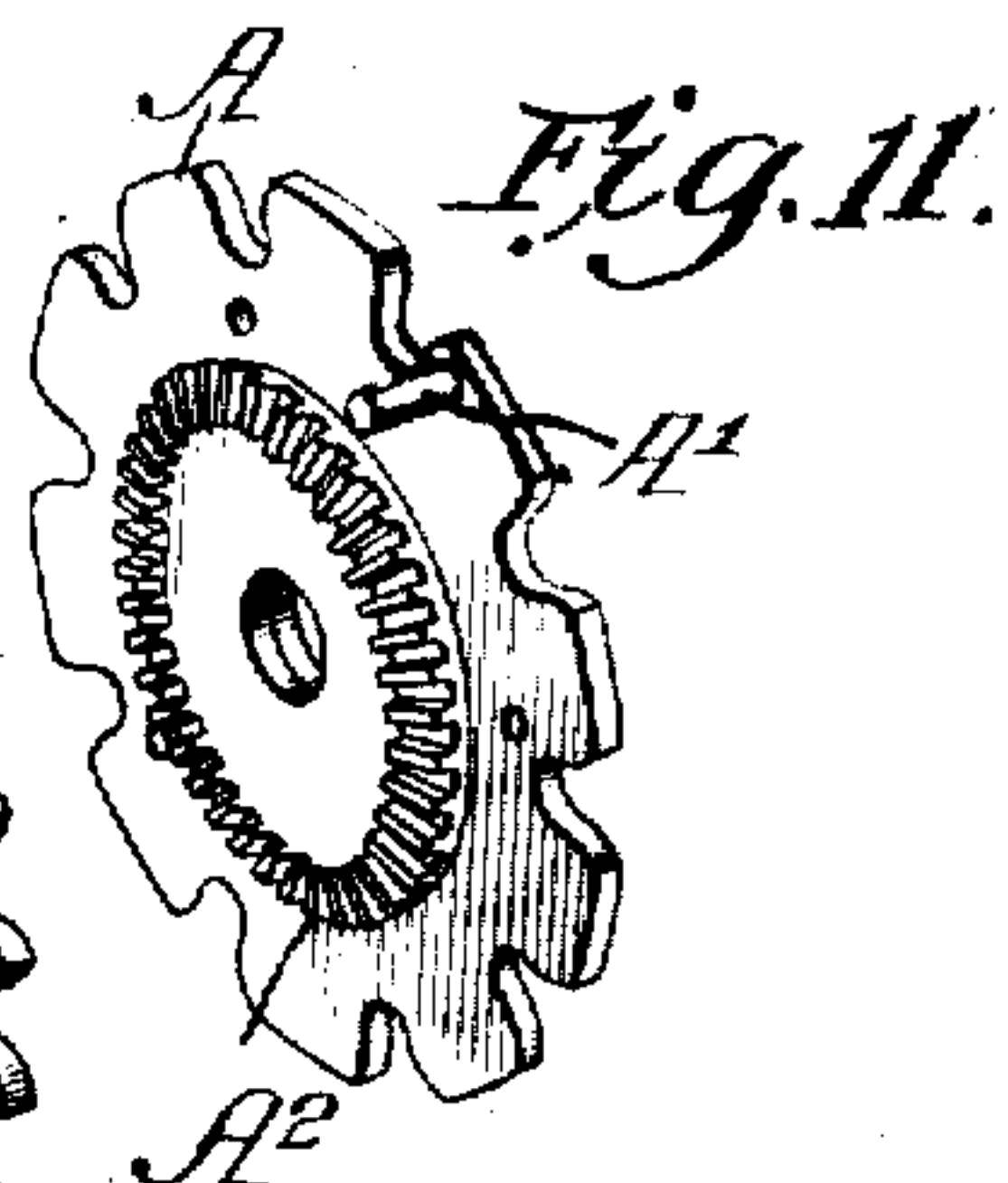
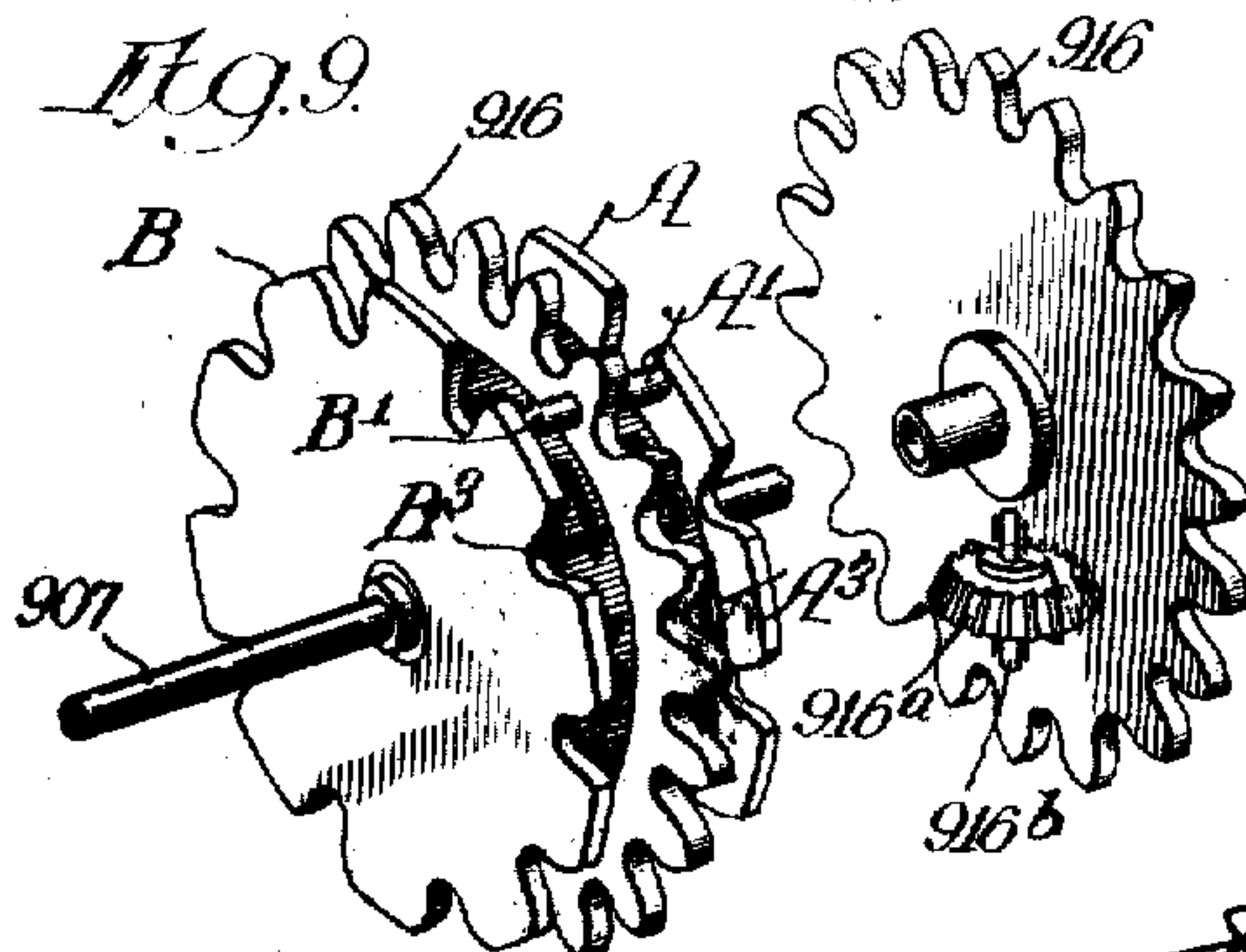


APPLICATION FILED JUNE 21, 1907.

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8 SHEETS—SHEET 1.



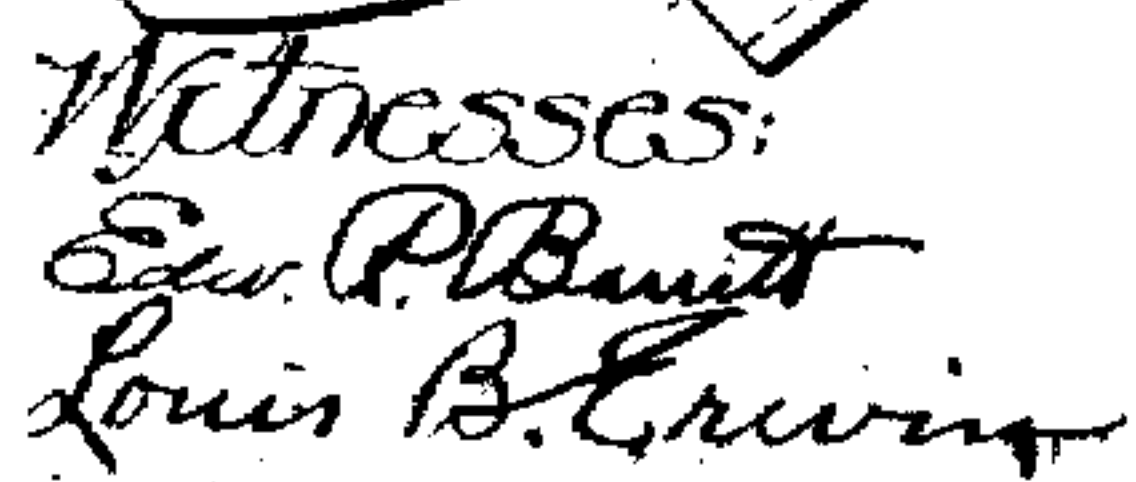
Inventor

Free Vincent
by Rector, Hibbard Davis
his filly's.

910,749.

8 SHEETS—SHEET 2.

Fig. 2.

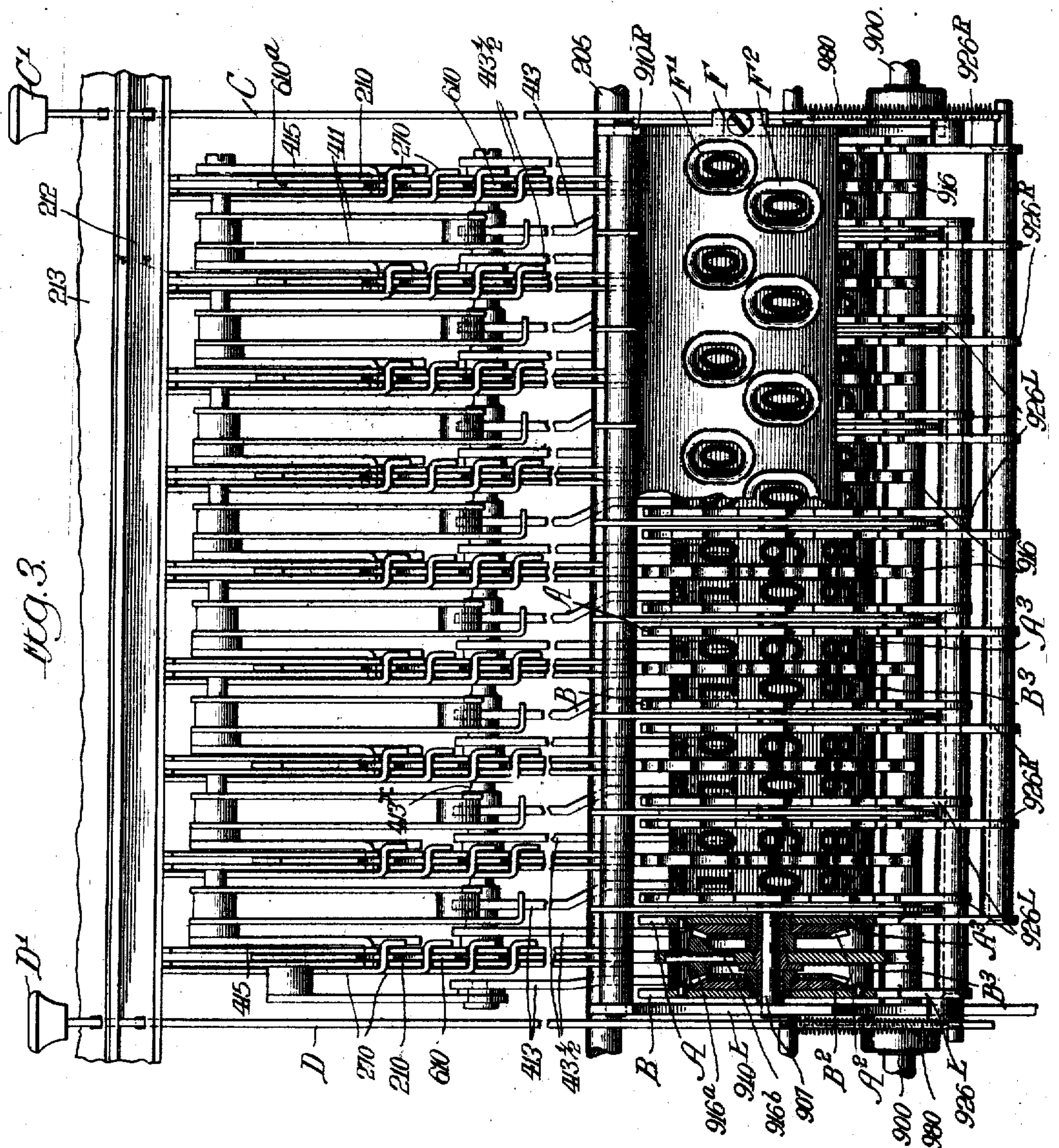


Inventor
James G. Vincent
by Rector Hibbert Davis
his Attys.

APPLICATION FILED JUNE 21, 1907.

Patented Jan. 26, 1909.

8 SHEETS—SHEET 3.



Witnesses:
Edw. P. Bennett
Louis B. Erwin

Inventor
James Vincent
by Reuben Hibbert & Davis
his Atty's.

J. G. VINCENT.
ADDING MACHINE.

APPLICATION FILED JUNE 21, 1907.

910,749.

Patented Jan. 26, 1909.

8 SHEETS—SHEET 4.

Fig. 5.

