W. J. KILPATRICK.

ADDING AND LISTING MACHINE.

APPLICATION FILED AUG. 13, 1912.

1,152,517.

Patented Sept. 7, 1915.

11 SHEETS—SHEET 1.

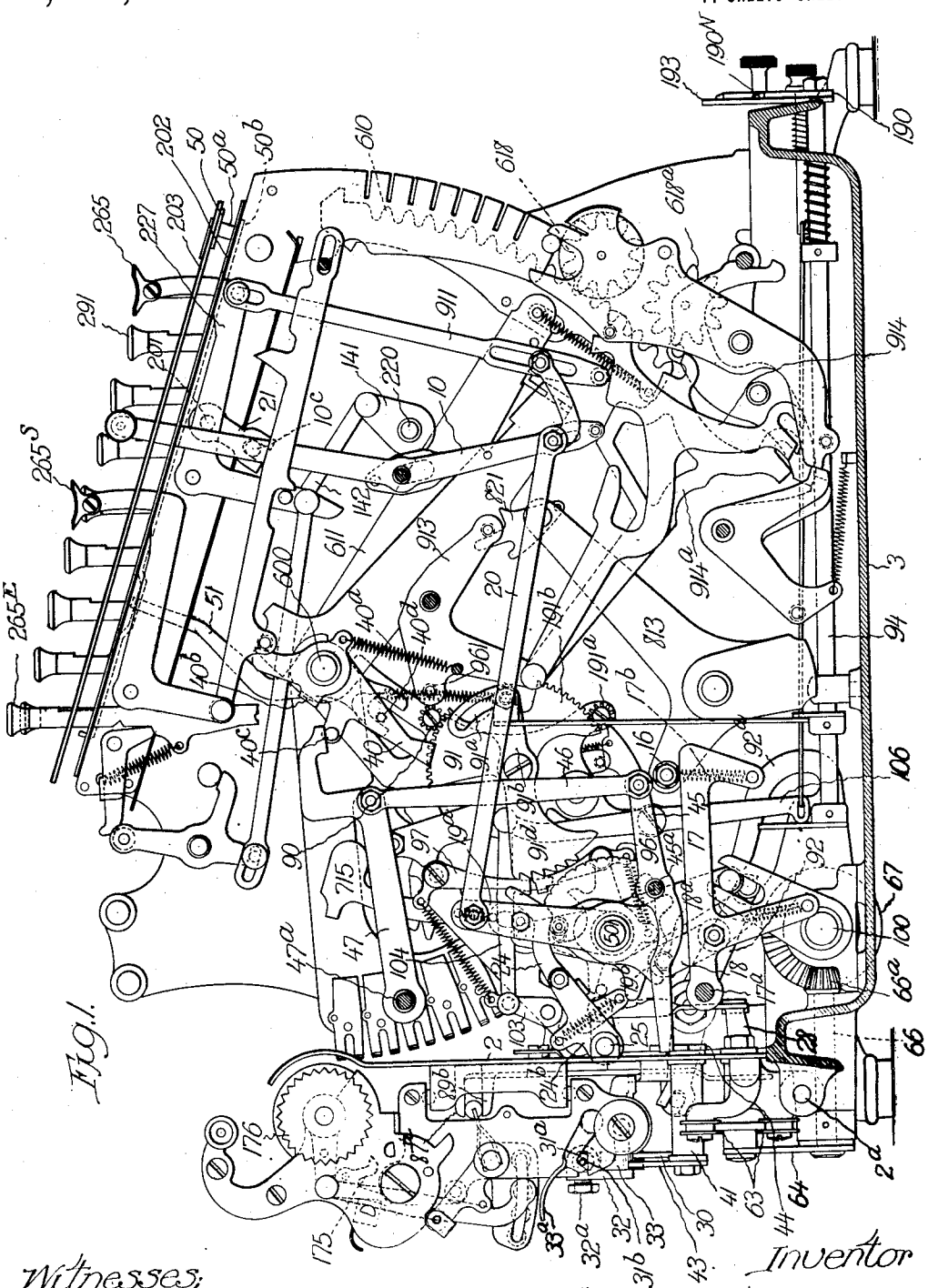


Fig. 1.

Witnesses;

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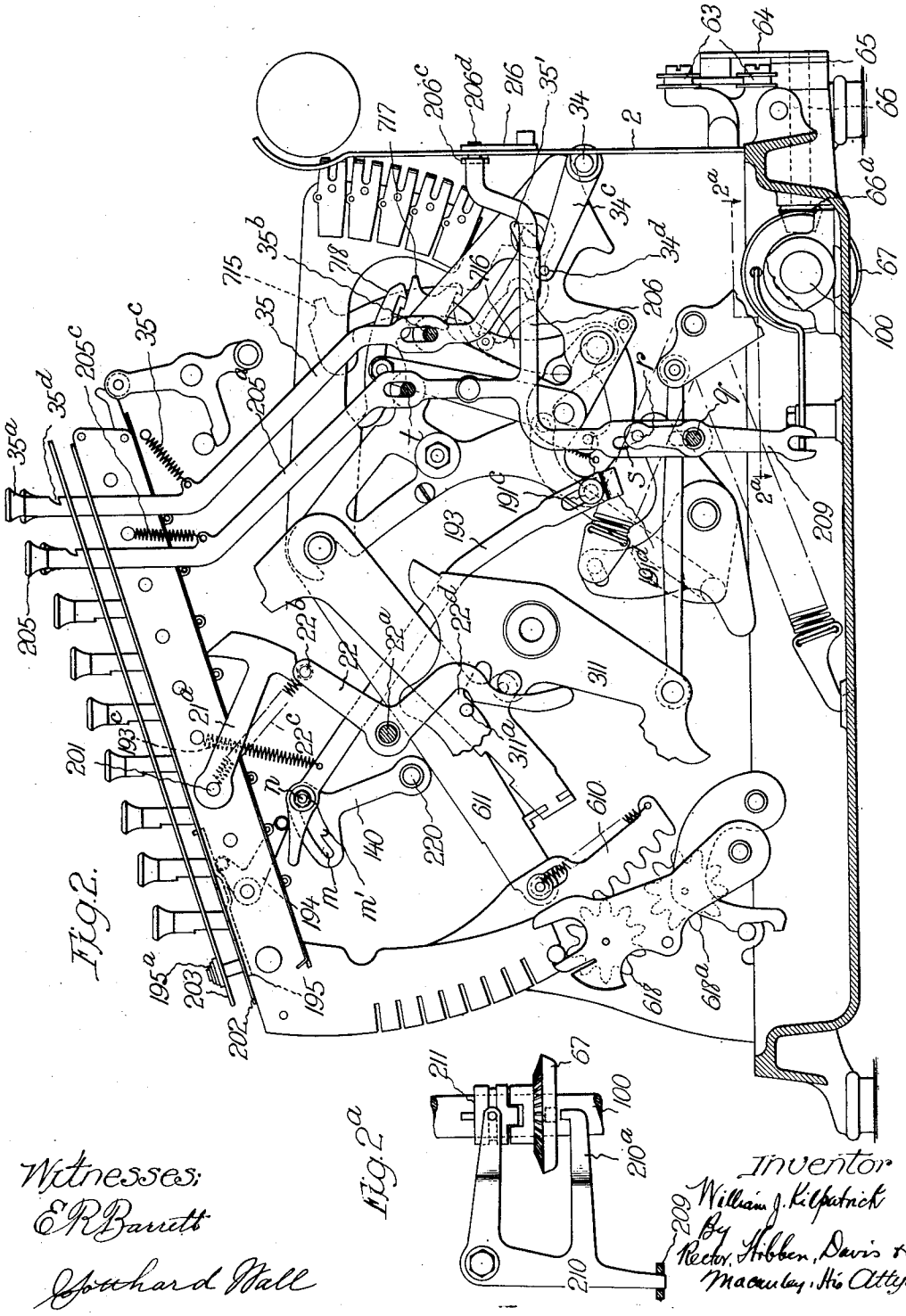


Fig. 2.