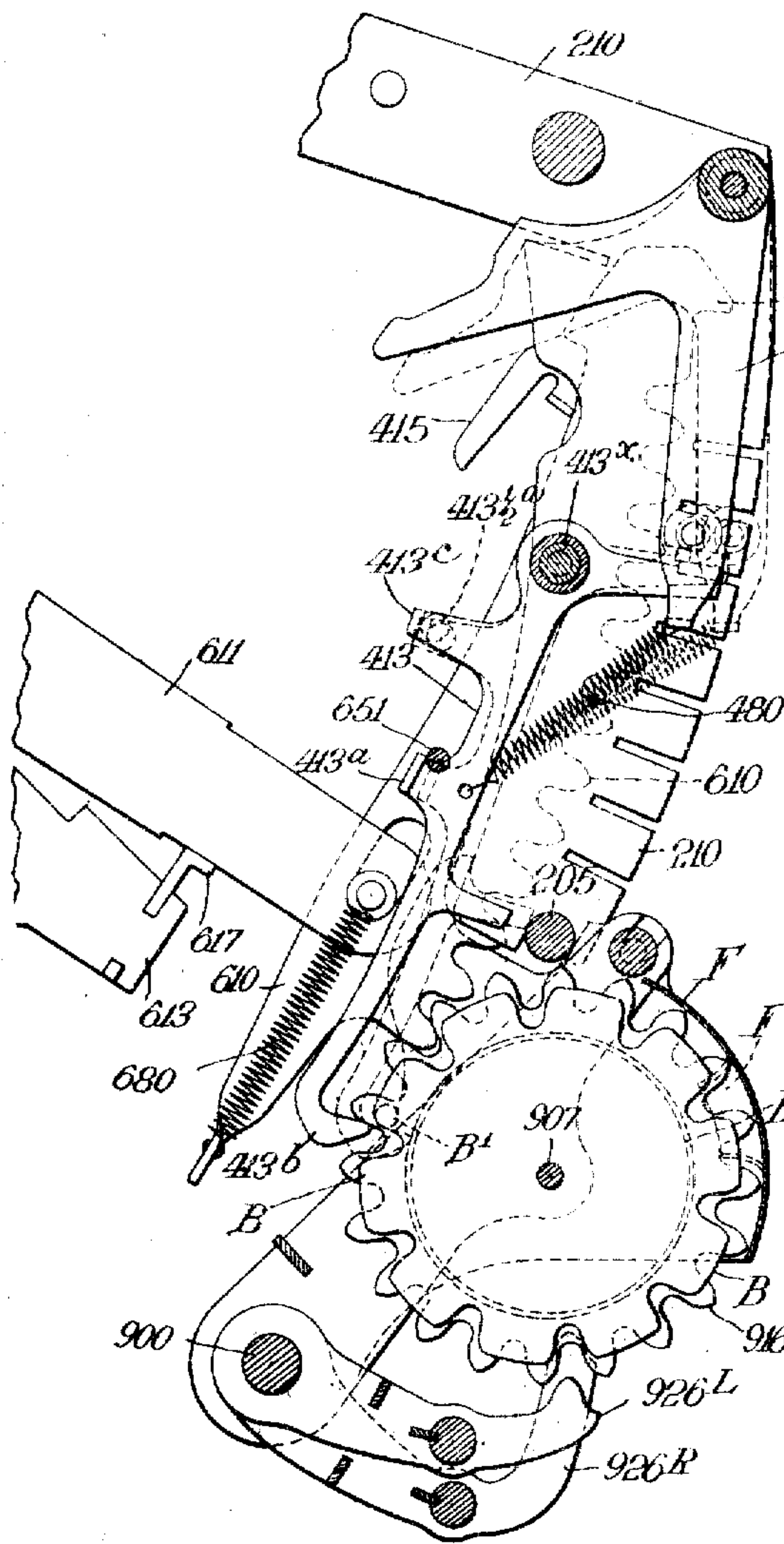
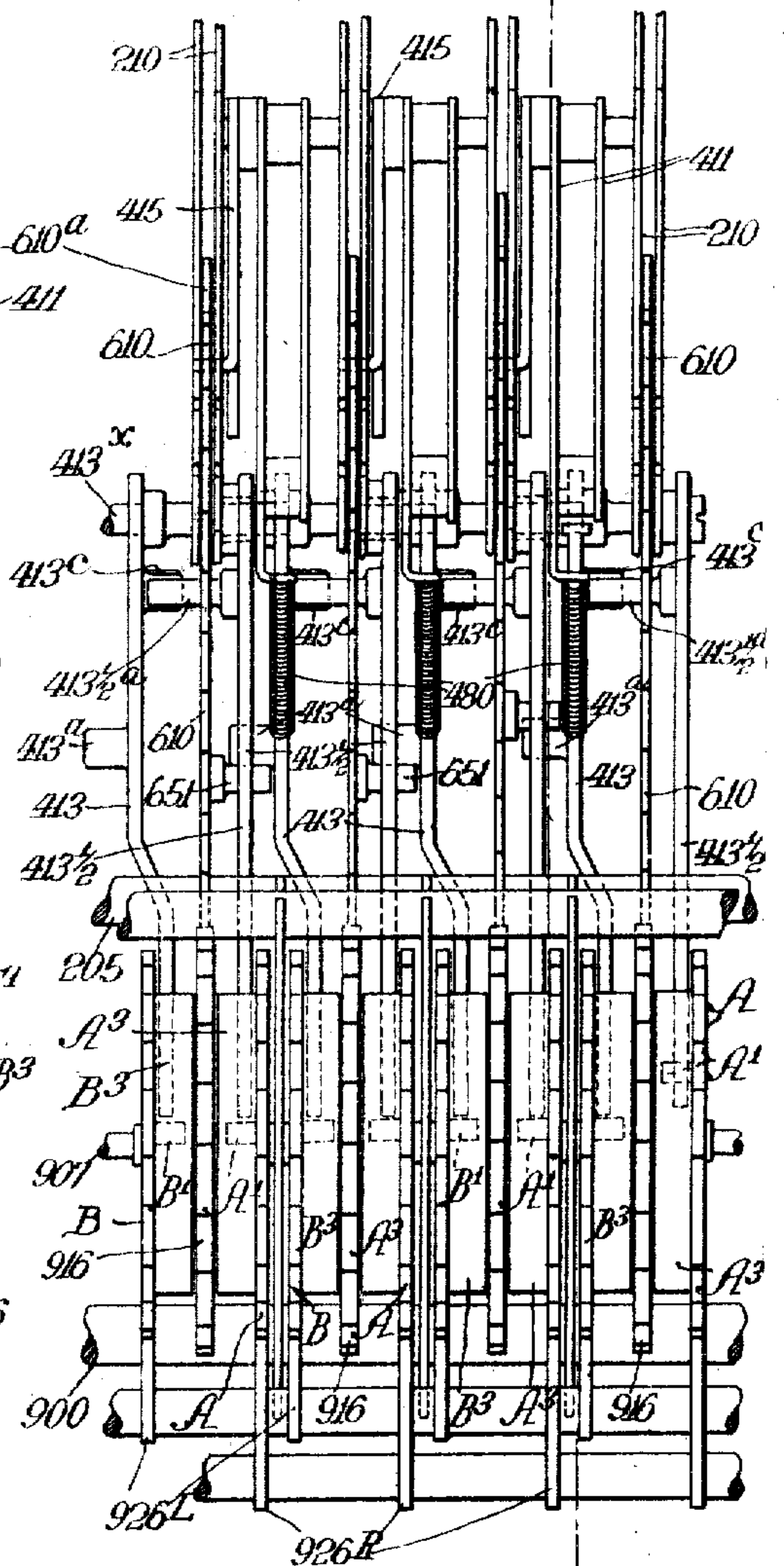


Fig. 4.



Witnesses
E. P. Barrett
Lewis B. Quinn

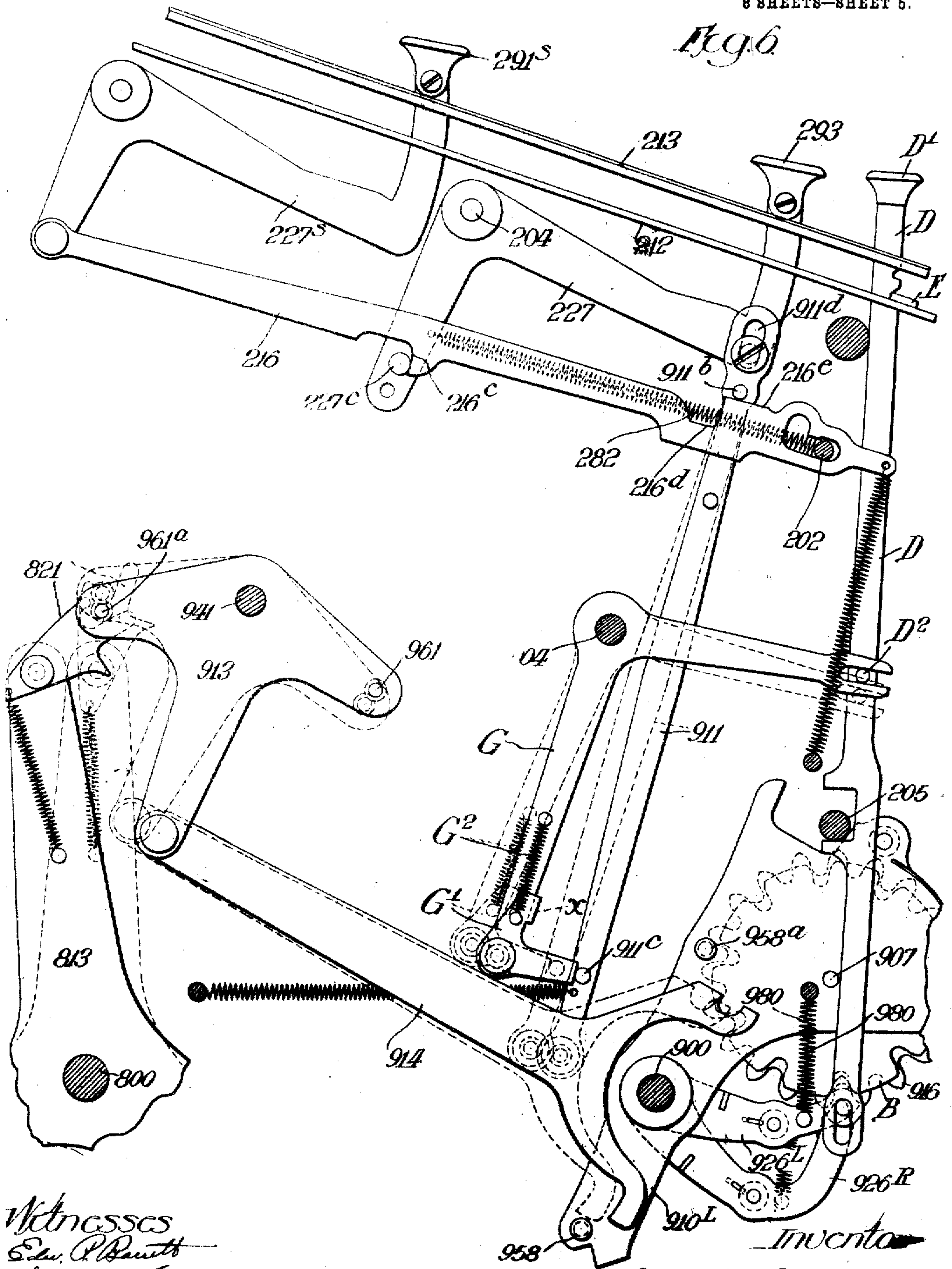
Inventor
J. G. Vincent
by Reta. Hibbard Davis
his Attys

APPLICATION FILED JUNE 21, 1907.

910,749.

Patented Jan. 26, 1909.

8 SHEETS—SHEET 5.



Witnesses
Edw. P. Barrett
Louis B. Gruen

920² ~~Invento~~
 James E. Vincent
 by Reuben Kibben & Son
 his Attys.

ADDING MACHINE.

APPLICATION FILED JUNE 21, 1907.

910,749.

Patented Jan. 26, 1909.

8 SHEETS--SHEET 6.



Witnesses
 Geo. P. Barrett
 Louis B. Ewom

Frank Vincent
by Rector Hibben & Davis
Attys

J. G. VINCENT.
 ADDING MACHINE.
 APPLICATION FILED JUNE 21, 1907.

910,749.

Patented Jan. 26, 1909.

8 SHEETS—SHEET 7.

Fig. 12

5.65	5.67	4.04	15.36*	SEPARATE TOTAL
7.09	1.26	4.68	13.03*	SEPARATE TOTAL
2.38	3.26	7.09	12.73*	SEPARATE TOTAL
			41.12*	GRAND TOTAL

Fig. 13

4.69
7.25
9.75
1.94
8.33
31.96* SEPARATE TOTAL
6.79
4.61
4.56
6.54
5.41
27.91* SEPARATE TOTAL
3.61
8.72
2.58
9.47
3.65
28.03* SEPARATE TOTAL
8.61
6.52
7.51
1.69
4.27
21.60* SEPARATE TOTAL
109.50* GRAND TOTAL

Fig. 14

2.67	6.82
8.04	
7.02	3.78
5.07	8.62
	2.49
6.74	8.69
8.69	6.78
9.64	
	3.02
9.20	6.00
8.30	3.62
65.37*	49.82* GRAND TOTALS

Fig. 15

4.59
4.59
7.05
4.06
7.04
27.33* SUB TOTAL
5.08
5.01
8.94
46.36* SUB TOTAL
4.69
8.53
5.37
64.95* GRAND TOTAL

Witnesses

Edw. P. Bennett
Louis B. Erwin

Inventor

James G. Vincent
by Reta Kibben & Son
his Atty's

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 APPLICATION FILED JUNE 21, 1907.

910,749.

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8 SHEETS—SHEET 8.

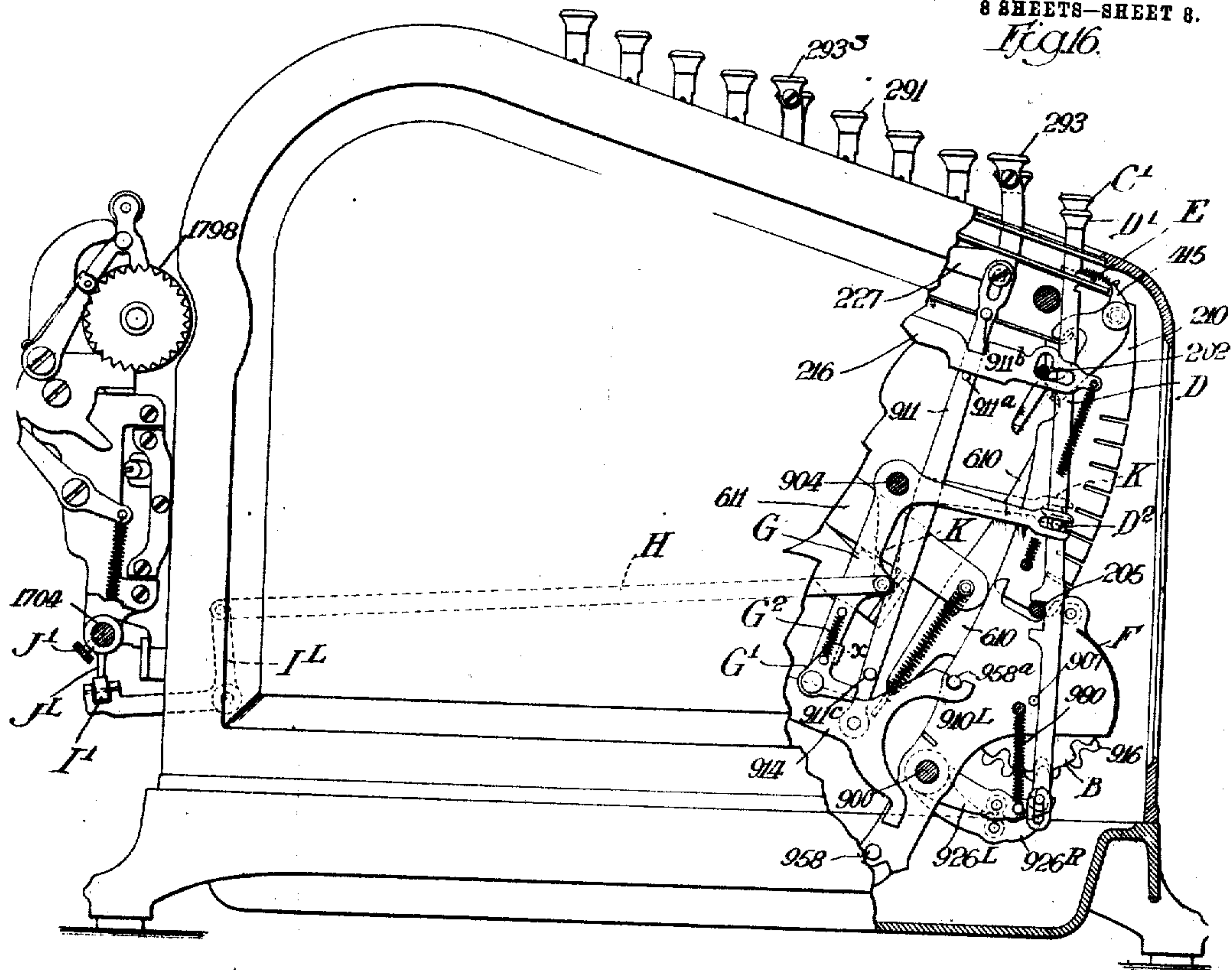
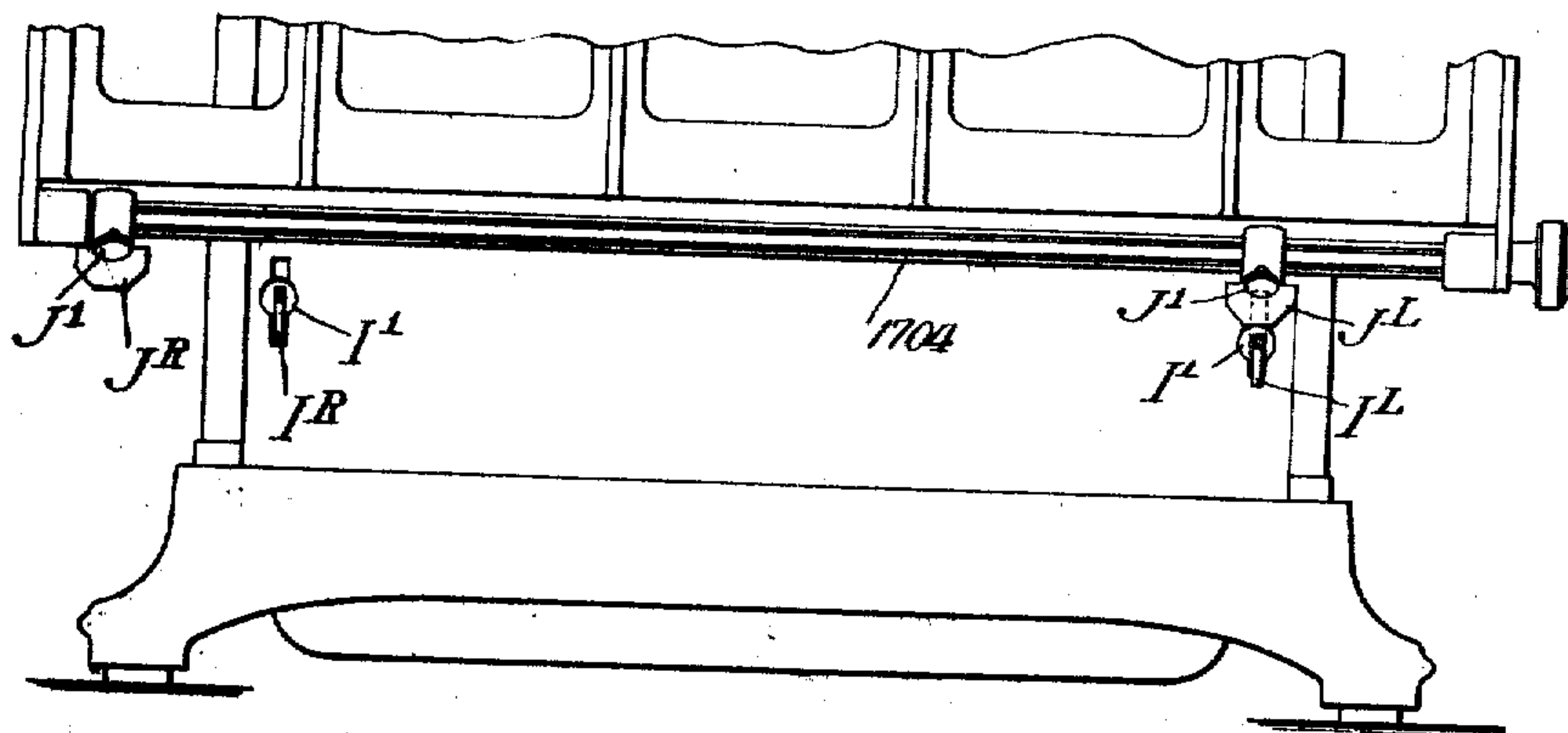


Fig. 17



Witnesses:
 Edw. P. Barrett
 Louis B. Quinn

Inventor
 J. G. Vincent
 by R. H. Hibbard
 his Attorney

UNITED STATES PATENT OFFICE.

JESSE G. VINCENT, OF DETROIT, MICHIGAN, ASSIGNOR TO BURROUGHS ADDING MACHINE COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF MICHIGAN

ADDING-MACHINE.

No. 910,749.

Specification of Letters Patent.

Patented Jan. 26, 1909.

Application filed June 21, 1907. Serial No. 380,124.

To all whom it may concern:

Be it known that I, JESSE G. VINCENT, a citizen of the United States, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Adding-Machines, of which the following is a description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to what are commonly known as adding machines, and more especially to that type thereof which are capable of not only adding or accumulating, but also of printing or listing, a series of items or amounts, and of printing a total thereof, such as the well-known Burroughs adding and listing machine, constructed under and in substantial accordance with Letters Patent of the United States Nos. 504,963 and 505,078, issued upon the applications of William S. Burroughs on September 12, 1893, and No. 823,474, issued upon the application of Alvan Macauley on June 12, 1906.

The Burroughs machine, constructed under and in accordance with the above mentioned patents, and other similar machines now upon the market, are capable of and regularly employed for listing and accumulating individual items or amounts in vertical columns, and printing totals or subtotals thereof when desired. In the taking of totals the accumulating wheels are returned to and left in initial or zero position, thereby "clearing" the machine; while in taking subtotals the accumulating wheels are left in the positions to which they have been advanced in accumulating the amount of the subtotal, and the latter is included in the next subtotal or total that may be taken, so that if a series of subtotals be taken in succession, before taking a final or grand total, each subtotal will include the amount of all preceding subtotals, as will also the final or grand total.

One of the objects of my invention is to equip machines of this class with means whereby a series of successive separate totals may be taken, so that each total will represent merely the sum of the particular series of items of which it constitutes a footing, and by means of which at the end of operations a grand total of all of the items, or of all of the separate totals, may be taken.

Another purpose of my invention is to pro-

vide means in machines of this class whereby cross accumulating work may be done, and the sum of a series of items in a horizontal line be printed at the right hand end of the line, and the aggregate sum or total of such line-totals be printed at the foot of the column of line-totals at the end of operations.

Another object of my invention is to equip machines of this class to list and independently accumulate two separate columns of items or amounts, such as debit and credit items, and print the totals of the respective columns at the foot thereof.

I have illustrated my invention as embodied in the well-known Burroughs machine, and I have provided novel and efficient mechanism for equipping such a machine for the various sorts of work referred to, without interfering with its normal and familiar operation and use; but my invention is not limited in its application or scope to the Burroughs machine, but may be embodied in other machines of the same general class, for the same purposes and with the same results.

In the accompanying drawings, Figure 1 is an elevation of the right side of a Burroughs adding and listing machine, partly in section, showing the application of my improvements to the regular machine; Fig. 2 is an enlarged detail elevation or portion of the left-hand side of the machine; Fig. 3 a front elevation of a portion of the machine, partly in section; Fig. 4 a detail front elevation; Fig. 5 a detail side elevation of some of the parts of Fig. 4, being a view taken approximately on the line 5-5 of Fig. 4; Fig. 6 a detail view of some of the parts shown in Fig. 5 and under a different adjustment; Fig. 7 a view corresponding to Fig. 6 with the parts in another adjustment; Fig. 8 a detail plan view of the locking device for the controlling keys; Fig. 9 a perspective view of one of the sets of accumulating wheels, and Figs. 10 and 11 similar views of separate parts thereof; Figs. 12, 13, 14 and 15 examples of some of the listing or printing operations of a machine equipped with my improvement; and Figs. 16 and 17 views illustrating means for placing the accumulating mechanism under the automatic control of the paper carriage for double column work.

The same letters of reference are employed to indicate corresponding parts in the several views.

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Inasmuch as the construction and operation of the Burroughs adding and listing machine is well known, and is also illustrated and described in the patents to which I have referred, and in various other patents and pending applications, I will confine the present description, as far as can be conveniently done, to those parts of the machine which are concerned with my present improvements.

As is well known, the Burroughs machine is provided with a keyboard having a series of keys 291 arranged in parallel rows from front to rear, each row containing nine keys representing the nine digits, and the several rows representing the different denominations in value in regularly increasing order from right to left. The keys 291 are arranged to operate or control a series of stop wires 270, Figs. 1, 2 and 3, whose laterally bent front ends are confined and adapted to play backwardly and forwardly in slots in curved plates 210 secured in fixed position in the forward part of the machine. There is a pair of these plates 210 for each row of keys 291 and their corresponding stop wires 270, and the laterally bent front ends of said wires extend across both plates of the pair and fit and play in the coincident slots therein, as best shown in Fig. 3. The front ends of the wires 270 constitute stops for limiting the downward movement of the sectors or rack plates 610 by which the adding or accumulating wheels of the machine are actuated, there being one of said racks located between each pair of plates 210 and adapted to play up and down between them. Each of said racks is provided at its upper end with a forwardly projecting hook or shoulder 610^a, and whenever a key 291 is depressed its corresponding stop wire 270 is drawn rearward and its laterally bent front end thereby brought into the path of downward travel of the shoulder 610^a of the corresponding rack 610, with the result that at the subsequent downward movement of the rack the latter will be arrested by the stop wire at a point corresponding to the value of the particular key 291 by which such stop wire is operated. There are eight of the stop wires 270 for each row of nine keys, the ninth or rearward key in each row being unprovided with such a wire, as a fixed cross rod 205 of the machine takes the place and serves the purpose of a ninth stop wire for all of the rows of keys.

The racks 610 are releasably held in their upper normal positions by the pivoted latches or retainers 415, Figs. 1, 2 and 16, each of which latches has a rearwardly extending arm or finger engaged by the upturned forward end of a sliding plate 214, there being one of these plates 214 beneath each row of keys 291. When any key in a row is depressed the plate 214 is forced rearwardly and the latch 415 at its front end is thereby disengaged from the corresponding

rack 610, to permit the latter to subsequently descend.

The racks 610 are carried by the lower forward ends of levers 611, which latter are hung about midway of their length upon the shaft 600 and extend rearwardly therefrom and have their rear ends widened out into depending sectors which carry the movable type plates 618 adapted to cooperate with the platen roller 1798 of the paper carriage. The levers 611 are held in the normal position shown, against the stress of springs 685, Fig. 1, tending to pull their forward ends downward and elevate their rear ends, by a lifting or restoring frame composed of two side arms 613 fastened at their rear ends upon the rock shaft 600, at opposite sides of the machine, Figs. 1, 2 and 5, and having their lower forward ends connected by a cross bar 617, Fig. 5, underlying the front ends of all of the levers 611. At each operation of the machine this lifting or restoring frame is swung downward, thereby removing the support from the front ends of the levers 611 and permitting their springs 685 to draw them downward. As in the regular Burroughs machine, the racks 610 are mounted upon the front ends of the levers 611 by slot-and-pin connections, and connected to the levers by springs 680, for a purpose hereinafter referred to.