Fig. 2a

Witnesses:
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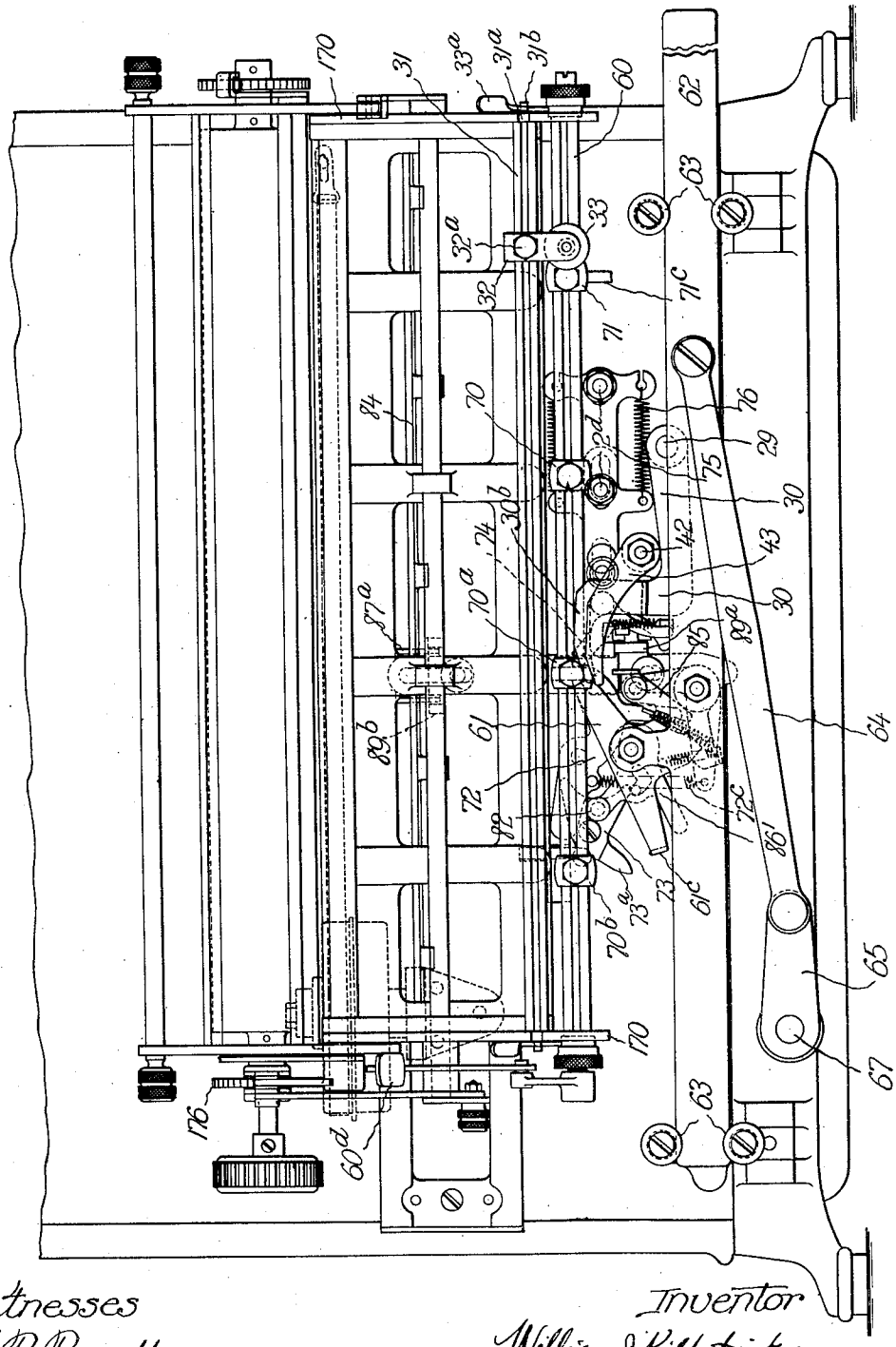


Fig. 3.

Witnesses
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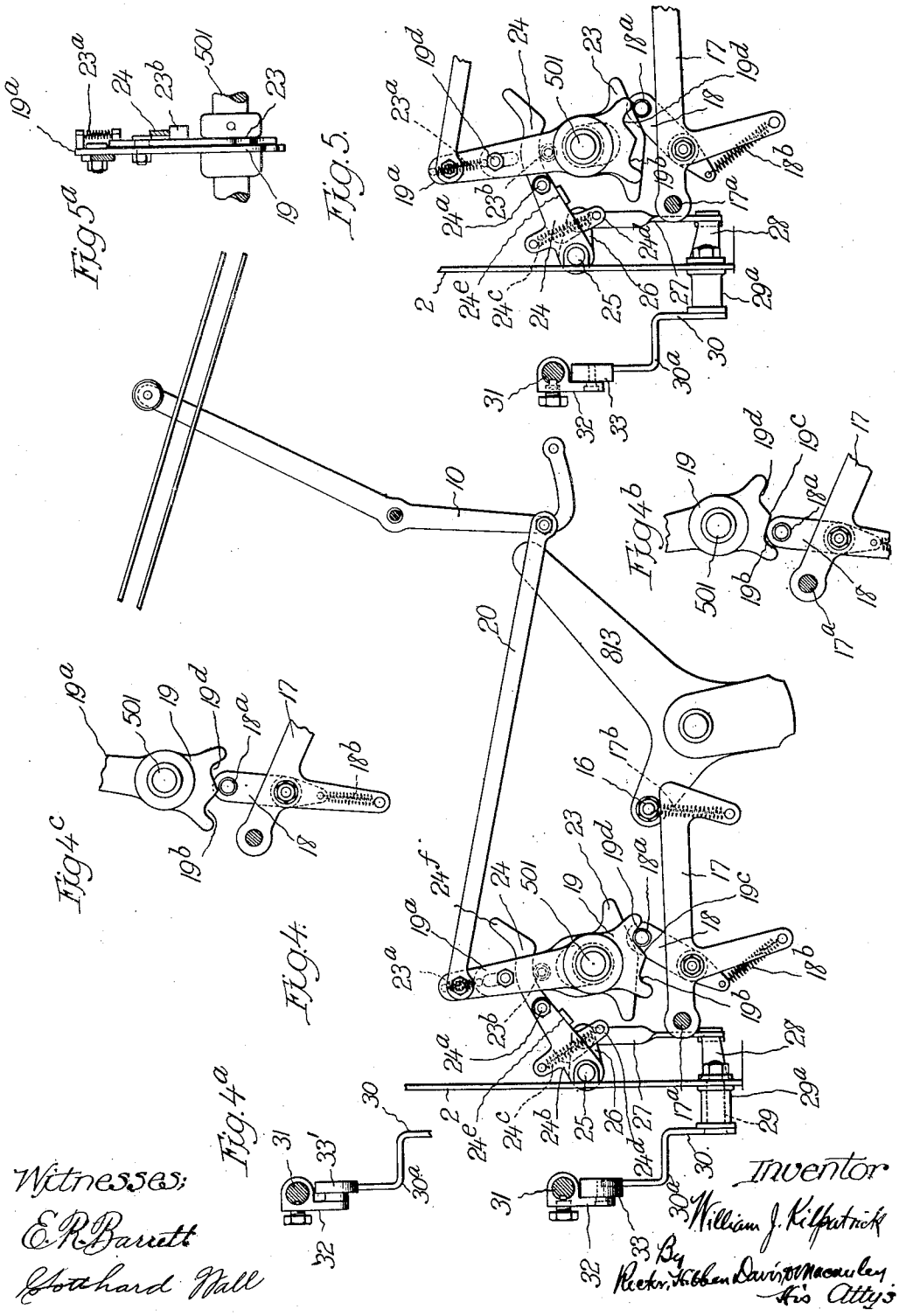
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11 SHEETS—SHEET 4.



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11 SHEETS—SHEET 5.

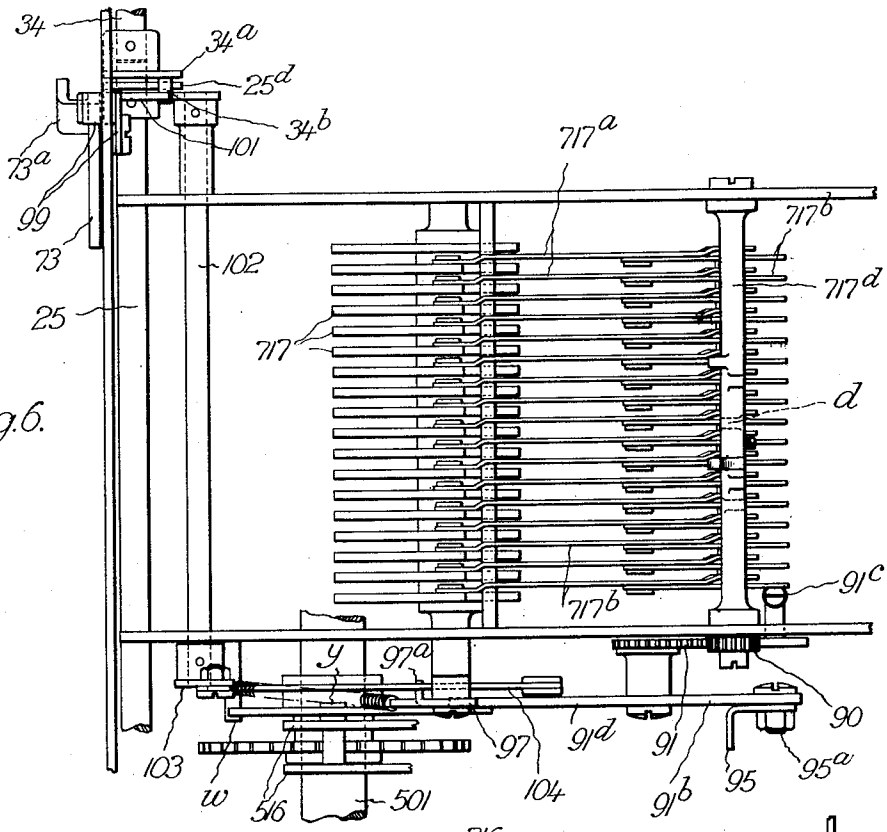


Fig. 6.

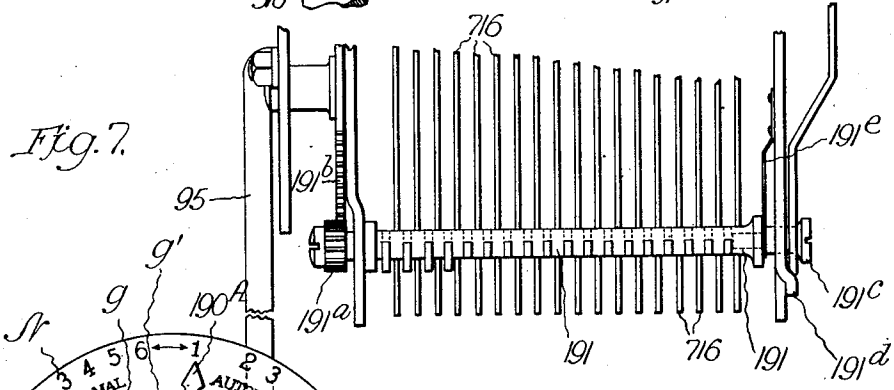
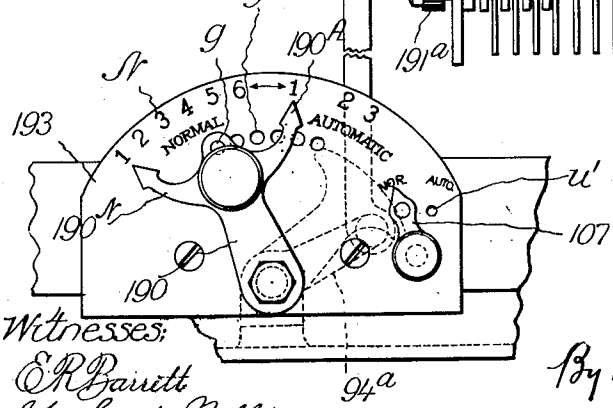


Fig. 7.



Witnesses:
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11 SHEETS—SHEET 6.

Fig. 8.

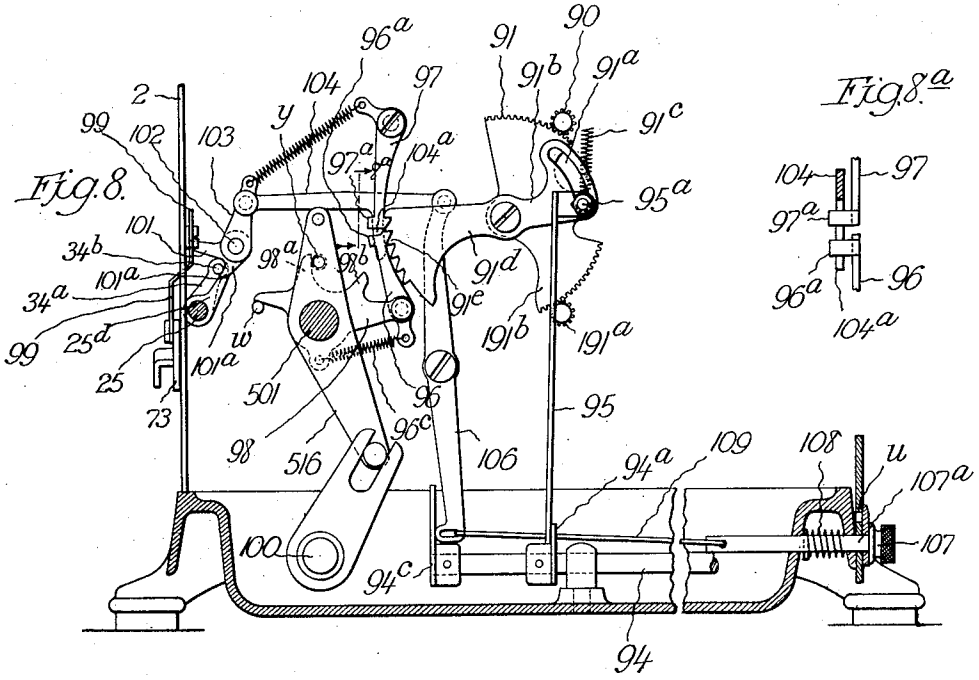
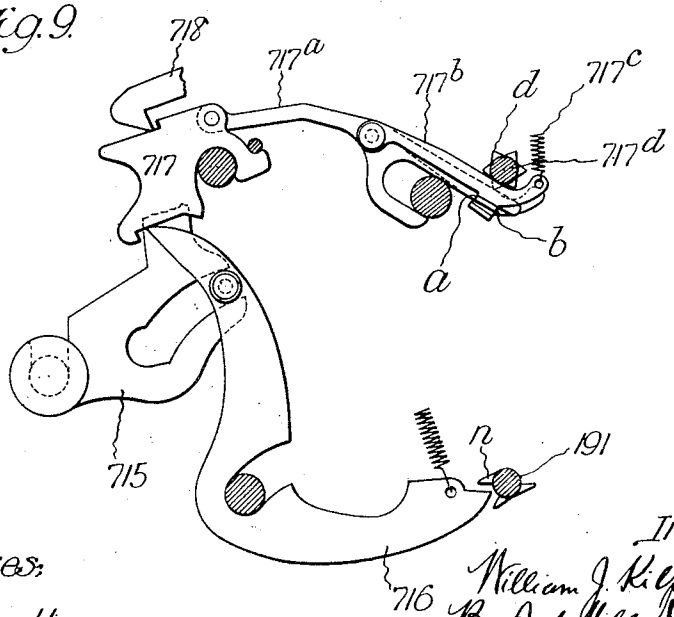


Fig. 8a.

Fig. 9.



Witnesses:
E. R. Barrett.
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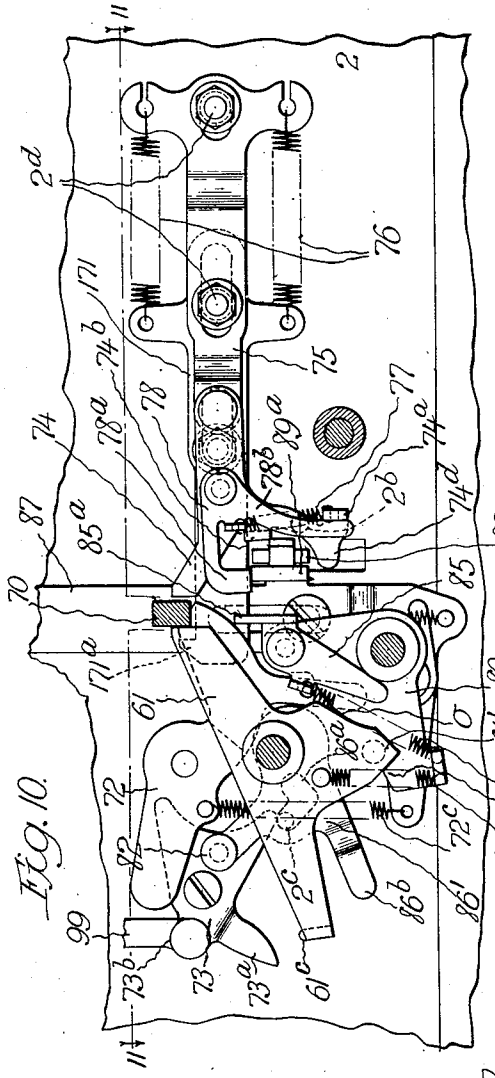


Fig. 10.

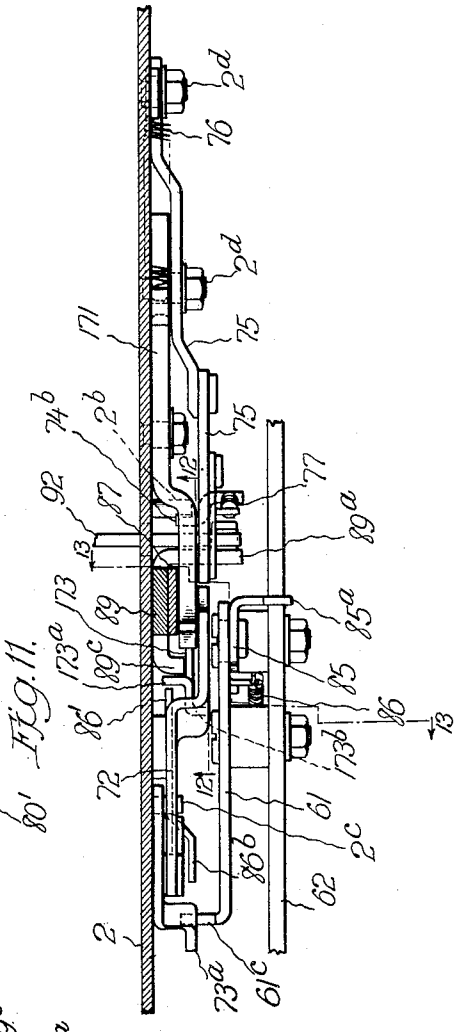


Fig. 11.

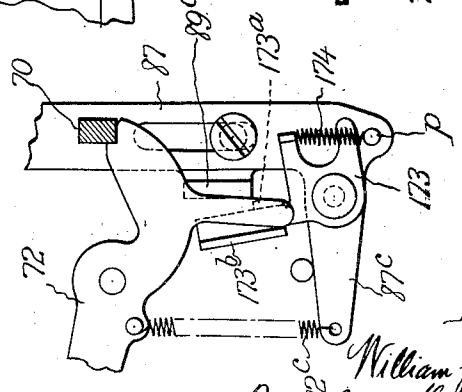


Fig. 12.

Witnesses
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11 SHEETS—SHEET 8.

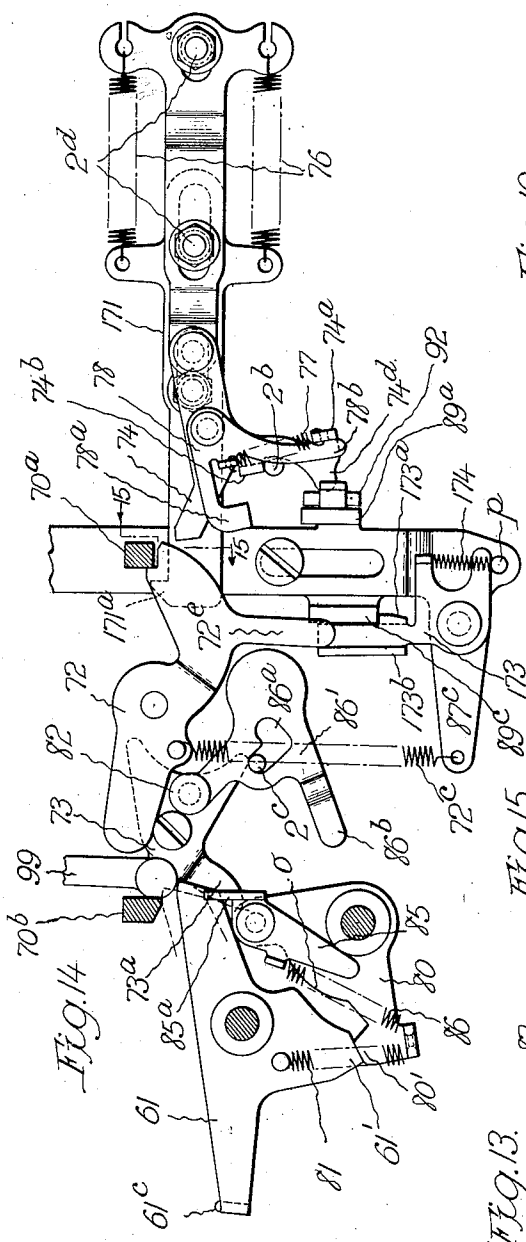


Fig. 14.