The regular operation of the Burroughs machine, in listing and accumulating items, consists in depressing or setting the proper keys 291, to represent the amount of the item, and then pulling forward and releasing the operating handle of the machine, if it be a hand operated machine. The depression of the keys 291 serves to unlatch the corresponding rack 610 and set the stop wires 270 in their paths of movement. The forward movement of the operating handle then swings the transverse bar 617 of the restoring frame downward, thereby removing the support of the front ends of the levers 611 and permitting the springs 685 to pull them downward and lift their rear ends. The front ends of all of the levers 611 will be thereby given an initial downward movement of one step at which point those levers whose racks 610 have not been released by their latches (no keys in the corresponding rows having been depressed) will be arrested by the contact of their studs or pins with the bottoms of the slots in their racks, while the remaining levers will move on downward carrying their racks with them, until arrested by the stop wires 270 which have been drawn into the paths of the shoulders 610^a of their racks by the depression of the corresponding keys in the keyboard of the machine. This operation will elevate the rear ends of the levers 611 in such manner as to bring to the printing line at the front of the platen roller 1798 the proper type 618 to print the amount of

the item set up on the keyboard, after which said type 618 will be driven against the platen to effect the printing, by means of the hammers 715, in the manner fully explained in Patents Nos. 505,078 and 823,474 heretofore referred to.

In the regular Burroughs machine the adding racks 610 cooperate with a series of adding wheel pinions mounted in a swinging frame across the lower forward part of the machine, in position to be swung rearward into mesh with the corresponding racks 610, and forward out of mesh with them. In the regular listing and accumulating operations of the machine these pinions are swung forward and held out of mesh with the racks during the downward movement of the latter, and are then swung rearward and held in mesh with the racks during the return upward movement of the latter, with the result that the wheels are turned forward, in one direction only, distances corresponding to the values of the operated keys. In the taking of totals, the pinions are swung rearward and held in mesh with the racks during the downward movement of the latter, and are thereby turned backward by the racks until the pinions reach zero position, where they are arrested by suitable stops provided for the purpose. This backward movement of the pinions and downward movement of the racks serves to position the type 618 at the rear of the machine to print the total which has been accumulated upon the pinions prior to their return to zero position. If the total taken is to be a grand total, and the machine to be cleared, the pinions are disengaged from the racks prior to the return upward movement of the latter, and consequently are left in initial or zero position at the end of the operation; while if the total taken is to be a subtotal the pinions are left in mesh with the racks during the return upward movement of the latter, and are thereby turned forward again to the position to which they had been advanced by the previous listing and accumulating operations of the machine.

For the purpose of my present invention I also employ a series of pinions 916 mounted upon a transverse shaft 907 extending across the lower forward part of the machine and carried in a swinging frame composed of two side plates or arms 910^a and 910^b secured at their lower ends upon the regular rock shaft 900 of the Burroughs machine, Figs. 1, 2, 3, 4, 5, 6, 7, 9, 10, 11 and 16; and these pinions 916 are swung into and out of mesh with the racks 610 in substantially the same manner as in the regular Burroughs machine, and by means similar to that employed in said machine, as hereinafter more fully explained. In the present instance, however, these pinions 916, instead of being simply accumulating or adding wheel pinions, as

in the regular Burroughs machine, are what I may term transmitting pinions, and are employed for the purpose of transmitting the movements of the adding racks 610 at will to either one of two sets of adding wheels. To this end and for this purpose the arrangement more particularly shown in Figs. 9, 10 and 11 is provided. As there seen, each pinion 916 is embraced upon its opposite sides by two number wheels A^a B^a 75 which are fast upon the inner sides of two notched disks or wheels A B loosely mounted upon the rod or shaft 907. Each of the disks or wheels A B is provided upon its inner side with an annular rack, that upon the wheel A being shown at A^a in Fig. 11, and both it and the rack B^a upon the wheel B being shown in Fig. 3. These racks mesh with the opposite sides of a beveled pinion 916^a, which is mounted upon a radial shaft or 85 pivot 916^b journaled in the transmitting pinion 916. Under this construction and arrangement of parts, as will be readily understood, if the wheel A be held stationary and the pinion 916 be turned on its axis, the 90 wheel B will be turned in the same direction as the pinion 916, but at twice the speed and consequently twice as far; while if the wheel B be held stationary and the pinion 916 be turned, the wheel A will be turned in the 95 same direction as the pinion but at twice the speed and twice as far. By providing means for holding either one of the wheels A or B stationary, at will, while leaving the other free to turn, I am enabled to transmit the 100 movement of the corresponding adding rack 610 through the pinion 916 to either the wheel A or the wheel B, as desired. The means which I have provided for this purpose is shown in Figs. 1, 2, 3, 4, 5, 6, 7 and 16. 105 As there shown, I provide a series of detents or locking dogs 926^a which are carried by and form part of a rigid frame hung at its rear end upon the shaft 900, and a second series of detents or locking dogs 926^b carried 110 by and forming part of a second rigid frame likewise hung at its rear end upon the shaft 900. The detents 926^a are arranged to cooperate with the notched disks or wheels A of the respective pairs of adding wheels, and 115 the detents 926^b are arranged to cooperate with the opposite wheels B of the respective pairs of wheels. Springs 980 connected at their lower ends to the respective detent frames and at their upper ends to fixed studs 120 upon the frame-work of the machine, Figs. 1, 2, 3, 6, 7 and 16, tend to pull the forward ends of the detent frames upward and to engage both sets of detents, 926^a and 926^b, with their respective sets of wheels A and B. 125 For the purpose of controlling the engagement of the detents with the wheels, and maintaining one set of detents out of engagement with its wheels while the other set of detents is engaged with its wheels, I pro- 130

vide the keys C and D, whose upper ends project through the keyboard of the machine, at the opposite forward corners of the latter, and are provided with the key tops or buttons C¹ D¹, and whose lower ends are provided with slots engaging studs upon the respective detent frames 926^a and 926^b, as shown in Figs. 1, 2, 3, 6, 7 and 16. By depressing either one of the keys C or D the corresponding detent frame may be depressed and its detents all disengaged from the wheels A or B. For the purpose of maintaining either of the keys in depressed position, after it has been moved thereto, I provide the latch bar E which is best shown in Fig. 8, where it will be seen that it is pivoted midway of its length at E¹ and extends transversely across the machine and is pressed by a spring E² in a direction to cause its opposite ends to cooperate with notches in the rear and front sides, respectively, of the two keys C and D, the notches in said keys being shown in Figs. 2, 6 and 7. Each of the keys is in the present instance provided with two notches, the lower one of which is engaged by the bar E when the key is in upper position and the upper one of which is engaged by said bar when the key is depressed. Clips or keepers E³ E⁴ engaging the opposite ends of the latch bar E prevent its ends being sprung upward by the upward pressure exerted on the keys C and D by the springs 980 connected to the detent frames with which the lower ends of said keys cooperate. The size and shape of the notches in the two keys are such that when either key is pressed downward the latch bar will be thereby oscillated sufficiently to release the opposite key and permit the detent frame controlled by the latter to be drawn upward by its spring 980 and its detents engaged with the corresponding wheels.

As will be understood from the foregoing description, if the key C be depressed and latched in depressed position, the detents 926^a will all be disengaged from the wheels A, and the detents 926^b be engaged with the wheels B. The wheels B will therefore be locked from movement while the wheels A will be left free to rotate. Under this adjustment of the parts, if the machine is operated in the ordinary way, to accumulate and list a series of items, such items will all be accumulated upon the wheels A and their attached number wheels A², and the latter will expose the amount of such accumulation to view at the front of the machine. On the other hand, if the controlling key D be depressed the detents 926^a will be disengaged from the wheels B and the detents 926^b be engaged with the wheels A, and under this adjustment of the parts the items listed will all be accumulated upon the wheels B and their attached number wheels B², and the accumulation be exposed to view by the latter wheels.

For the purpose of properly exposing to view and separating the accumulations upon the two sets of wheels A² and B², I provide the front of the machine with a shield or screen plate F, Fig. 2, having two sets of openings, F¹ and F², through the former of which the numbers upon the wheels A² are exposed to view, and through the latter of which the numbers upon the wheels B² are exposed; and to provide for such separate exposure of the numbers upon the two sets of wheels I have arranged the wheels so that when they are in initial or zero position their corresponding numbers are all offset one number space from each other, as clearly shown in Fig. 3.

In the regular Burroughs machine the adding wheel pinions 916 are provided with ten teeth and the adding wheels secured to them are provided with ten corresponding numbers; but in the present case, inasmuch as the number wheels turn at twice the speed as the pinions 916, and to twice the extent, as heretofore explained, I provide the pinions 916 with twenty teeth, so that a half revolution of each pinion will turn the number wheel operated by it a full revolution, and the number wheels are accordingly provided with ten numbers and ten notches each.

Having now explained the manner in which and the means by which the items listed upon the machine may be accumulated upon either one of the two sets of adding wheels at will, I will next explain how a series of items may be accumulated upon one set of wheels, and the total thereof be then printed and the wheels be cleared, and such total be transferred to and preserved upon the other set of wheels, so that successive series of items may be listed and accumulated upon the one set of wheels and successive separate totals be printed therefrom and the wheels cleared, and a grand total of all of the items, or of all of the separate totals, be preserved upon the other set of wheels and printed at the end of operations. As heretofore explained, and as set forth in the patents which have been referred to, in the regular listing and accumulating operations of the Burroughs machine the adding wheel pinions are maintained out of engagement with the adding racks during the downward movement of the latter and are held in engagement with them during their return upward movement, while in taking a total on said machine the pinions are maintained in engagement with the racks during their downward movement, and are held out of engagement with them during their return upward movement if the adding wheels are to be left at zero and the machine cleared, but are left in mesh with the racks during their return upward movement if merely a subtotal is to be taken and the adding wheels returned to the position which they occupied prior to the

taking of such subtotal. In the present instance I avail myself of the provisions for taking a subtotal to enable me to print a total from one set of adding wheels and clear said wheels, and at the same time and by the same operation to transfer such total to and preserve it upon the other set of wheels. Thus, if we assume the controlling key C to be depressed and the machine to be operated to list a series of items and accumulate them upon the adding wheels A (which carry the number wheels A²) the total accumulated upon said wheels may at any time be printed and the wheels be cleared, and the amount of such total be transferred to the wheels B, in the following manner: The regular subtotal key of the machine (hereinafter referred to) will be depressed and the operating handle be drawn forward to its limit of movement. This will cause the wheels A to be turned backward to zero position and the types representing the amount of the accumulation upon said wheels to be brought to the printing line in the usual manner, after which said types will be forced against the platen to print a total representing the amount of the accumulation upon said wheels. If, now, before the operating handle is released and the adding racks moved upward to normal position, the controlling key D be depressed, the detents 926¹ will be disengaged from the wheels B and the detents 926² be engaged with the wheels A, thereby locking the latter wheels in their zero or initial position and leaving the wheels B free to rotate; and upon then releasing the operating handle and permitting the adding racks to move upward to normal position the wheels B will be turned forward corresponding distances and the amount of the previous accumulation upon the wheels A will be transferred to and accumulated upon the wheels B. At the end of the operation, therefore, the wheels A will be left clear, ready for the accumulation of another independent series of items, while the total of the previous series will be carried upon the wheels B. This sequence of operations may be repeated indefinitely; and a grand total then be printed from the wheels B by operating the machine in the usual manner for the taking of a grand total immediately after the last separate total has been transferred to the wheels B and while the controlling key D remains depressed.

In the foregoing explanation I have described the controlling key D as being depressed by hand at the end of the forward stroke of the operating handle and downward movement of the adding racks, in the operation of printing a separate total from the wheels A and transferring such total to the wheels B, and the operation may be performed and the result accomplished in this manner; but for the purpose of avoiding the necessity of depressing the key D by hand in

said operation I provide means for automatically depressing it at the proper time as a mere incident to the regular operation of the machine in the taking of a subtotal. This means is illustrated more particularly in Figs. 2, 6 and 7, and an explanation of it will involve more or less explanation of the mechanism employed in the Burroughs machine for engaging the adding wheel pinions with and disengaging them from the adding racks, both in the regular accumulating operations of the machine and in the operations of taking totals and subtotals. As in the regular Burroughs machine, so in my improved machine, the upper end of the rocking accumulator frame which carries the adding wheels and their operating pinions 916, and which is hung upon the shaft 900 as before explained, is swung forwardly and backwardly, to disengage the pinions 916 from and reengage them with the racks 610, by means of a forked pitman 914 which is pivoted at its rear end to the depending arm of a three-armed plate 913 hung upon a stud 941, and whose forward end is supported upon the lower end of a link 911, which link is in turn connected at its upper end to the bell crank 227 of the "total" key 293 of the machine, the link 911 being provided at its upper end with a slot 911^a engaging a stud or screw carried by the bell crank 227. The total key 293 is yieldingly held in its upper normal position, Fig. 2, by a long coiled spring 282 connected at its rear end to the depending arm of the bell crank 227, and shown in dotted lines in Figs. 2, 6 and 7; and in this position of the parts the link 911 holds the front end of the pitman 914 in elevated position, Figs. 2 and 16, in which position a notch in its upper arm or fork engages a stud 958^a upon one of the side arms or plates 910² of the working accumulator frame. In this position of the parts, if the pitman 914 be forced forward it will swing the upper end of the accumulator frame forward and carry the pinions 916 out of mesh with the racks 610, and when the pitman is moved rearward again it will carry the pinions backward into reengagement with the racks. In the regular operation of the machine for listing and accumulating items the forward end of the pitman is maintained in elevated position, as in Fig. 2, and the pitman 914 is forced forward at the beginning of the forward stroke of the operating handle, to carry the pinions 916 out of engagement with the racks 610 prior to the downward movement of the latter, and is drawn rearward again at the beginning of the backward stroke of the operating handle to reengage the pinions with the racks prior to the return upward movement of the latter. The means illustrated in the present instance for thus operating the pitman 914 are the same as those employed in the regular Burroughs machine and described in the patents

to which reference has been made, consisting of an arm 813 fast upon the rock shaft 800 and carrying a reversible wiper plate 821 adapted to cooperate with studs 961 and 961^a upon the forwardly and rearwardly projecting arms of the three-armed plate 913 to the lower end of whose middle depending arm the rear end of the pitman 914 is pivoted. At the beginning of the forward movement of the operating handle of the machine the arm 813 carried by the rock shaft 800 is swung rearward and the wiper plate 821 engages the stud 961 and rocks the plate 913 slightly upon its pivot 941, from the position of the dotted lines in Figs. 6 and 7 to the position of the solid lines, thereby swinging the lower end of its depending arm forward and forcing the pitman 914 forward to carry the adding wheel pinions out of mesh with the racks. At the beginning of the return movement of the operating handle the arm 813 is swung forward again, from the position of Fig. 6 to that of Fig. 2, thereby oscillating the three-armed plate 913 back to its normal position, Fig. 2, and carrying the adding wheel pinions rearward into engagement with the racks prior to the return upward movement of the latter.

In the operation of taking a total or subtotal the front end of the pitman 914 is lowered sufficiently to disengage its notched upper arm from the stud 958^a before the operating handle is pulled forward, so that although the pitman is forced forward as usual its forward movement will be an idle one and the adding wheel pinions will remain in mesh with the racks during the downward movement of the latter. If it is desired to leave the adding wheels at zero, and thereby clear the machine, the pinions will be swung forward, out of mesh with the racks, prior to the return upward movement of the latter; and this is accomplished by lowering the front end of the pitman 914 far enough to cause its lower hooked arm to engage the stud 958 upon the lower end of the rocking accumulator frame as shown in Fig. 7, so that at the beginning of the backward movement of the operating handle and return rearward movement of the pitman 914 the hooked lower arm of the latter will pull the lower end of the adding wheel frame rearward and swing its upper end forward, thereby disengaging the pinions from the racks. This is accomplished by depressing the total key 293 prior to the forward movement of the operating handle, the depression of such key serving to lower the front end of the pitman 914 far enough to permit its lower hooked arm to drop over and engage the stud 958 when the pitman moves forward. If, on the other hand, only a subtotal is to be taken, and the adding wheels are to be returned to the position which they occupied before the taking of such subtotal, their pinions are left in

mesh with the racks during both the downward and upward movement of the latter; and to this end, when a subtotal is to be taken the forward end of the pitman 914 is lowered to the intermediate position shown in Fig. 6, which is sufficient to disengage its notched upper arm from the stud 958^a but not sufficient to permit its lower hooked arm to engage the stud 958, with the result that both the forward and backward movements of the pitman are idle ones and have no effect upon the accumulator frame. For the purpose of lowering the front end of the pitman 914 to its intermediate position when a subtotal is to be taken, and maintaining it in such position during its forward and backward movement, the subtotal key 293^a and its connections are provided, such subtotal key being carried upon the upper end of the vertically projecting stem or arm of a bell crank lever 227^a similar to the total key lever 227 and located immediately in rear of the latter. To the depending rear arm of the bell crank 227^a is pivoted the rear end of a long plate or bar 216 which is supported and guided at its front end upon a fixed stud or rod 202. About midway of its length the bar 216 is provided upon its under side with a rearwardly facing lug or shoulder 216^c adapted to cooperate with a stud 227^c projecting from the depending arm of the bell crank 227, said stud normally occupying a position immediately in rear of said shoulder 216^c, as shown in Fig. 2. Under this construction and arrangement of the parts, when the subtotal key 293^a is depressed the bar 216 is drawn rearwardly and the engagement of its shoulder 216^c with the stud 227^c on the bell-crank 227^a of the total key rocks the latter bell crank upon its pivot and swings its forward end downwardly, in the same manner as if said bell crank were depressed by direct pressure upon the total key 293. If there were no further provision the link 911 controlling the pitman 914 would be lowered to the same extent as when the total key 293 is directly depressed by hand in the taking of a total and clearing the machine, in the manner before explained; but to prevent the link 911 and front end of the pitman 914 from being lowered to such an extent, and to arrest them in the intermediate position shown in Fig. 6, the link is provided near its upper end with a stud 911^b into whose path of downward movement a locking surface 216^a upon the upper edge of the bar 216 is drawn by the rearward movement of said bar due to a depression of the subtotal key 293^a, as shown in Fig. 6. The contact of the stud 911^b with the upper edge of the bar 216 in this manner limits the downward movement of the link 911 and front end of the pitman 914 and maintains them in the intermediate position of Fig. 6, so that upon pulling the operating handle of the machine forward and

releasing it a subtotal will be taken in the manner heretofore explained. The slot-and-pin connection of the upper end of the link 911 with the total key lever 227 permits a full downward movement of the front end of said lever, notwithstanding the arrest of the link in the manner described, as shown in Fig. 6. A recess 216^b in the upper edge of the bar 216, immediately in rear of the locking surface 216^a on the latter, provides for a full downward movement of the link 911 and its stud 911^b when the total key 293 is alone depressed.

The total and subtotal keys and their connections, above described, are now regularly employed in the Burroughs machine, but differ from those disclosed in the patents to which reference has been made. They are, however, fully illustrated and described in my pending application Serial No. 336,921, filed October 1, 1906, to which reference may be made for any further explanation of them, as well as for a description of various parts accompanying them. I do not consider it necessary to here describe any of such parts, further than to point out that the depression of either the total or subtotal key causes all of the racks 610 to be released by their retainers 415 (as in all Burroughs machines), this being due to the rearward movement of a release rod 209 which is carried in the front ends of a pair of rearwardly extending arms or links 226 on opposite sides of the machine, the rear end of the left hand one of the links 226 being connected to the lower end of the depending arm of the bell crank 227, Fig. 2, and the rear end of the right hand one of said links being similarly connected to the lower end of a corresponding arm 227^a at the opposite side of the machine, Fig. 1, the latter arm being secured at its upper end to the rock shaft 204 to whose opposite end the bell crank 227 at the left hand side of the machine is secured. The rod 209 carried by the links 226 is supported and guided at its opposite ends in slots in the side frames of the machine, (not shown) and extends across all of the retainers 415 immediately in front of their rearwardly depending arms or fingers, as shown. When either the total or subtotal key is depressed the rod 209 is drawn rearwardly and serves to disengage all of the retainers 415 from their corresponding racks 610, to permit the latter to move downward when the operating handle of the machine is drawn forward.

Having now described the means employed in the Burroughs machine for disengaging the adding wheel pinions from their actuating racks and reengaging them therewith, at different times and under different conditions, depending upon the results to be accomplished, I will explain how I make use of such means for automatically operating one of the controlling keys heretofore de-

scribed (in the present instance the key D) in such manner as to cause the printing of a total and clearing of one set of adding wheels to transfer the amount accumulated upon such wheels to the other set of wheels. As shown in Figs. 2, 6, 7 and 16, I provide a bell crank G mounted upon the shaft 904 at the left side of the machine and having the front end of its upper horizontal arm provided with a slot engaging a stud D² on the controlling key D. The depending vertical arm of the bell crank G carries at its lower end a pivoted bell crank plate G¹ whose forwardly projecting horizontal arm constitutes a foot adapted to cooperate with a stud 911^a upon the link 911. A coiled spring G² yieldingly holds the plate G¹ in normal position with a laterally projecting lug α upon its vertical arm resting against the front edge of the arm of the bell crank G.

When, with the controlling key D in elevated position, as in Fig. 6, and the bell crank G in corresponding position, the subtotal key 293^a is depressed and the link 911 and pitman 914 thereby lowered to their intermediate position, and the operating handle then drawn forward, the stud 911^a will take a position immediately in front of the foot G¹ upon the depending arm of the bell crank, as shown in Fig. 6. At the backward movement of the pitman 914, therefore, which occurs at the beginning of the return stroke of the operating handle, as before explained, the lower end of the link 911 will be carried rearward with the pitman, and the stud 911^a, bearing against the foot G¹ of the bell crank lever, will rock the latter upon its pivot 904 and depress the front end of its horizontal arm (dotted lines Fig. 6), thereby forcing the controlling key D downward, disengaging all of the detents 926^a from the adding wheels B, and releasing the controlling key C and permitting the spring 980 connected to the detent frame 926^a to draw the latter upward into locking engagement with the wheels A. The result of this operation will be, as heretofore explained, that the adding wheels A will be locked in their zero or initial position (to which they have been turned by the forward movement of the operating handle and downward movement of the adding racks) and the adding wheels B will be left free to rotate and during the return upward movement of the adding racks will be turned forward distances corresponding to the backward movement which was given the wheels A in returning them to zero; and the amount previously accumulated upon the wheels A be therefore transferred to and added and preserved upon the wheels B. In the manner and by the means explained, therefore, a series of items may be listed and accumulated upon the adding wheels A, and the total of such accumulation be then printed from said wheels and the

wheels be returned to zero, and such total transferred to and added and preserved upon the wheels B, by simply depressing the subtotal button 293^a of the machine and drawing forward and releasing the operating handle in the usual manner of taking a subtotal; after which the controlling key C (which will have been released and elevated to upper position by the automatic depression of the key D) may be again depressed (thereby releasing the key D and engaging the detent frame 926^a with the wheels B) and another series of items be listed and accumulated upon the wheels A, and another separate total be then taken, and the wheels A be again cleared and the amount of such second total added upon the wheels B; and so on until as many series of items have been listed and as many separate totals thereof printed as may be desired, after which a grand total of all of the items, (and of all of the separate totals) may be printed, and the adding wheels B be returned to and left in zero position, by operating the machine in the regular manner for the taking of a total; that is to say, by depressing the total key 293 and pulling forward and releasing the operating handle. At such operation the controlling key D will be in depressed position (having been automatically depressed at the taking of the last separate total and clearing of the wheels A,) so that no manipulation of either controlling key is necessary in the taking of such grand total and clearing of the wheels B.

Fig. 13 of the accompanying drawings represents the listing of four separate series of items, and the printing of four separate totals at the foot of the respective series, and the final printing of a grand total of all of the series, in the manner which has been explained; while Fig. 15 represents, in contradistinction to Fig. 13, the taking of two separate subtotals in the course of the listing of a continuous series of items, and the taking of a final or complete total of the series at the end of operations, in the manner provided for in the regular Burroughs machine upon which my present invention is an improvement.

In the present instance, owing to the provision of means for automatically depressing the controlling key D, the adding wheels B of my improved machine would be the ones used for accumulating the items and printing the subtotals thereof in the manner indicated in Fig. 15, since by employing the wheels B for such purpose the controlling key D would be normally depressed and would therefore not be affected by the operation of the mechanism provided for its automatic depression where the items are listed upon the wheels A in the manner heretofore described.

My present invention not only provides for the printing of separate totals at the foots of successive series of items in vertical col-

umns, and the final printing of a grand total, as indicated in Fig. 13, but also lends itself to the printing of separate line-totals at the right hand ends of horizontal (instead of vertical) series or lines of items, and the final printing of a grand total of all of the items or separate totals, as indicated in Fig. 12. The Burroughs machine has heretofore been provided with means rendering it capable of so-called cross addition or accumulation, and the printing of separate totals at the ends of successive horizontal lines of items, and the printing of a grand total at the foot of the column of line totals, such means being disclosed in the pending applications of Heber C. Peters for improvements upon the Burroughs machine, Serial Nos. 207,631 and 255,637 filed May 12, 1904 and April 14, 1905; but my present invention provides more simple means for the purpose than that heretofore devised. The regular Burroughs machine, for the listing of items in vertical columns, is provided with familiar line-spacing mechanism, by means of which the paper is automatically advanced one vertical line space at each operation of the machine, and this mechanism is employed or left operative in the use of the Burroughs machine with my improvement when the latter is employed for the listing of items in vertical columns as heretofore described. When, however, cross addition or accumulation is to be performed, as in Fig. 12, such automatic line-spacing mechanism is disabled, and means provided for shifting the paper carriage one column space (either by hand or automatically) after the printing of each item in a given line; and after the printing of a total at the end of the line the paper is then advanced vertically one space (either by hand or automatically) prior to or during the return of the paper carriage to right hand position for the beginning of another line. The Peters applications above referred to disclose suitable means both for automatically shifting the paper carriage laterally from one column position to another, and for automatically line-spacing the paper at the end of each line of items, and I will therefore not illustrate or describe any particular mechanism for that purpose in the present case, since no particular form of mechanism is essential, and so far as an explanation of my invention is concerned it may be assumed that the paper carriage is shifted laterally by hand, and that the paper is also line-spaced by hand at the end of each line of items. With this understanding, it will be clear that cross addition or accumulation may be accomplished with my present invention, in the manner indicated in Fig. 12, by depressing the controlling key C, then listing a series of items in a horizontal line, and then, when the end of the line is reached, depressing the subtotal key 293^a and pulling forward and releasing the operating handle of the machine, the result being that a separate

total of the single line of items will have been accumulated upon the wheels A, and that such total will be printed at the end of the line, and that said wheels will be cleared and the accumulation upon them be transferred to and preserved upon the wheels B. Any number of successive horizontal lines of items may be listed in this manner, and these separate totals of these several lines be printed at the ends thereof, and finally a grand total of all of them be printed at the foot of the right-hand line-total column, as indicated in Fig. 12, by depressing the total key 293 and pulling forward and releasing the operating handle of the machine, such printing of a grand total serving to clear the wheels B, and thus to leave both sets of wheels clear, ready for succeeding operations, as heretofore explained.