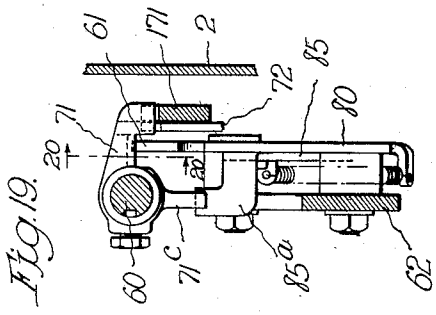


Fig. 19.

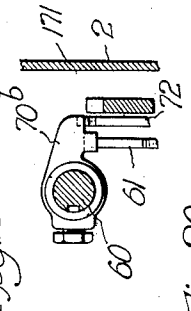


Fig. 16.

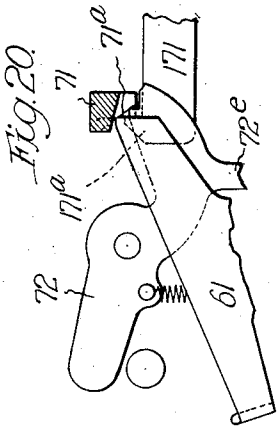


Fig. 20.

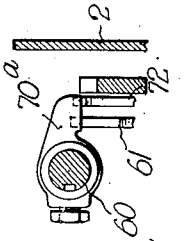


Fig. 15.

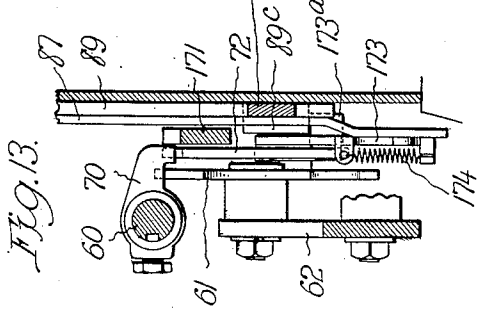


Fig. 13.

Witnesses

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11 SHEETS—SHEET 9.

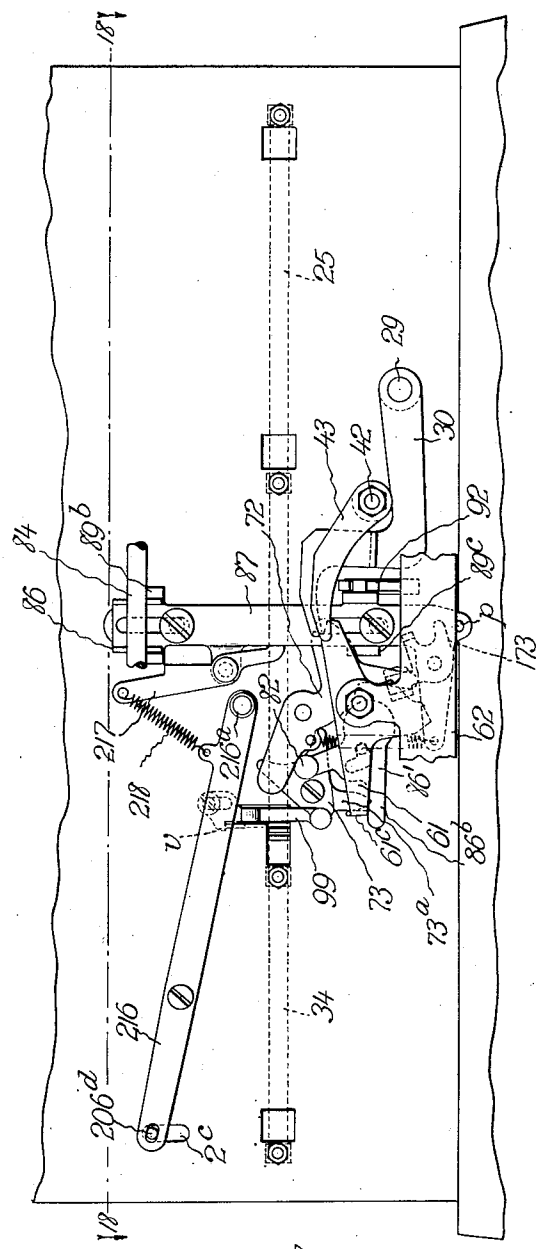


FIG. 17.

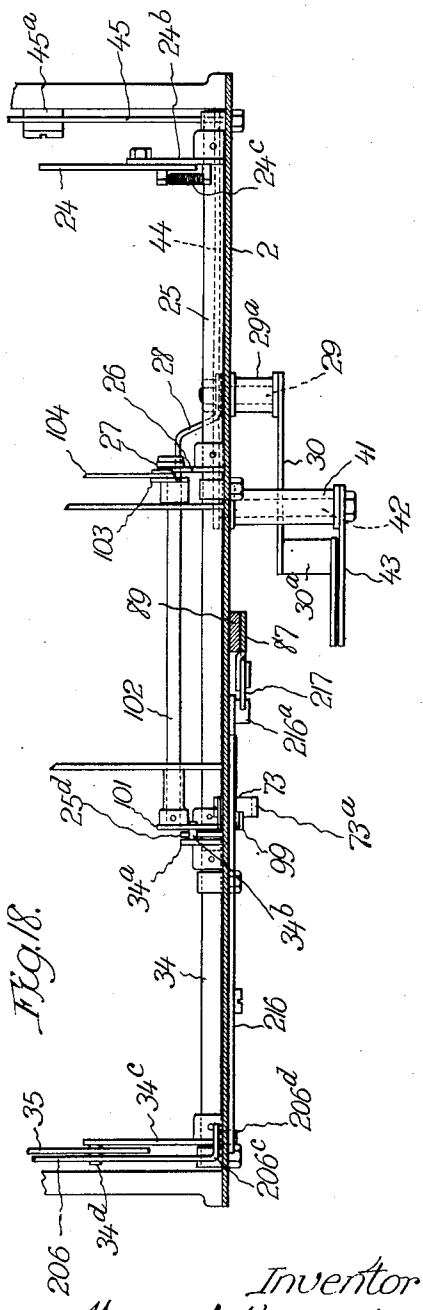


FIG. 18.

Witnesses;
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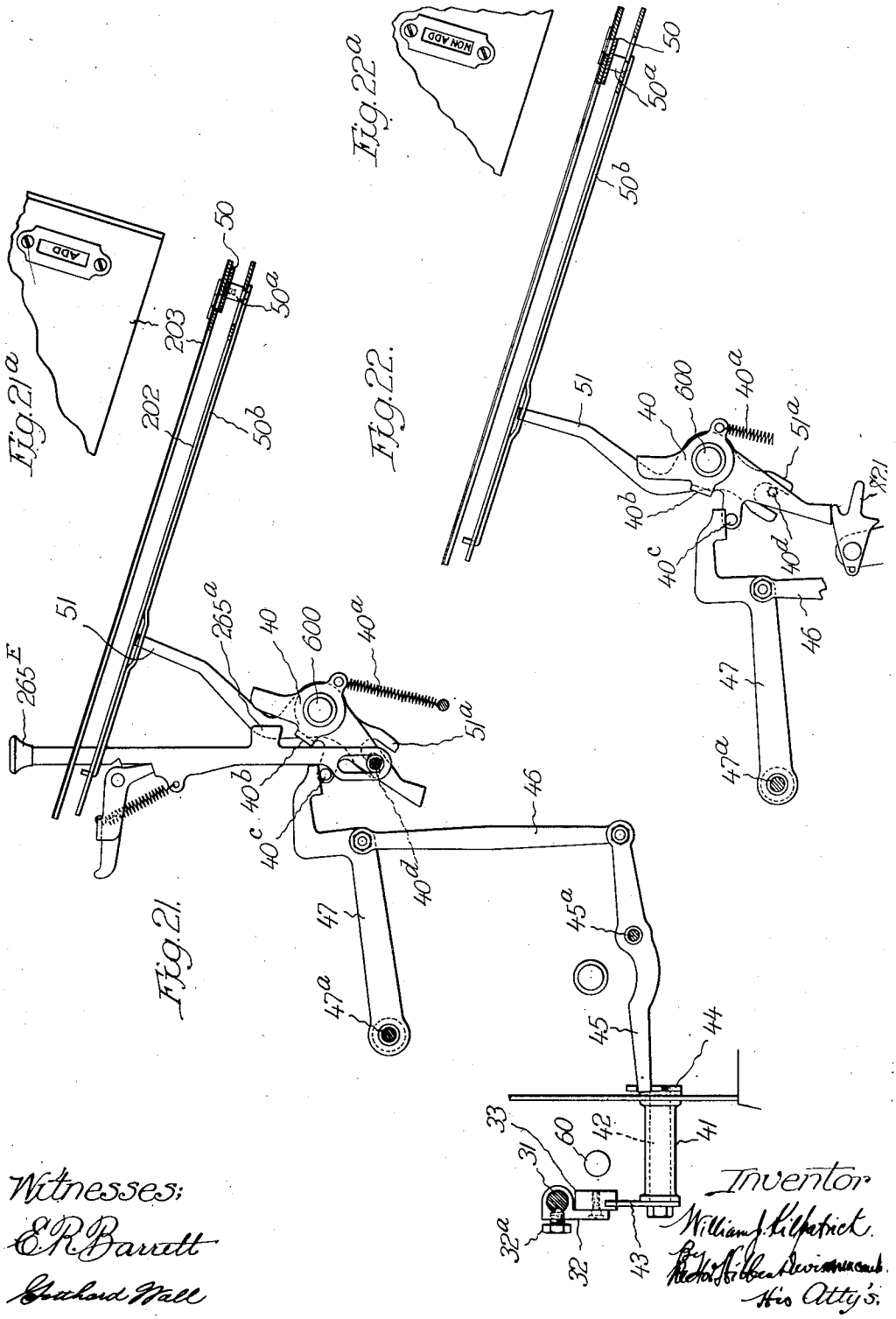
ADDING AND LISTING MACHINE.

APPLICATION FILED AUG. 13, 1912.

1,152,517.

Patented Sept. 7, 1915.

11 SHEETS—SHEET 10.



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ADDING AND LISTING MACHINE.

APPLICATION FILED AUG. 13, 1912.

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11 SHEETS—SHEET 11.

Fig. 23.

LOT NUMBER.	TAX	DISCOUNT	NET	PARK MAINTAINANCE	TOTAL
122.11	112.21	12.31	99.90	22.10	122.00 =
123.21	232.11	43.21	188.90	22.10	211.00 =
43.21	401.23	21.23	380.00	32.10	412.10 =
	745.55	76.75	568.80*	76.30	745.10*

Fig. 24.

CHECK NUMBER	PIECE WORK	DAY WORK	TOTAL	DEDUCTIONS	TOTAL
16.95	15.00	3.85	18.85	2.00	16.85 =
16.96	17.00	1.50	16.50	1.00	15.50 =
16.97	19.00	.50	18.50	.50	18.00 =
	51.00	5.85	53.85*	3.50	50.35*

Fig. 25.

CLERKS NUMBER	SALES
6.45	78650.00
2.34	3540.00
7.65	21645.00
1.35	54321.00
6.78	43678.90
2.34	1234.00
	203068.00*

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UNITED STATES PATENT OFFICE

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ADDING AND LISTING MACHINE.

1,152,517. Specification of Letters Patent. Patented Sept. 7, 1915.

Application filed August 13, 1912. Serial No. 714,799.

To all whom it may concern:

Be it known that I, WILLIAM J. KILPATRICK, a citizen of the United States, residing in Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Adding and Listing Machines, of which the following is a specification.

The present invention relates more particularly to the tabulating type of adding and listing machine, that is to say, a machine which, in addition to the usual equipment for adding, listing and total printing, has a laterally movable paper carriage and means for automatically stepping the same from one columnar position to another.

The general purpose of the present invention is to considerably enlarge the capabilities of a machine of this type and to provide for the doing of a greater variety of tabulating work through automatic action, together with varied control of accumulation or adding. Thus, the invention provides for combining in one organism duplex accumulators and mechanism by which the paper carriage may be caused to automatically step from column to column for cross-tabulating purposes, the duplex accumulators being under control of the tabulating mechanism; and the invention also provides for controlling a variable "split" or "cipher cut-out" equipment by such character of tabulating mechanism. (The above quoted phrases are employed in this art to denote an equipment whereby the printing mechanism may be subdivided so that two items may be printed simultaneously on the same horizontal line.)

An early example of the "split" or "cipher cut-out" is disclosed in the patent of Heber C. Peters, 1,094,012 issued April 21, 1914, which also affords an example of an automatic cross-tabulating mechanism applied to a standard type of adding and listing machine, and that application extends to a disclosure of "split" devices under control of cross-tabulating mechanism. As to this general combination, the present invention differs principally from the disclosure of said Peters patent in that the latter shows control by the tabulating mechanism of the splitting or subdividing of the printing mechanism at a single point, whereas by the present invention provision is made for effecting a succession of splits at different points under control of the tabulating mechanism.

As to duplex accumulators, reference may be had to United States Patent 919,656, issued April 27th, 1909, on the invention of Jesse G. Vincent and Nelson White, also to Patent No. 1,048,249 issued Dec. 24, 1912 on the later invention of Nelson White of a duplex accumulating arrangement, similar to that disclosed in the said Vincent-White patent, but combined with an automatic cross-tabulating arrangement. The principal difference between the combination disclosed in said White patent and my combination of cross-tabulating and duplex accumulating means is that White's cross-tabulating arrangement is confined to two-column or so-called "shuttle" work, whereas my invention provides for the stepping of the paper carriage from column to column throughout a series of three or more columnar positions, accompanied by automatic control of the duplex accumulating arrangement.

It will be understood that the term "shuttle" signifies an arrangement whereby the paper carriage reciprocates between two columnar positions, being shifted first one way and then the other in successive operations of the machine. See U. S. Patent 924,118 issued June 8, 1909, on the invention of said Vincent and one Russell E. Benner.

My invention embraces such advanced type of cross-tabulating arrangement as disclosed in Patent No. 1,046,546 issued Dec. 10, 1912, on the invention of said Benner wherein the paper carriage is automatically propelled from column to column, moving from right to left, by power stored up in the initial stroke of the prime mover, and is then automatically run back to its original position, moving from left to right as an incident to the operation of the machine with the carriage in its final or left-most position. In this connection my present invention extends to an improvement for preventing a release and restoration to normal of the carriage holding detent until the carriage has returned all the way home, thus avoiding a difficulty that has been encountered in the use of this character of mechanism through interference with the return of the paper carriage, as, for example, by the buckling of the paper.

The present invention extends to various

other features calculated to give the machine a wider range of usefulness, such as special manipulative devices for suspending at will one or more automatic functions; also various safeguards against mis-operation or derangement.

With the above indicated objects in view, and others of a minor character to be hereinafter pointed out, the invention consists in certain novel features of construction and combination of elements, the essentials whereof will be recited in appended claims of varying scope and character, and a preferred form of embodiment of which, illustrated in the accompanying drawings, will now be described in detail.

Of said drawings, Figure 1 represents in left side elevation (with inclosing casing omitted and base casting, frame studs, and rods in section) an adding and listing machine of the well-known Burroughs type equipped to embody the present invention, all parts being shown at normal; Fig. 2 is a similar right-hand elevation of the machine; Fig. 2^a is a detail horizontal section taken substantially on the line 2^a of Fig. 2; Fig. 3 is a rear elevation of the machine, abbreviated as to its top portion; Fig. 4 is a left side elevation of the accumulator controlling mechanism under a condition obtaining when the lower one of the two accumulators is active; Fig. 4^a is a detail corresponding with the extreme left-hand portion of Fig. 4 and denoting interchangeability of cam rollers on the paper carriage; Fig. 4^b is a detail corresponding with the central portion of Fig. 4 and illustrating the effect of the initial stroke of the prime mover upon the accumulator shifting devices; Fig. 4^c is a similar view illustrating the condition when the upper one of the two accumulators is active; Fig. 5 is an elevation similar to Fig. 4, but illustrating displacement of the accumulator shifting devices; Fig. 5^a is a cross-section taken on the line 5^a—5^a of Fig. 5; Fig. 6 is a plan view of part of the printing mechanism, including the devices for effecting successive splits at different points under control of the tabulating mechanism; Fig. 7 is a front elevation of some of the same parts, together with indexing devices at the front of the machine; Fig. 8 is a sectional left side elevation of parts illustrated in Figs. 6 and 7; Fig. 8^a is a sectional detail taken on line 8^a—8^a of Fig. 8; Fig. 9 is a sectional elevation of one set of printing devices, together with splitting and hammer blocking elements; Fig. 10 is a sectional rear elevation illustrating the tabulating condition, *i. e.* the relation of parts when the carriage is at an intermediate columnar position; Fig. 11 is a horizontal section taken on line 11—11 of Fig. 10; Fig. 12 is a section taken substantially on the line 12—12 of Fig. 11, some parts within the range of the section line being omitted for the sake of clearness; Fig. 13 is a vertical sectional view on the line 13—13 of Fig. 11; Fig. 14 is a view similar to Fig. 10, but illustrating the condition when the carriage is in the final columnar position and the prime mover has made its initial stroke; Fig. 15 is a detail sectional view taken substantially on the line 15—15 of Fig. 14, though not including all the parts in the range of the section line; Fig. 16 is a view similar to Fig. 15, but showing the finger which appears in cross section at left of Fig. 14 instead of the finger appearing in cross section at the middle of said figure; Fig. 17 is a view similar to Figs. 10 and 14 illustrating a third step in the tabulating operation, to wit, the condition that obtains when the carriage is released for the return to normal at the conclusion of the final or return stroke of the prime mover—this view also illustrating connections for automatically restoring to normal the automatically variable split mechanism; Fig. 18 is a horizontal section taken substantially on the line 18—18 of Fig. 17: Fig. 19 is a vertical cross section somewhat on the order of Figs. 15 and 16, but illustrating the relation of parts when the carriage has returned to normal from the position indicated in Fig. 17, a different controlling finger therefore appearing than in either of Figs. 15 and 16; Fig. 20 shows this different controlling finger in cross section, together with some associated parts in elevation, the section being taken substantially on the line 20—20 of Fig. 19; Fig. 21 is a sectional left side elevation illustrating eliminating or "non-adding" connections controlled by the paper carriage and also a visual signal arrangement for showing whether the condition is an adding or a non-adding one; Fig. 21^a is a fragmentary top plan view of the keyboard where this signal is located, showing the word Add displayed; Fig. 22 is a view similar to Fig. 21, but illustrating the non-adding condition; Fig. 22^a is a corresponding fragmentary plan view of the keyboard: and Figs. 23 to 25 show various examples of work of which the machine of my invention is capable.