My present invention also lends itself to the listing of two parallel vertical series of items, such as debit and credit columns of items, and the separate and independent accumulation of the items in the two columns, as indicated in Fig. 14. Thus, by setting the paper carriage to position to cause the items to be listed in the left-hand column, and depressing the controlling key D, the items will be listed in such column and accumulated upon the wheels B; while upon shifting the paper carriage to position to cause the items to be listed in the right hand column, and depressing the controlling key C, the items will be listed in such right-hand column and be accumulated upon the wheels A; and at the end of operations the footing of the left hand column may be printed from the wheels B, and the footing of the right-hand column from the wheels A. To facilitate this operation of listing and accumulating items in two separate columns, and obviate the necessity of operating the controlling keys C and D by hand when the paper carriage is shifted back and forth from one column to another, in the listing of the individual items, I provide means for placing the controlling keys C and D under the automatic control of the paper carriage, so that when the paper carriage is shifted to one position the corresponding set of accumulating wheels will be placed in operative connection with the adding racks and transmitting pinions of the machine, and when it is shifted to its opposite position the other set of accumulating wheels will be placed in operative connection with such actuating devices. To this end I secure upon the transverse rod 1704 mounted in the lower part of the paper carriage frame at the rear of the machine, Fig. 17, two cams J^R and J^L , each of which cams is carried by a hub surrounding and free to slide upon the rod 1704 and provided with a set screw J^1 for locking it in its different adjusted positions along said rod. The cams J^R and J^L are adapted to cooperate with rollers I^1 journaled in the rearwardly projecting

horizontal arms of a pair of bell cranks I^R and I^L at the opposite sides of the machine. As shown in Fig. 16, the vertically extending arm of the bell crank I^L has pivoted to its upper end the rear end of a long link H extending forward and pivoted at its front end to the bell crank G heretofore described. The bell crank I^R at the opposite or right-hand side of the machine has the upper end of its vertical arm connected to a second link corresponding to the link H of Fig. 16, and such second link has its front end pivoted to the lower end of the depending vertical arm of a bell crank K hung upon the shaft 904 at the right side of the machine and having its front end slotted to engage a stud upon the controlling key C, as indicated by the dotted lines in Fig. 16. Under this construction and arrangement of the parts, it will be evident that whenever the rearwardly projecting horizontal arm of either bell crank I^R or I^L is depressed the corresponding key C or D will be likewise depressed and be latched in depressed position. As shown in Fig. 17, the cams J^R and J^L are secured upon the rod 1704 in such position that when the paper carriage is in the position shown in Fig. 17 the cam J^L will depress the rear end of the bell crank I^L , and consequently depress the controlling key D, as shown in Fig. 16; and when the paper carriage is slid to the left (to the right in Fig. 17) until the cam J^R overrides and depresses the rear end of the bell crank I^R the controlling key C will be depressed, and the key D be released and lifted by its spring 980. In the former position of the paper carriage, therefore, the items listed will be printed in the left hand column and be accumulated upon the adding wheels B, while in the latter position of the paper carriage they will be listed in the right hand column and accumulated upon the adding wheels A. The mere shifting of the paper carriage back and forth, from one columnar position to the other, therefore automatically throws the accumulation into the corresponding set of adding wheels; and at the end of operations a total of the items in each column may be printed from the corresponding set of wheels by operating the machine in the usual manner in connection with the total key 293, such operation leaving both sets of adding wheels clear and ready for the accumulation of additional columns of items. When the machine is being used for other than double column work the cams J^R and J^L will be turned upon the rod 1704 to inoperative positions, for which purpose the rod is provided with two longitudinal grooves, with the lower one of which the set screws J^1 engage when the cams are to be secured in operative position, as in Fig. 17, and with the upper one of which they may be engaged when the cams are turned to inoperative position.

In the regular Burroughs machine, having a single set of adding wheels, provision is made (as in all adding machines) for causing each wheel in the series, when it completes a revolution, to advance the next higher wheel one step; and in the present instance I have modified and supplemented such carrying or transferring mechanism in such a way as to take care of both of the sets of adding wheels with which my improved machine is provided, so that when any wheel in either set completes a revolution the next higher wheel in that set will be advanced one step. The modified and supplemental devices which I have provided for this purpose are best shown in Figs. 1, 2, 3, 4, and 5, reference being also had to Figs. 9 and 11. As shown in the latter figures, the adding wheels A and B of each pair are provided with inwardly projecting studs A' and B', which studs correspond in purpose and function with the radial arms or cams 924 of the regular Burroughs machine; that is to say, each operates at each complete revolution of the wheel which carries it to trip the detent or latch which controls the carrying or transfer movement of the adding rack which cooperates with the next higher wheel in the series, and each also operates as a stop arm to arrest its wheel at zero position when the wheels are turned backward in the taking of a total or subtotal. The detents referred to consist in the present instance of long irregularly shaped arms 413 hung at their upper ends upon and depending from fixed pivotal supports 413^x at their upper ends, Fig. 5. Each of these detent arms 413 (except the extreme left-hand one, Fig. 2) is provided about midway of its length with a lug 413^a projecting laterally toward the left, Figs. 1, 2, 4 and 5. Coiled springs 480 connected at their lower ends to the detent arms 413 tend to swing the lower ends of said arms forward and serve to yieldingly maintain them in normal position, with forwardly projecting arms or lugs on their front edges resting in contact with the fixed shaft 205 of the machine, as shown in Fig. 2. In this position of the detent arms 413 the lug 413^a projecting laterally to the left from each of said arms overlies a stud 651 carried by the adding rack 610 which cooperates with the pinion 916 of the next higher pair of adding wheels in the series, as shown in dotted lines in Figs. 1 and 2. Each of the adding racks 610 is mounted upon its corresponding lever 611 by a slot-and-pin connection, as shown, and springs 680 connected at their upper ends to the levers (or the pins carried by them) and at their lower ends to the lower extremities of the racks 610 exert an upward pull upon the racks, and tend to move them upward relatively to the respective levers which carry them. In the normal position of the parts, Figs. 1 and 2, the only thing

which restrains the racks from such upward movement is the engagement of the lugs 413^a of the detent or stop arms 413 with the studs 651 of the racks. Consequently, if, with the parts in the position shown in Figs. 1 and 2, the lower end of any detent arm 413 be swung rearwardly far enough to carry its lug 413^a out of the path of the stud 651 upon the corresponding rack, the latter will instantly spring upward until arrested by the contact of the lower wall of its slot with the pin or stud of the lever which carries it, as shown in Fig. 5. The length of the slots in the racks is such that when a rack is thus moved upward by its spring as far as the length of its slot will permit the adding wheel pinion in mesh with such rack will be turned one step or the space of one tooth. When any adding wheel B completes a revolution its pin B', during the last step of such revolution, will contact with the rounded or beveled lower end 413^b of the corresponding detent arm 413 and force the latter rearward, to the position shown in Fig. 5, where the adding wheel B is represented as having come to rest at exactly the end of a complete revolution, so that its stud B' is shown as just having passed and cleared the lower end of the detent arm 413. The adding rack 610 is there shown as having been lifted by its spring 680, upon the disengagement of the lug 413^a from its stud 651, to advance the next higher wheel in the series one step and effect the transfer.

The rack 610 shown in Fig. 1, being the extreme right hand one in the series, performs no carrying function and hence is not provided with any stud 651, the stud 651 shown in dotted lines in said view being the stud carried by and projecting from the right side of the second rack in the series. So, also, the detent arm 413 shown in Fig. 2, being the extreme left hand one in the series, cooperates with no rack and hence is not provided with any lug 413^a, the lug 413^a shown in dotted lines in said view being the lug carried by and projecting to the left from the next detent arm 413 to the right of the one shown in Fig. 2, beyond the rack 610 there shown and cooperating with the stud 651 carried by and projecting to the right from said rack.

The carrying mechanism so far described is not materially different from the corresponding mechanism employed in the regular Burroughs machine, and is sufficient to take care of the transfers between the adding wheels of the B set; but as it is also essential that the transfers between the wheels of the A set shall likewise be taken care of, I provide the additional devices to be now described.

Hung upon the same pivotal support as the detent arms 413 is a second series of detent arms 413¹, Figs. 1 and 4, whose lower ends are shaped like the lower ends of the detent

arms 413 and are adapted to cooperate with the studs A^1 of the adding wheels A in the same manner that the lower ends of the arms 413 cooperate with the stud B^1 of the wheels B. Each of the detent arms 413 $\frac{1}{2}$ (except the extreme left hand one) is provided near its upper end with a lug or stud 413 $\frac{1}{2}^a$, whose left hand end projects immediately in front of a lug 413 c upon the right side of the adjacent detent arm 413, Fig. 4. It results from this provision that whenever the lower end of a detent arm 413 $\frac{1}{2}$ is swung rearward by the stud A^1 of its corresponding adding wheel A, as said wheel completes a revolution, said detent arm will carry the adjacent detent arm 413 at the left with it, the two arms moving in unison as a single part; and as the lug 413 a of the detent arm 413 of such pair controls the adding rack 610 which meshes with the transmitting pinion of the next higher pair of adding wheels in the series, it follows that such adding rack will be released and be permitted to move upward one step beyond normal position, and thereby advance the adding wheel A of such higher pair one step to effect the transfer.

As will be understood from the foregoing, when an adding wheel B completes a revolution the corresponding detent arm 413 is swung rearward independently of the detent arm 413 $\frac{1}{2}$ which cooperates with the associated adding wheel A, but when any detent arm 413 $\frac{1}{2}$ is swung rearward by the complete revolution of the corresponding adding wheel A it carries the detent arm 413 of the associated adding wheel B with it. This provision for the movement of the detent arms in unison in one case, and for the independent movement of the arm 413 in the other, is not essential, and is a mere incident to the more convenient construction and arrangement of the parts in the present instance; and where it can be conveniently done the two detent arms may be connected together as one member or be formed integral with each other.

The foregoing explanation of the carrying mechanism has assumed that the adding racks and their levers 611 were in normal position when the racks were released by the detent arms 413 to effect the transfers, so that the racks would be immediately drawn upward the space of one step by their springs to effect such transfers; but in the operation of the Burroughs machine the detents are usually or more often tripped by the revolutions of the corresponding adding wheels while the levers and racks are out of normal position, and during the time they are returning to such position and are consequently in the act of turning the adding wheels; and it is therefore necessary to provide means for holding the detent arms 413 in displaced position after they have been tripped by the studs A^1 B^1 upon the adding wheels, until,

the levers and adding racks are returned to normal position, so that the racks may then effect the transfers by moving on upward one step beyond normal position owing to the fact that the stop lugs which normally arrest them have been displaced from their paths of movement. For this purpose latches 411 are provided, whose lower ends cooperate with arms projecting forwardly from the upper ends of the detent arms 413, as shown in Fig. 5. When the lower end of any detent arm 413 is swung rearward to the position shown in Fig. 5 the corresponding latch arm 411 will engage the upper horizontal arm of the detent 413 in such a way as to latch the detent in its displaced position, the latch arm 411 being moved in such instance by the spring 480 from the position of the dotted lines in Fig. 5 to the position of the solid ones. At the end of each operation of the machine all of the latch arms which have been displaced in this manner are swung back to normal position, thereby unlatching the detent arms 413 and permitting the springs 480 to swing their lower ends forward again as soon as the displaced racks 610 are drawn downward to normal position and their studs 651 carried below and out of the path of forward movement of the lugs 413 a on the detent arms. This occurs at the beginning of the succeeding operation of the machine, as in the regular Burroughs machine, the racks being drawn downward to normal position by the lowering of the front ends of the levers 611 one step from their normal position, the studs of the levers which pass through the slots in the racks serving at such time to carry the displaced racks downward to normal position at such movement of the levers.

As before stated, the studs A^1 B^1 of the adding wheels not only serve to displace the detent arms in the carrying operation, but also serve to arrest the adding wheels at zero position when turned backward in the taking of totals. To this end the hooked lower ends 413 b of the detent arms are provided with abrupt upper surfaces approximately radial to the axis of the adding wheels, and as these hooked lower ends of the detent arms normally project into the path of the studs B^1 upon the wheels B it follows that when the latter wheels are turned backward their studs will contact with such stop surfaces of the detent arms and arrest the wheels, (dotted lines Fig. 2), and the relative adjustment and arrangement of the parts are such that the wheels when so arrested will stand in zero position. The hooked lower ends of the arms 413 $\frac{1}{2}$ likewise cooperate with the studs A^1 of the adding wheels A to arrest said wheels at zero when they are turned backward in totaling operations. The extreme left hand pair of arms 413 and 413 $\frac{1}{2}$ cooperate with no rack, and their sole function is to arrest the left hand pair of wheels A B at

zero position when turned backward thereto in totaling operations.

Having thus fully described my invention, I claim:

5 1. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of two sets of adding wheels associated in pairs with the respective racks, means for normally transmitting the
10 movement of the racks in one direction to one set of wheels only, and means operable at will to cause the racks automatically to first transmit their reverse movement to said set of wheels and then their opposite move-
15 ment to the other set of wheels.

2. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of two sets of adding wheels associated in pairs with the respective
20 racks, means for causing the racks to transmit their movement in one direction to either set of wheels at will, and means operable at will to cause the racks automatically to first transmit their reverse movement to such
25 moved set of wheels and then their opposite movement to the other set of wheels.

3. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of two sets of adding
30 wheels associated in pairs with the respective racks, means for causing the racks to normally transmit their movement in one direction to one set of said wheels, means operable at will to cause the racks automatically to
35 first transmit their reverse movement to said set of wheels and then their opposite movement to the other set of wheels, and means for subsequently causing the racks to transmit their reverse movement to the last men-
40 tioned set of wheels.

4. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of a series of pinions
45 operated by the respective racks, two sets of adding wheels associated in pairs with the respective pinions, and means for transmitting the movements of the pinions to either set of adding wheels at will.

5. In an adding machine, the combination,
50 with the adding racks and their operating and controlling devices, of a series of pinions operated by the respective racks, two sets of adding wheels associated in pairs with the re-
55 spective pinions, means for transmitting the movements of the pinions to either set of adding wheels at will, and means for causing the complete revolution of each adding wheel to advance the corresponding wheel of the next higher pair one step.

6. In an adding machine, the combination,
60 with the adding racks and their operating and controlling devices, of a series of pinions operated by the respective racks, two sets of adding wheels associated in pairs with the re-
65 spective pinions, means for transmitting the

movements of the pinions to one of said sets of adding wheels, and means for returning said set of wheels to zero position and correspondingly advancing the other set of wheels. 70

7. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of a series of pinions operated by the respective racks, two sets of
75 adding wheels associated in pairs with the respective pinions, means for normally transmitting the movement of the pinions in one direction to one set of wheels, and means operable at will for causing the racks to turn the pinions in the reverse direction and to
80 transmit such reverse movement of the pinions to said set of adding wheels and their opposite movement to the other set of wheels.

8. In an adding machine, the combination,
85 with the adding racks and their operating and controlling devices, of a series of pinions operated by the respective racks, two sets of adding wheels associated in pairs with the re-
90 spective pinions, means for transmitting the movements of the pinions to either set of adding wheels at will, and means for returning either set of wheels to zero position and correspondingly advancing the other set of wheels. 95

9. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of a series of pinions operated by the respective racks, two sets
100 of adding wheels associated in pairs with the respective racks, means for causing the pinions to normally transmit their movement in one direction to one set of said wheels, means operable at will to cause the racks to turn the pinions in the reverse direc-
105 tion and to transmit such reverse movement of the pinions to said set of wheels and their opposite movement to the other set of wheels, and means for subsequently causing the pinions to transmit their reverse move-
110 ment to the last mentioned set of wheels without moving the other set of wheels in either direction.