In view of the disclosures in the prior patents already mentioned and many other patents of the prior art, it will not be necessary in this specification to describe in detail the mechanism that goes to make up the machine proper, nor to point out the particulars of the now well-known Burroughs duplex accumulator arrangement. It will suffice to designate a few of the familiar elements, such as the amount keys, 291; total and subtotal keys, 265 and 265^s; adding racks 610; upper accumulating pinions, 618; lower accumulating pinions, 618^a; pitman, 914, for the upper accumulator; pit-

man 914ª for the lower accumulator; slotted link, 911, pendant from the total keys and shiftable to coact with either of said pitmen; and controlling lever 10, also coacting with said pitmen and coupled to the link 911. As fully described in said Vincent-White patent and said Nelson White patent, the shifting of the lever 10 determines whether one set of accumulating pinions or the other shall coact with the racks 610. When the lever is rearward as to its upper arm (Fig. 1), the upper accumulator is the active one, and when the lever is forward as to its upper arm (Fig. 4), the lower accumulator is the active one.

Automatic accumulator shift.—For the purposes of my present invention, I provide means for shifting from one accumulator to the other in the successive operations of the machine, not, as in the said Nelson-White patent, by action of carriage reciprocating means, but through connection with actuating elements of the machine proper, thus the familiar rocking arm 813, which carries the wiper pawl 821, has its roller stud 16 overlying and normally in contact with a lever 17 which is pivoted upon a frame stud 17ª at its rear end, and is connected at its forward end with the stud 16 by a spring 17ᵇ, as shown in Figs. 1 and 4. Upon this lever 17 intermediate its ends there is pivotally mounted a thrust piece 18, which is adapted to act upon a rocking plate 19 to swing it one way or the other. This plate has an upwardly extending arm 19ª which is connected by a link 20 to the controlling lever 10.

When the upper accumulator adjustment obtains, as illustrated in Fig. 1, a roller stud 18ª carried by the thrust piece 18 seats in a notch 19ᵇ at the rear part of the under edge of the rocking plate 19, as illustrated by dotted lines in Fig. 1, whereas when the lower accumulator adjustment obtains said roller seats in a similar notch 19ᵈ at the forward part of the under edge of said plate, as shown in Fig. 4. A centralizing spring 18ᵇ connects the thrust piece 18 with the lower end of a downwardly projecting arm of the lever 17 and when, upon the prime mover making its initial stroke, the arm 813 forces down the lever 17, the thrust piece will straighten, as shown in Figs. 4ᵇ and 4ᶜ, so that its roller stud 18ª will pass to one side or the other of a V-shaped projection 19ᶜ of the rocking plate 19, which projection intervenes between the notches 19ᵇ and 19ᵈ. Therefore, upon return of the lever 17, accompanying the final or return stroke of the prime mover, the roller stud 18ª will not reëngage the notch which it occupied at the beginning of the operation, but will pass into engagement with the other notch and rock the plate 19 by action against the substantially radial side of the notch. Fig. 4ᵇ shows the lever 17 depressed and the thrust piece 18 straightened whereby its roller stud is thrown to the rear of the apex of the V-shaped projection 19ᶜ, so that upon the return of the lever 17 said stud will seat in the notch 19ᵇ and rock the plate 19 to the upper accumulator position illustrated in Fig. 1; and Fig. 4ᶜ shows the plate in that position and about to be rocked by the thrust piece into the lower accumulator position,—being the converse of the condition illustrated in Fig. 4ᵇ. It will be clear from the above that, in the absence of any adjustment to prevent it, the two accumulators will be alternately active in the successive operations of the machine. This is desirable for some classes of work, but not for others, and provision is made, as hereinafter explained, for controlling the effectiveness of this accumulator shift arrangement by columnar position of the carriage, and also by certain special keys.

The spring connection between the lever 17 and the operating arm 813 is employed on account of the desirability or necessity of delaying the shift until movement of the actuator elements of the machine proper is over, or nearly over, an interlocking arrangement being employed to prevent shifting the controlling lever 10 until such time. Therefore, during the return stroke of the operating arm 813, the spring 17ᵇ is stretched after the roller stud 18ª seats itself in the notch of the plate 19, and until the interlocking action above mentioned is over.

The interlocking mechanism is illustrated in Figs. 1 and 2 and comprises a short arm 21 forked to embrace a stud 10ᶜ on the controlling lever 10 (Fig. 1), and secured to a rock shaft 201, which, at the opposite side of the machine (Fig. 2), carries an arm 21ª having a segment-shaped outer portion with angular end edges. A bell-crank lever 22 is pivoted to a frame stud 22ª, and one arm of this lever carries a stud 22ᵇ coacting with the arm 21ª, the other arm of the lever coacting with a stud 311ª on the familiar full stroke sector 311. A spring 22ᶜ connects the upper arm of the bell-crank lever with the shaft 201 and holds the stud 22ᵇ against one or the other end edge of the segment on the arm 21ª. A notch 22ᵈ in the lower arm of the bell-crank lever normally alines with the stud 311ª so that the arm 21ª may shift, but as soon as the full stroke sector 311 moves, its stud 311ª passes down in front of an elongated extension of the bell-crank lever, thereby locking the latter and so preventing shifting of the arm 21ª until the full stroke sector is back in normal position again. Vice versa, movement of the full stroke sector cannot take place while the controlling arm 10 is being shifted, for during this shifting the concentric rear edge of the arm 21ª is riding upon the stud 22ᵇ, hold-

ing the bell crank lever out of normal and its notch 22^d engaged with the stud 311^a.

Disabling the accumulator shift by the paper carriage.—In order to prevent the above described action of the accumulator shift, it is only necessary to prevent coaction between the roller stud 18^a and the rocking plate 19. Therefore a shield or guard plate 23 is mounted alongside the plate 19 slotted for engagement with a stud 19^d (Figs. 5 and 5^a) carried by the arm 19^a of said rocking plate, and further slotted to embrace the shaft 501 upon which the plate 19 rocks. This shield or guard plate is normally upheld by a spring 23^a which connects it with the upper extremity of arm 19^a, as shown in Fig. 5^a, and normally the acting portion of the plate, which is substantially segmental in form, is withdrawn so as not to interfere with the coaction of the stud 18^a and the rocking plate 19. However, the thrusting of the shield plate downward to such position as illustrated in Fig. 5, projects its segmental portion beyond the plate 19 so that the roller stud 18^a is prevented from reaching the latter, and, upon return of the lever 18 under actuation of its spring 17^b, said roller stud will simply travel along the under edge of the plate 23, the spring 18^b simply stretching a little more than it otherwise would while the rock-plate 19 remains immovable.

For the purpose of setting the shield plate to effective position, there is pivotally mounted upon the back panel 2 of the machine casing a jointed arm arranged to coact with a roller stud 23^b carried by the plate 23. This jointed arm comprises a forward section 24, curved (except for a horn-like extension 24^f Fig. 4) so as to be normally concentric with the plate and of sufficient extent to preserve its engagement with the stud 23^b under both adjustments of the rocking plate 19. This forward section 24 is pivoted at 24^a to a rear section 24^b which is secured to a rock shaft 25 in bearings upon said back panel. A spring 24^e connects a branch of the arm section 24^b with a branch 24^d of the arm-section 24, and a lip 24^e on the latter extends under the arm-section 24^b. This sectional construction of the arm is merely for the purpose of permitting the swinging back of the panel 2, which, as usual, is hinged to the base casting 3 at the point designated by the numeral 2^a (Fig. 1) and the horn-like extension 24^f serves merely to insure reëngagement of the arm with the roller when said back panel is swung forward into place again, the under cam-like edge of said horn riding upon the roller.

There is secured to the shaft 25 some distance to the left of the arm 24^b, as the parts are seen in Fig. 18, a short forwardly projecting arm 26 from which is suspended a link 27 (Figs. 4 and 5). The latter at its lower end is jointed to an arm 28 extending at right angles to the arm 26, and secured to a short shaft 29 which is journaled in a bearing 29^a secured to the back panel 2. There is secured to the rear end of said shaft 29 an arm 30 which extends in the same general direction as the arm 28, and is offset rearwardly, as shown at 30^a (Fig. 18), and thence projects upwardly and further to the left, its upper portion 30^b constituting a cam piece (Fig. 3). Between the end plates 170 of the main frame of the laterally shifting paper carriage (Fig. 3), there is detachably mounted a rod 31 which carries an adjustable bracket 32 with a roller 33 adapted to ride upon the said cam piece and thereby rock the arm 30 and shaft 25, and so depress the plate 23 with the effect already described.

The rod 31 is grooved throughout its length and the bracket 32 is adapted to slide upon it and carries a set-screw 32^a so as to be settable at any desired point along the rod. This is of course desirable in order to provide for varying kinds of work which would call for disabling of the accumulator shifting mechanism at one or another point in cross tabulating. The detachability of the rod 31 is advantageous where it is desired to preserve some certain adjustment of one or more brackets upon the rod and save resetting them when the same sort of work is to be resumed after some other and different work has intervened calling for a different setting of brackets. In such a case the rod 31 would be replaced by a similar rod with one or more brackets set at appropriate places. The rod is made detachable by having squared portions 31^a at the ends fitting notches in the carriage end plates 170 as illustrated in Fig. 1, said rod having projecting studs 31^b engaged by latches 33^a pivoted upon the said end-plates 170.

Disabling accumulator shift by special key.—Alined with the shaft 25 and similarly journaled in bearings upon the back panel 2 is a rock shaft 34 (Fig. 18), which at its right-hand end as the part here appears, carries an arm 34^a having a stud 34^b which projects in rear of an arm 25^d fastened to the shaft 25 (Fig. 8). To the opposite end of said shaft 34 (Fig. 18) is secured a forwardly projecting arm 34^c carrying a stud 34^d underlying the widened lower end 35′ of a key stem 35, (Fig. 2), which is of irregular shape and has a portion projecting through the keyboard and surmounted by a key 35^a. This key stem 35 is slotted at an intermediate point to embrace a frame stud 35^b. Obviously depression of the key rocks the shaft 34 and that shaft rocks the shaft 25 with the same effect as the rocking of the latter shaft by the aforesaid lever 30. The key 35^a is upheld normally by a spring 35^c and the stem has a notch 35^d to engage un-

der the upper keyboard plate 203 so that the key may be caught down and so held indefinitely. The spring 35[c] pulls upon the stem 35 both upwardly and rearwardly and the stem may rock slightly upon the frame stud 35[b].

Elimination or non-adding.—It is a familiar proposition in the art to provide for printing without adding and this has been done both by equipping the machine with a special key and by arranging for the shifting carriage to effect the non-adding adjustment. It is further a familiar proposition to accomplish the elimination in a machine of the Burroughs type by disabling the wiper pawl 821 so that upon return of the rock arm 813 that pawl will not act to engage adding pinions with racks. The elimination is accomplished in that manner in the machine here shown. Thus there is mounted to rock upon the shaft 600 a tappet piece 40 (Figs. 1, 21 and 22) normally held rearwardly by a spring 40[a] so as to not interfere with the action of the wiper pawl 821 but adapted when rocked in opposition to the spring to be interposed in the path of the wiper pawl so as to prevent its co-action with the rear stud 961 of the lever 913. There is the familiar elimination key 265[E] which effects the rocking of said tappet piece by the action of a lug 265[a] (Fig. 21) upon a yoke portion 40[b] of the tappet piece, the stem of the key being slotted to embrace a guiding frame stud 240[d]. In addition to this there is rocking of said tappet piece by the paper carriage either by the same roller 33 which disables the accumulator shifting mechanism or by a similar but narrower roller such as that shown in Fig. 4[a] and designated 33′, though that particular roller there illustrated is designed to disable the accumulator shift without affecting the registration. In a bearing 41 secured to the back panel and similar to but longer than the bearing 29[a], there is journaled a shaft 42 to the rear end of which is secured an arm 43 (Fig. 3) which extends upward and to the left as viewed from the rear, being of cam formation at its upper part for co-action with such a roller. To the inner end of said shaft 42 is secured an arm 44 extending oppositely to the arm 43 (Fig. 18) and slotted to receive the rear end of a lever 45 (Fig. 21). This lever is pivoted on a frame stud 45[a] and its forwardly extending arm is connected by a vertical link 46 with an arm 47 which overlies a stud 40[c] carried by a branch of the tappet piece 40, said arm 47 being pivoted on a frame stud 47[a]. Obviously depression of the arm 43 by the roller 33 pulls down the arm 47 and sets the tappet piece 40 to disable the wiper pawl 821.

Visual add and non-add signal.—It is advantageous for the operator to be able to tell at a glance whether at any certain time the machine is set for adding or is in a non-adding condition. Therefore I have provided a visual signal in the form of a plate 50 sliding under a slot in the upper keyboard plate 203 (Fig. 21), said plate being inscribed "Add" and "Non-add" (Fig. 21[a] and Fig. 22[a]). The said plate is fastened to a post 50[a] mounted upon a sliding strip 50[b] which is suitably guided under the lower keyboard plate 202. At an intermediate point the strip is slotted to receive the upper end of a lever 51 which is pivoted upon the shaft 600 adjacent the tappet piece 40 and has a lower arm 51[a] bifurcated to embrace a stud 40[d] upon the tappet piece. When the latter is at normal its stud 40[d] engages the rear fork of the bifurcated arm 51[a] and holds the strip 50[b] forward so that the plate 50 displays the word "Add". When the tappet piece is rocked to the eliminating position its said stud acts upon the forward fork of the bifurcated arm and shifts the strip 50[b] rearward so that the plate 50 displays the inscription "Non-add".

Shifting the carriage from column to column.—Between the carriage end plates 170 there is mounted another longitudinally grooved rod 60 (Fig. 3) on which are adjustably secured certain forwardly projecting fingers which coact with a carriage shifting dog or pawl 61. The latter is pivoted intermediate its ends upon an ear of a reciprocating bar 62 which extends across the rear of the machine guided between rollers 63 (Fig. 3). This bar is reciprocated through the medium of a pitman 64 which is connected to a crank 65 secured to a shaft 66. The latter is journaled in a bearing on the base casting and carries at its forward end a bevel-pinion 66[a] (Fig. 1) in mesh with a bevel wheel 67 upon the drive shaft 100, the latter being operatively connected as usual with the full stroke sector 311. The slide bar 62 normally occupies its right-hand position as viewed from the rear of the machine, Fig. 3. The initial stroke of the prime mover throws the crank 65 over a half turn and slides the bar to the left. Then in the final or return stroke of the prime mover the crank 65 is turned back again so that the dog or pawl 61 is moved in a direction to propel the carriage in the tabulating direction, *i. e.*, from right to left as the machine is viewed from the front. Of course the tabulating arrangement can be varied indefinitely as to the number of columnar positions that the carriage is to occupy and the spacing apart of columns, the equipment here shown in that regard being merely a typical one. Four of the controlling fingers are shown mounted upon the rod 60 and only the two intermediate ones, desig-

nated 70 and 70ª, are operated upon by the dog or pawl 61 to propel the carriage, so that only three columnar positions are provided for. Normally with the carriage farthest to the right as viewed from the front the stop finger 71 is adjacent the pawl 61, as shown in Fig. 20. When the bar 62 is then operated the said pawl will be carried past the finger 70 and upon return of the bar will act upon that finger and propel the carriage to the new columnar position (Fig. 10). In the next operation the pawl will be carried past the finger 70ª and will then act upon that finger and propel the carriage to the next columnar position (Fig. 3). A suitable spring (contained in a spring-barrel 170ᵇ dotted lines Fig. 3 connected by a band 170ᶜ with the carriage) is employed to return the carriage and of course when propelled in opposition to said spring means must be provided for holding the carriage at each columnar position to which it is moved by the pawl 61. To this end a detent 72 is pivoted on the back panel and formed to engage the fingers 70 and 70ª. It is also desirable to provide some sort of a buffer to prevent overrunning of the carriage when propelled by the pawl. To this end an abutment piece 74 is provided (Fig. 10) against which the fingers 70 and 70ª strike. Said abutment piece is pivoted to a buffer plate 75 arranged to slide on bolts 2ᵈ secured to the back panel 2 and being held to the left as the parts are viewed in Fig. 10, by a pair of springs 76. The pivoting of the abutment piece 74 is necessary in order to provide for its moving out of the path of the fingers to permit them to pass when the carriage is shifted to a new columnar position. The abutment piece is yieldingly held in effective position by a spring 77 which connects a depending branch thereof with the upper portion of a tappet piece 78 pivoted upon the abutment piece 74. This tappet piece has a depending arm 78ᵇ which engages a lug 74ª on the aforesaid depending branches of the abutment piece, and also has a horizontal arm with a downwardly projecting lug 78ª resting upon an ear 89ª of a vertical plate 89 Fig. 11. The latter is a familiar element in machines of this type and forms part of the line spacing mechanism, being reciprocated in every operation of the machine. It moves downward during the initial stroke of the prime mover and the tappet piece 78 follows it by gravity and the abutment piece 74 necessarily drops as though integral with the tappet piece 78. Therefore, at the end of the initial stroke of the prime mover the condition is as illustrated in Fig. 14. Downward movement of the tappet piece and abutment piece is limited by abutment of an ear 74ᵇ on the abutment piece against a stud 2ᵇ on the back panel, and the ear 89ª moves on down. Therefore in the return stroke of the prime mover the pawl 61 has time to move the last positioned tabulator finger on beyond the abutment piece 74 before the latter is lifted to meet the oncoming finger. Then too it will be noted that the spring 77 will yield should the abutment piece happen to strike the passing finger, though the primary function of this spring is to permit the tabulating fingers to ride over the abutment piece when the carriage is returning to normal. Gravity is not wholly relied upon to lower the abutment piece, but it is formed with a cam lug 74ᵈ which is acted upon by the lever 92 which lowers the plate 89, as illustrated in Fig. 14.

Automatic return of the carriage.—In order to effect the automatic return of the carriage it is of course essential that the pawl 61 and detent 72 shall both be withdrawn from the paths of the fingers 70 and 70ª. This is controlled by the remaining finger 70ᵇ. When the carriage is positioned by the finger 70ª, as shown in Fig. 14, said finger 70ᵇ is in position to engage the pawl when the latter is retracted during the initial stroke of the prime mover. A latch plate 80 is pivoted to the bar 62 and normally holds the pawl 61 up in acting position. Thus said latch plate is notched to receive a lower portion of the pawl (Fig. 10) having a V-formation 61′, and the latch at one side of the notch has a similar formation 80′. When the pawl wipes under either of the fingers 70 and 70ª its rocking is not sufficient to carry the point of its V-shaped portion 61′ past the point of the V-shaped portion 80′ of the latch plate 80, consequently the pawl restores under action of the spring 81 which connects it to the latch plate. However, when the pawl wipes under the deeper finger 70ᵇ it is rocked far enough to carry its V-point past the V-point of the latch plate 80, and then the pawl is moved farther down by the spring 81 to the position shown in Fig. 14 by reason of the camming action between the engaged inclines. This occurs during the initial stroke of the prime mover when the carriage must still be held in position, for the printing occurs just at the end of that initial stroke. The complete release of the carriage occurs during the back stroke and toward the close of the same and is brought about through a tripping of the detent 72 by the pawl 61 in its latched down position just as the latter reaches the end of its excursion which accompanies such back stroke of the operating handle. The tail of the detent 72 overlies a stud 82 upon a rocker plate 73 pivoted to the back panel and having an offset branch 73ª adapted to be acted upon by an ear 61ᵉ on the tail of the dog or pawl 61. This op-

eration is illustrated by Fig. 17 where the condition illustrated is such as to release the carriage and permit its return.