10. In an adding machine, the combina-
115 tion, with the adding racks and their operating and controlling devices, of a series of pinions engageable with and disengageable from said racks, means for maintaining said pinions out of engagement with the racks during the movement of the latter in one direc-
120 tion and in engagement with them during their movement in the opposite direction, two sets of adding wheels associated in pairs with the respective pinions, and means for transmitting the movements of the pinions
125 to either set of wheels at will.

11. In an adding machine, the combina-
tion, with the adding racks and their operat-
ing and controlling devices, of a series of pinions engageable with and disengageable from 13

said racks, means for maintaining the pinions out of engagement with the racks during the movement of the latter in one direction and in engagement with them during their movement in the opposite direction, two sets of adding wheels associated in pairs with the respective pinions, means for transmitting the movements of the pinions to either set of adding wheels at will, and means for causing the complete revolution of each wheel to advance the corresponding wheel of the next higher pair one step.

12. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of a series of pinions engageable with and disengageable from said racks, two sets of adding wheels associated in pairs with the respective pinions, means for normally maintaining the pinions out of engagement with the racks during the movement of the latter in one direction and in engagement with them during their movement in the opposite direction, for the purpose of turning the pinions forward, means for transmitting the forward movements of the pinions to either set of adding wheels at will, and means for reversing the normal engagement of the racks and pinions and transmitting the backward movements of the pinions to either set of wheels.

13. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of a series of pinions engageable with and disengageable from the racks, two sets of adding wheels associated in pairs with the respective pinions, means for normally maintaining the pinions out of engagement with the racks during the movement of the latter in one direction and in engagement with them during their movement in the opposite direction, for the purpose of turning the pinions forward, means for transmitting the forward movements of the pinions to one set of wheels, means operable at will to maintain the pinions in engagement with the racks during the movements of the latter in both directions, and means for transmitting the backward movement of the pinions to said last mentioned set of wheels and their return forward movement to the other set of wheels.

14. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of a series of pinions engageable with and disengageable from the racks, two sets of adding wheels associated in pairs with the respective pinions, means for normally maintaining the pinions out of engagement with the racks during the movement of the latter in one direction and in engagement with them during their movement in the opposite direction, for the purpose of turning the pinions forward, means for transmitting the forward movement of the pinions to either set of adding wheels at

will, means operable at will to maintain the pinions in engagement with the racks during the movements of the latter in both directions, and means for transmitting the backward movement of the pinions to one set of wheels and their return forward movement to the other set of wheels.

15. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of a series of pinions engageable with and disengageable from the racks, two sets of adding wheels associated in pairs with the respective pinions, means for normally maintaining the pinions out of engagement with the racks during the movement of the latter in one direction and in engagement with them during their movement in the opposite direction, for the purpose of turning the pinions forward, means for transmitting the forward movement of the pinions to one set of wheels, means operable at will to maintain the pinions in engagement with the racks during the movements of the latter in both directions, means for transmitting the backward movement of the pinions to said last mentioned set of wheels and their return forward movement to the other set of wheels, and means for reversing at will the normal engagement of the racks and pinions and transmitting the backward movement of the pinions to the set of wheels not previously turned backward.

16. In an adding and listing machine, the combination, with the adding racks and printing type and their operating and controlling devices, of two sets of adding wheels associated in pairs with the respective racks, means for normally transmitting the movements of the racks in one direction to one set of wheels and listing the corresponding items, and means operable at will to cause the racks automatically first to return said wheels to zero position and print the total accumulated upon them, and then to correspondingly advance the other set of wheels for the purpose of preserving such total upon the latter set of wheels.

17. In an adding machine, the combination, with the adding racks and printing type and their operating and controlling devices, of two sets of adding wheels associated in pairs with the respective racks, means for normally transmitting the movement of the racks in one direction to one set of wheels, means operable at will for causing the racks automatically to first return said set of wheels to zero position and print the total accumulated upon them, and then to correspondingly advance the other set of wheels, and means for subsequently returning the last-mentioned set of wheels to zero position independently of the other set and printing the total accumulated upon them.

18. In an adding and listing machine, the combination, with the adding racks and

printing type and their operating and controlling devices, of a series of pinions operated by the respective racks, two sets of adding wheels associated in pairs with the respective pinions, and means for transmitting the movements of the pinions to either set of wheels at will and listing the item represented by such movements of the pinions.

19. In an adding and listing machine, the combination, with the adding racks and printing types and their operating and controlling devices, of a series of pinions cooperating with the respective racks, two sets of adding wheels associated in pairs with the respective pinions, means for normally transmitting the movements of the pinions to one set of adding wheels and listing the corresponding items, and means for returning said set of adding wheels to zero position and printing the total previously added upon them and correspondingly advancing the other set of wheels to preserve such total upon the latter set of wheels.

20. In an adding and listing machine, the combination, with the adding racks and the printing types and their operating and controlling devices, of a series of pinions cooperating with the respective racks, two sets of adding wheels associated in pairs with the respective pinions, means for normally transmitting the movements of the pinions to one set of adding wheels and listing the corresponding items, means for returning said wheels to zero position and printing the total and correspondingly advancing the other set of wheels, and means for subsequently returning the last mentioned set of wheels to zero position independently of the other set and printing the total accumulated upon them.

21. In an adding and listing machine, the combination, with the adding racks and printing types and their operating and controlling devices, of a series of pinions engageable with and disengageable from the racks, means for normally maintaining the pinions out of engagement with the racks during the movement of the latter in one direction and in engagement with them during their movement in the opposite direction, two sets of adding wheels associated in pairs with the respective pinions, means for transmitting the forward movements of the pinions to one set of adding wheels and listing the corresponding items, means operable at will to maintain the pinions in engagement with the racks during the movements of the latter in both directions, means for transmitting the backward movement of the pinions to the first-mentioned set of adding wheels and printing the total accumulated upon said wheels, and means for transmitting the return forward movements of the pinions to the other set of adding wheels.

22. In an adding and listing machine, the

combination, with the adding racks and printing types and their operating and controlling devices, of a series of pinions engageable with and disengageable from said racks, means for normally maintaining the pinions out of engagement with the racks during the movement of the racks in one direction and in engagement with them during their movement in the opposite direction, for the purpose of turning the pinions forward, two sets of adding wheels associated in pairs with the respective pinions, means for transmitting the forward movements of the pinions to one set of said adding wheels and listing the corresponding items, means operable at will to maintain the pinions in engagement with the racks during the movements of the latter in both directions, means for transmitting the backward movements of the pinions to the first-mentioned set of adding wheels and printing the total accumulated upon said wheels, means for transmitting the return forward movements of the pinions to the other set of adding wheels, and means operable at will to reverse the normal engagement of the racks and pinions for the purpose of returning the last mentioned set of adding wheels to zero, and printing the grand total accumulated upon them.

23. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of two sets of adding wheels associated in pairs with the respective racks, means for normally transmitting the movement of the racks in one direction to one set of wheels, and a sub-total key and connections operable to cause the racks to transmit their reverse movement to said set of wheels and their opposite movement to the other set of wheels.

24. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of two sets of adding wheels associated in pairs with the respective racks, means for normally transmitting the movement of the racks in one direction to one set of wheels, a sub-total key and connections operable to cause the racks to transmit their reverse movement to said set of wheels and their opposite movement to the other set of wheels, and a total key and connections for causing the racks to transmit their reverse movement only to the latter set of wheels.

25. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of a series of pinions engageable with and disengageable from said racks, means for normally maintaining said pinions out of engagement with the racks during the movement of the latter in one direction and engagement with them during their movement in the opposite direction, for the purpose of turning the pinions forward, two sets of adding wheels asso-

ciated in pairs with the respective pinions, means for transmitting the forward movements of the pinions to one set of wheels, and a sub-total key and connections operable to maintain the pinions in engagement with the racks during the movements of the latter in both directions and to cause the movement of the racks in one direction to return said last-mentioned set of wheels to zero position and their movement in the reverse direction to correspondingly advance the other set of wheels.

26. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of a series of pinions engageable with and disengageable from said racks, means for normally maintaining said pinions out of engagement with the racks during the movement of the latter in one direction and in engagement with them during their movement in the opposite direction, for the purpose of returning the pinions forward, two sets of adding wheels associated in pairs with the respective pinions, means for transmitting the forward movements of the pinions to one set of wheels, a sub-total key and connections operable to maintain the pinions in engagement with the racks during the movements of the latter in both directions and to cause the movement of the racks in one direction to return said last-mentioned set of wheels to zero position and their movement in the opposite direction to correspondingly advance the other set of wheels, and a total key and connections operable to maintain the pinions in engagement with the racks during their movement in one direction only and to cause such movement of the racks to return the latter set of wheels to zero position.

27. In an adding machine, the combination, with a series of adding wheel actuating pinions and means for imparting differential movements to said pinions, of two sets of adding wheels associated in pairs with the respective pinions, a differential gearing between each pinion and its associated pair of adding wheels, and means for holding one set of adding wheels from movement while leaving the other set free to be turned by their associated pinions.

28. In an adding machine, the combination, with a series of adding wheel actuating pinions and means for imparting differential movements to said pinions, of two sets of adding wheels associated in pairs with the respective pinions, a differential gearing between each pinion and its associated pair of adding wheels, means for locking one set of adding wheels from movement while leaving the other set free to be turned by their associated pinions, and means for causing the unlocking of the locked set of wheels to automatically lock the other set of wheels.

29. In an adding machine, the combina-

tion, with a series of adding wheel actuating pinions and means for imparting differential movements to said pinions, of two sets of adding wheels associated in pairs with the respective pinions, a differential gearing between each pinion and its associated pair of adding wheels, and means for holding either set of adding wheels from movement at will while leaving the other set of wheels free to be turned by their associated pinions.

30. In an adding machine, the combination, with a series of adding wheel actuating pinions and means for imparting differential movements to said pinions, of two sets of adding wheels associated in pairs with the respective pinions, a differential gearing between each pinion and its associated pair of adding wheels, means for holding either set of adding wheels from movement at will while leaving the other set of wheels free to be turned by their associated pinions, and means for causing the release of such set of wheels to automatically lock the other set of wheels.

31. In an adding machine, the combination, with a series of adding wheel actuating pinions and means for imparting differential movements to said pinions, of two sets of adding wheels associated in pairs with the respective pinions, a differential gearing between each pinion and its associated pair of adding wheels, means for holding one set of adding wheels from movement while leaving the other set of wheels free to be turned by their associated pinions, and means for turning the last-mentioned set of wheels backward to zero position and releasing and correspondingly advancing the other set of wheels.

32. In an adding machine, the combination, with a series of adding wheel actuating pinions and means for imparting differential movements to said pinions, of two sets of adding wheels associated in pairs with the respective pinions, a differential gearing between each pinion and its associated pair of adding wheels, means for holding either set of adding wheels from movement at will while leaving the other set of wheels free to be turned by their associated pinions, means for returning the last-mentioned set of wheels to zero position and releasing and correspondingly advancing the other set of wheels, and means for subsequently returning the latter wheels to zero position independently of the other wheels.

33. In an adding machine, the combination, with a series of adding wheel actuating pinions and means for imparting differential movements to said pinions in a forward direction, of two sets of adding wheels associated in pairs with the respective pinions, a differential gearing between each pinion and its associated pair of adding wheels, means for holding one set of adding

wheels from movement while leaving the other set free to be turned by the forward movements of their associated pinions, and a sub-total key and connections for causing
5 said pinions to turn said last-mentioned set of adding wheels backward to zero position and to correspondingly advance the other set of wheels.

34. In an adding machine, the combination, with a series of adding wheel actuating pinions and means for imparting differential movements to said pinions in a forward direction, of two sets of adding wheels associated in pairs with the respective pinions, a differential gearing between each
15 pinion and its associated pair of adding wheels, means for holding one set of adding wheels from movement while leaving the other set free to be turned by the forward movements of their associated pinions, a sub-total key and connections for causing
20 said pinions to turn said last mentioned set of adding wheels backward to zero position and to correspondingly advance the other set of wheels, and a total key and connections for causing the pinions to return the latter wheels to zero position independently of the other wheels.

35. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of a series of pinions operated by the respective racks, two sets of adding wheels associated in pairs with the respective pinions, a differential
35 gearing between each pinion and its associated pair of adding wheels, and means for holding one set of adding wheels from movement while leaving the other set free to be turned by the movements of their associated pinions.
40

36. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of a series of pinions operated by the respective racks,
45 two sets of adding wheels associated in pairs with the respective pinions, a differential gearing between each pinion and its associated pair of adding wheels, and means for holding either set of adding wheels from movement at will while leaving the other
50 set of wheels free to be turned by their associated pinions.

37. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of a series of pinions operated by the respective racks,
55 two sets of adding wheels associated in pairs with the respective pinions, a differential gearing between each pinion and its associated pair of adding wheels, means for locking either set of adding wheels from movement at will while leaving the other set of wheels free to be turned by their associated pinions, and means for causing the unlock-

ing of such set of wheels to automatically
65 lock the other set of wheels.

38. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of a series of pinions operated by the respective racks,
70 two sets of adding wheels associated in pairs with the respective pinions, a differential gearing between each pinion and its associated pair of adding wheels, means for locking one set of adding wheels from movement
75 while leaving the other set of wheels free to be turned by their associated pinions, and means for turning the last mentioned set of wheels backward to zero position and unlocking and correspondingly advancing the
80 other set of wheels.

39. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of a series of pinions operated by the respective racks, two
85 sets of adding wheels associated in pairs with the respective pinions, a differential gearing between each pinion and its associated pair of adding wheels, means for locking one set of adding wheels from movement while leaving
90 the other set of wheels free to be turned by their associated pinions, means for returning the last-mentioned set of wheels to zero position and unlocking and correspondingly advancing the other set of wheels, and
95 means for subsequently returning the latter wheels to zero position independently of the other wheels.

40. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of a series of pinions engageable with and disengageable from said racks, means for maintaining said pinions out of engagement with the racks during the movement of the latter in one direction
105 and in engagement therewith during their movement in the opposite direction, two sets of adding wheels associated in pairs with the respective pinions, a differential gearing between each pinion and the adding wheels
110 of its pair, and means for holding one set of wheels from movement while leaving the other set of wheels free to be turned by their associated pinions.

41. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of a series of pinions engageable with and disengageable from said racks, means for maintaining said pinions out of engagement with the racks during
120 the movement of the latter in one direction and in engagement therewith during their movement in the opposite direction, two sets of adding wheels associated in pairs with the respective pinions, a differential gearing between each pinion and the adding wheels of
125 its pair, and means for holding either set of wheels from movement at will while leaving

the other set of wheels free to be turned by their associated pinions.

42. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of a series of pinions engageable with and disengageable from said racks, means for maintaining said pinions out of engagement with the racks during the movement of the latter in one direction and in engagement therewith during their movement in the opposite direction, two sets of adding wheels associated in pairs with the respective pinions, a differential gearing between each pinion and the adding wheels of its pair, means for holding either set of wheels from movement at will while leaving the other set of wheels free to be turned by their associated pinions, and means for causing the release of one set of wheels to automatically lock the other set of wheels.

43. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of a series of pinions engageable with and disengageable from said racks, means for normally maintaining said pinions in engagement with the racks during their movement in one direction and out of engagement therewith during their movement in the opposite direction, for the purpose of turning the pinions forward, two sets of adding wheels associated in pairs with the respective pinions, a differential gearing between each pinion and the adding wheels of its pair, means for normally holding one set of adding wheels from movement while leaving the other set of wheels free to be turned by the forward movements of their associated pinions, means operable at will to maintain the pinions in engagement with the racks during the movements of the latter in both directions, and means for releasing the locked set of wheels and locking the other set after the racks have completed their movement in one direction and prior to their return movement in the opposite direction, whereby the one set of wheels may be returned to zero position and their accumulation be transferred to the other set of wheels.

44. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of a series of pinions engageable with and disengageable from said racks, means for normally maintaining said pinions in engagement with the racks during their movement in one direction and out of engagement therewith during their movement in the opposite direction, for the purpose of turning the pinions forward, two sets of adding wheels associated in pairs with the respective pinions, a differential gearing between each pinion and the adding wheels of its pair, means for holding either set of wheels from movement at will while leaving the wheels of the other set free to be turned

by the forward movements of their associated pinions, means operable at will for maintaining the pinions in engagement with the racks during the movements of the latter in both directions, and means for releasing the locked set of wheels and locking the other set at the end of the movement of the racks in one direction and prior to their return movement in the opposite direction.

45. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of a series of pinions engageable with and disengageable from said racks, means for normally maintaining said pinions in engagement with the racks during their movement in one direction and out of engagement therewith during their movement in the opposite direction, for the purpose of turning the pinions forward, two sets of adding wheels associated in pairs with the respective pinions, a differential gearing between each pinion and the adding wheels of its pair, means for normally holding one set of adding wheels from movement while leaving the wheels of the opposite set free to be turned by the forward movements of their associated pinions, means operable at will for maintaining the pinions in engagement with the racks during their movements in both directions, and means for automatically releasing the locked set of wheels and locking the other set of wheels at the end of the movement of the racks in one direction and prior to their return movement in the opposite direction.

46. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of a series of pinions engageable with and disengageable from said racks, means for normally maintaining said pinions in engagement with the racks during their movement in one direction and out of engagement therewith during their movement in the opposite direction, for the purpose of turning the pinions forward, two sets of adding wheels associated in pairs with the respective pinions, a differential gearing between each pinion and the adding wheels of its pair, means for normally holding one set of wheels from movement while leaving the other set of wheels free to be turned by the forward movements of their associated pinions, means operable at will for maintaining the pinions in engagement with the racks during the movements of the latter in both directions, means for releasing the locked set of wheels and locking the other set at the end of the movement of the racks in one direction and prior to their return movement in the opposite direction, for the purpose of returning the one set of wheels to zero position and transferring their accumulation to the other set of wheels, and means for subsequently reversing the nor-

mal engagement of the racks and pinions for the purpose of returning the last mentioned set of wheels to zero position.

47. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of a series of pinions engageable with and disengageable from said racks, means for normally maintaining said pinions in engagement with the racks during their movement in one direction and out of engagement therewith during their movement in the opposite direction, for the purpose of turning the pinions forward, two sets of adding wheels associated in pairs with the respective pinions, a differential gearing between each pinion and the adding wheels of its pair, means for normally holding one set of wheels from movement while leaving the wheels of the opposite set free to be turned by the forward movement of their respective pinions, means operable at will for maintaining the pinions in engagement with the racks during the movements of the latter in both directions, means operating automatically to release the locked set of wheels and to lock the other set at the end of the movements of the racks in one direction and prior to their return movement in the opposite direction, for the purpose of returning the one set of wheels to zero position and transferring their accumulation to the other set, and means for subsequently reversing the normal engagement of the racks and pinions for the purpose of returning the last mentioned set of wheels to zero position.

48. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of a series of pinions engageable with and disengageable from said racks, means for normally maintaining said pinions out of engagement with the racks during the movement of the latter in one direction and in engagement with them during their movement in the opposite direction, for the purpose of turning the pinions forward, two sets of adding wheels associated in pairs with the respective pinions, a differential gearing between each pinion and the adding wheels of its pair, means for holding one set of adding wheels from movement while leaving the wheels of the other set free to be turned by the forward movements of their associated pinions, a sub-total key and connections operable to cause the pinions to remain in engagement with the racks during the movements of the latter in both directions, and means for releasing the locked set of wheels and locking the other set prior to their return movement in the opposite direction.

49. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of a series of pinions engageable with and disengageable from

said racks, means for normally maintaining said pinions out of engagement with the racks during the movement of the latter in one direction and in engagement with them during their movement in the opposite direction for the purpose of turning the pinions forward, two sets of adding wheels associated in pairs with the respective pinions, a differential gearing between each pinion and the adding wheels of its pair, means for holding one set of adding wheels from movement while leaving the wheels of the other set free to be turned by the forward movement of their associated pinions, a sub-total key and connections operable to cause the pinions to remain in engagement with the racks during the movements of the latter in both directions, and means cooperating with said sub-total key and its connections for automatically releasing the locked set of wheels and locking the other set of wheels at the end of the movement of the racks in one direction and prior to their return movement in the opposite direction.

50. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of a series of pinions engageable with and disengageable from said racks, means for normally maintaining said pinions out of engagement with the racks during the movement of the latter in one direction and in engagement with them during their movement in the opposite direction, for the purpose of turning the pinions forward, two sets of adding wheels associated in pairs with the respective pinions, a differential gearing between each pinion and its associated pair of adding wheels, means for holding one set of wheels from movement while leaving the other set free to be turned by the forward movements of their associated pinions, and means operable at will for reversing the normal engagement of the racks and pinions for the purpose of causing the racks to turn the operated adding wheels backward to zero position.

51. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of a series of pinions engageable with and disengageable from said racks, means for normally maintaining said pinions out of engagement with the racks during the movement of the latter in one direction and in engagement with them during their movement in the opposite direction, for the purpose of turning the pinions forward, two sets of adding wheels associated in pairs with the respective pinions, a differential gearing between each pinion and its associated pair of adding wheels, means for holding either set of wheels from movement, at will, while leaving the wheels of the other set free to be turned by the forward movements of their associated pinions, and means operable at will to reverse the normal engagement of

the racks and pinions for the purpose of causing the racks to turn the operated adding wheels backward to zero position.

52. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of a series of pinions engageable with and disengageable from said racks, means for normally maintaining said pinions out of engagement with the racks during the movement of the latter in one direction and in engagement with them during their movement in the opposite direction, for the purpose of turning the pinions forward, two sets of adding wheels associated in pairs with the respective pinions, a differential gearing between each pinion and its associated pair of adding wheels, and a total key and connections operable at will to reverse the normal engagement of the racks and pinions for the purpose of causing the racks to turn the operated adding wheels backward to zero position.

53. In an adding machine, the combination with the adding racks and their operating and controlling devices, of a series of pinions engageable with and disengageable from said racks, means for normally maintaining said pinions in engagement with the racks during the movement of the latter in one direction and out of engagement with them during their movement in the opposite direction, two sets of adding wheels associated in pairs with the respective pinions, a differential gearing between each pinion and its pair of adding wheels, means for holding one set of wheels from movement while leaving the wheels of the other set free to be turned by the forward movements of their associated pinions, a sub-total key and connections operable to cause the pinions to remain in engagement with the racks during the movement of the racks in both directions, means for releasing the locked set of wheels and locking the other set at the end of the movement of the racks in one direction and prior to their return movement in the opposite direction, and a total key and connections for subsequently reversing at will the normal engagement of the racks and pinions for the purpose of causing the racks to return the last mentioned set of adding wheels to zero position.

54. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of a series of pinions engageable with and disengageable from said racks, means for normally maintaining said pinions in engagement with the racks during the movement of the latter in one direction and out of engagement with them during their movement in the opposite direction, two sets of adding wheels associated in pairs with the respective pinions, a differential gearing between each pinion and its pair of adding wheels, means for holding one

set of wheels from movement while leaving the wheels of the other set free to be turned by the forward movements of their associated pinions, a sub-total key and connections operable to cause the pinions to remain in engagement with the racks during the movements of the racks in both directions, means cooperating with said sub-total key and its connections for automatically releasing the locked set of wheels and locking the other set at the end of the movement of the racks in one direction and prior to their return movement in the opposite direction, for the purpose of returning the one set of adding wheels to zero position and transferring its accumulation to the other set of wheels, and a total key and connections subsequently operable at will to reverse the normal engagement of the racks and pinions for the purpose of causing the racks to return the last mentioned set of adding wheels to zero position.

55. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of a series of pinions operated by the respective racks, two sets of adding wheels associated in pairs with the respective pinions, a differential gearing between each pinion and its pair of adding wheels, independent sets of locking devices for the two sets of adding wheels, and controlling keys and connections for the respective sets of locking devices.

56. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of a series of pinions operated by the respective racks, two sets of adding wheels associated in pairs with the respective pinions, a differential gearing between each pinion and its pair of adding wheels, independent locking frames cooperating with the respective sets of wheels, springs tending to maintain said frames in locking engagement with their respective sets of wheels, and controlling keys and connections for operating said frames.

57. In an adding machine, the combination, with the adding racks and their operating and controlling devices, of a series of pinions operated by the respective racks, two sets of adding wheels associated in pairs with the respective pinions, a differential gearing between each pinion and its pair of adding wheels, independent sets of locking devices for the two sets of adding wheels, and controlling keys and connections for the respective sets of locking devices such that the operation of one of said controlling keys will cause one set of wheels to be locked from movement while leaving the other set free to be turned by their associated pinions, and such that the operation of the other controlling key will release the locked set of wheels and cause the other set to become locked.

58. In an adding machine, the combina-

tion, with the adding racks and their operating and controlling devices, of a series of pinions operated by the respective racks, two sets of adding wheels associated in pairs with the respective pinions, a differential gearing between each pinion and its pair of adding wheels, independent locking frames cooperating with the respective sets of wheels, springs tending to maintain said frames in locking engagement with their respective sets of wheels, and controlling keys and connections for operating said frames such that the operation of either key to disengage its locking frame from the corresponding set of wheels will cause the other locking frame to automatically engage and lock its set of wheels.

59. In an adding and listing machine, the combination, with a plurality of sets of adding wheels and operating devices therefor, including transfer mechanism constituting each set of wheels a totalizer distinct from the other set of a paper carriage movable transversely of the machine independently of the adding wheels and their operating devices, and means controlled by the paper carriage for determining which set of adding wheels shall be actuated by the operating devices of the machine.

60. In an adding and listing machine, the combination, with the adding racks and their operating and controlling devices, of two sets of adding wheels associated in pairs with the respective racks and independently operable thereby, a paper carriage movable transversely of the machine independently of the adding wheels, and means controlled by the paper carriage for determining which set of adding wheels shall be actuated by the adding racks.

61. In an adding and listing machine, the combination, with the adding racks and their operating and controlling devices, of two sets of adding wheels associated in pairs with the respective racks and independently operable thereby, a paper carriage movable transversely of the machine, and means for causing the position of the paper carriage to determine which set of wheels shall be operated by the adding racks.

62. In an adding and listing machine, the combination, with the adding racks and their operating and controlling devices, of a series of pinions operated by the respective racks, two sets of adding wheels associated in pairs with the respective pinions and independently operable thereby, a paper carriage movable transversely of the machine, and means controlled by said paper carriage for determining which set of adding wheels shall be operated by the pinions.

63. In an adding and listing machine, the combination, with a series of adding wheel actuating pinions and means for imparting differential movements to said pinions, of

two sets of adding wheels associated in pairs with the respective pinions, a differential gearing between each pinion and its associated pair of adding wheels, means for holding one set of adding wheels from movement while leaving the other set free to be turned by their associated pinions, a transversely movable paper carriage, and means controlled by said paper carriage for determining which set of adding wheels shall be held from movement and which set left free to be turned by their associated pinions.

64. In an adding and listing machine, the combination, with the adding racks and their operating and controlling devices, of a series of pinions operated by the respective racks, two sets of adding wheels associated in pairs with the respective pinions, a differential gearing between each pinion and its associated pair of adding wheels, means for holding one set of adding wheels from movement while leaving the other set free to be turned by the movements of their associated pinions, a transversely movable paper carriage, and means controlled by the said paper carriage for determining which set of adding wheels shall be held from movement and which set left free to be turned by their associated pinions.

65. In an adding and listing machine, the combination, with the adding racks and their operating and controlling devices, of a series of pinions operated by the respective racks, two sets of adding wheels associated in pairs with the respective pinions, a differential gear between each pinion and its pair of adding wheels, independent sets of locking devices for the two sets of adding wheels, a transversely movable paper carriage, and means intermediate the paper carriage and said sets of locking devices for controlling the operation of the locking devices by the movements of the paper carriage.

66. In an adding and listing machine, the combination, with the adding racks and their operating and controlling devices, of a series of pinions operated by the respective racks, two sets of adding wheels associated in pairs with the respective pinions, a differential gear between each pinion and its pair of adding wheels, independent sets of locking devices for the two sets of adding wheels, controlling keys and connections for the respective sets of locking devices, a transversely movable paper carriage, and means intermediate said paper carriage and said controlling keys for causing the operation of the controlling keys and locking devices to be controlled by the movements of the paper carriage.

JESSE G. VINCENT.

Witnesses:

RUSSELL E. BENNER,
ROYAL S. MIELERT.