When the carriage has returned the pawl 61 should be released so as to be able to resume its work of propelling the carriage from column to column. To this end an abutment piece 85 is pivoted to the latch plate 80 and held against the latter's hub by a spring 86. This abutment piece has an ear 85^a which is adapted to be struck by a depending lug 71^e on the hub of the finger 71, Fig. 19. In this way the latch plate 80 is forced back until the point of its V-shaped portion passes the point of the V-shaped portion of the pawl 61, whereupon the latter springs up to normal position.

In order to guard against the possibility of the detent 72 restoring before the carriage returns (as might be the case if the carriage stuck and the machine was again operated, retracting the pawl 61 and thereby releasing the detent), a latch is provided for the plate 73. This latch is in the form of a weighted plate 86′ pivoted on the stud 82 and formed with a right angled slot 86^a engaging a stud 2^e on the back panel. Normally the stud is in the upper part of the slot, as shown in Fig. 14. However, when the plate 73 is rocked by the ear 61^e of the pawl 61, the latch plate 86′ of course moves and the arrangement is such that the widened lower part of the slot comes into engagement with the stud 2^e, the latch plate dropping to the position illustrated in Fig. 17, where it holds the plate 73 in its detent-displacing position. A branch 86^b of said latch plate 86′ is offset to come in line with the ear 61^e of the pawl. When the latter is released by the return of the carriage to normal it is in its right-hand position as the machine is viewed from the rear and its said ear stands over the offset branch 86^b of the latch so that the tilting of the pawl swings said latch and releases the plate 73 and the detent 72 will rise until it strikes the finger 71.

In order to cushion the impact resulting from the rapid return of the carriage under spring action, a buffer plate 171 is mounted upon the back panel 2, being slotted to engage the beforementioned bolts 2^d secured in said panel. This plate lies between the panel and the other buffer plate 75 before described, and the same springs 76 serve as the cushioning means, said springs being stretched between cross arms on the two plates, as clearly shown in Figs. 3, 10 and 14. Said plate 171 is offset to extend across just in rear of the line spacing plates 87 and 89, Fig. 1, and has a terminal lug 171^a for the carriage finger 71 to strike as illustrated in Figs. 19 and 20, it being understood that said finger projects farther forward than the fingers 70 and 70^a, the latter not coming into the plane of the buffer plate (see Figs. 13 and 16).

Line-spacing mechanism.—It will be understood that in order to do cross tabulating, which involves printing one item after another along a horizontal line, there should be no line spacing except between horizontal series of items. Consequently, in the machine here shown, the line-spacing mechanism is disabled except when the machine is in the final columnar position. I have already mentioned the line-spacing plates 87 and 89 which are of similar character to plates correspondingly designated in aforesaid Patent 924,118, and I have already had occasion to describe the plate 89 as reciprocated in every operation of the machine, this being brought about as usual through the medium of the lever 92 and the cam 92^a carried by the shaft 100 (Fig. 1). The said plate 89 has fingers 89^b which project under the cross rod 84 of the usual line-spacing bail such as that similarly designated in said last-mentioned patent, and the other plate 87 has flanges 87^a notched to engage said cross rod, as also shown in said patent. It will be understood that only when the two plates reciprocate together is there any line-spacing action, for otherwise the fingers 89^b simply lower away from the cross rod of the line-spacing bail. Operative connection between the two plates for line-spacing purposes is effected through the medium of a dog 173 which is pivoted to a lower off-set portion of the plate 87, (Fig. 14), and is connected to a stop stud *p* thereon by a spring 174 which tends to establish the line-spacing connection. Thus the dog has a forwardly turned ear 173^a to engage under a flange 89^c which projects rearwardly from a lateral extension of the plate 89. The dog is controlled by a depending arm 72^e of the detent plate 72, said arm engaging an elongated flange 173^b on the upper arm of the dog. Whether the dog and plate 89 are operatively engaged depends upon the character of engagement between the said detent plate and the carriage fingers. Thus, if the fingers are of such dimensions as to limit the rise of the detent plate, the dog will be restrained, as shown, for example, in Fig. 12, so that its ear 173^a is out of line with the flange 89^c, and the plate 89 will pass down without affecting the plate 87. This is the case when the carriage is in its normal position, for then the lower part of a beveled surface 71^a of the finger 71 engages a corner of the detent plate 72, as illustrated in Fig. 20, holding that plate so far down that its arm 72^e prevents the dog from moving to engaging position. So in the case of the stop finger 70 the detent plate is prevented from rising beyond a position in which it holds

the dog displaced, as shown in Fig. 12. However, the stop finger 70ª is of less dimension vertically than the stop finger 70 or the finger 71, and therefore permits the detent plate to move farther up as shown in Fig. 14, and in this case the arm 72ᵉ swings over far enough to permit the dog to engage with the flange of the plate 89. Consequently when the plate 89 lowers during the initial stroke of the prime mover, the plate 87 is carried along with it and line-spacing pawl 175 is retracted and engaged with the roller platen ratchet 176, so that in the return stroke of the prime mover line-spacing will occur. In order to insure against any accidental lowering of the plate 87 the spring 72ᶜ, which serves to enforce engagement between the detent plate 72 and the carriage stops, is connected to an arm 87ᶜ of the plate 87, thus tending at all times to hold the latter plate up.

The above described tabulating mechanism is the same in general principle of operation as that disclosed in the aforesaid Benner Patent, No. 1,046,546. The general purposes of the variations that I have made from the Benner construction are to make the action more certain; to make the assembling of parts better adapted to varying conditions, such, for example, as conditions brought about through varying widths of machines; and to simplify as far as possible, both by reducing the number of parts and adopting shapes of parts conducing to greater economy and facility in manufacture.

Reviewing the several changes that I have made from the Benner construction, there is the latch 86 for the rocking plate 73, the main purpose and function of which has already been explained, but which subserves an incidental purpose of avoiding the necessity for a centralizing spring for the plate which, in my construction, is held at normal by the weight of the latch. Then there is the new form of latch for the carriage propelling pawl 61, which has the advantage of more certainly and securely controlling the pawl, since it permits some range of relative positioning of latch and pawl without disturbing the proper adjustment of the pawl. Thus when the latch has been thrown back to permit restoration of the pawl to the normal position shown in Fig. 10, it may remain rocked over or tilted beyond such position as there illustrated, without impairing the action at all, for, in such case, the concentric edge *o* of the latch would simply ride along the engaged edge of the pawl without affecting the adjustment of the latter. Therefore a slight variation in the positioning of the terminal finger 71 will not result in any erratic performance of the mechanism. In this same connection it may be noted that the occasion for pivoting the tappet piece 85 upon the latch is to provide for the passing by of the finger 71 should the carriage be set over so far to the right for some special work in hand as to locate said finger beyond the flange 85ª of said tappet piece. It will be understood that, as in prior tabulating machines of this same type, the carriage rod 60 is journaled in the end plates 170 (Fig. 3), and operatively connected to a handle 60ᵈ so that the operator may at any time disengage the carriage from the tabulating mechanism and move it to any position within the range of its lateral travel either way. A minor change to be noted is the doing away with a separate cam piece fixed to the pawl for coaction with the right-hand terminal finger, said finger in my construction coöperating directly with the pawl. It may be also noted that said finger 70ᵇ is beveled on the under side, as illustrated in Fig. 14, for the purpose of preventing a lock-up by engagement of the end edge of the pawl with the right hand side of the finger in the event of the movement of the carriage by hand so far to the left as to carry said finger past the end of the pawl. Other new features are the cushioning of the abutment piece 74 which limits the throw of the carriage under propulsion by the pawl, and the simplified arrangement for preventing accidental lowering of the line-spacing plate 87, a single spring 72ᶜ serving this purpose besides performing the function of enforcing engagement of the detent 72 with the tabulating fingers.

Variable split or cipher cut-out.—The printing mechanism proper is the same as in the familiar Burroughs machine, comprising hammers 715, hammer driving levers 716, hammer restraining latches or detents 717, and latch tripping pawls 718 which cooperate in the familiar way with the type-carrying levers 611. The construction which is shown for coupling and uncoupling latches and detents is also a familiar one (see for example Patent No. 1,013,910, issued January 9th, 1912, on the invention of Jesse G. Vincent). Pivoted to each latch, except the farthest one to the right which is for special printing purposes, is a pitman 717ª (Fig. 9), and pivoted upon each pitman is a catch 717ᵇ. The catches have lugs *b* extending to the left and the pitmen have shoulders *a* to act upon said lugs for the purpose of transmitting movement from one detent 717 to another. In this way ciphers are filled in automatically according to the well-known system in machines of this type. The coöperative relationship between latches is normally enforced by springs 717ᶜ which hold the pivoted catches 717ᵇ up in engagement with the pitmen to the left. Obviously the coöperative action can be suspended by disengaging the catches from the pitmen, and, in the present instance, as in prior constructions, this is accomplished by the set-

ting of a rotary rod or shaft 717[d] which carries lugs *d* variously located around the shaft and variously positioned lengthwise thereof. The shaft carries a gear pinion 90 at its left-hand end (Figs. 6 and 8), which meshes with a gear sector 91. Ordinarily the latter is simply connected to an index hand at the front of the machine in such a way as to be rocked by the swinging of said hand, and such equipment is provided in the present machine, but in addition to it, there is an equipment through which the sector may be automatically moved as the paper carriage shifts, so that one sort of split will be established when the carriage is in one columnar position and a different sort of split when the carriage is in another columnar position, without the necessity of any special manipulation between times.

The numeral 190 designates the index hand located at the front of the machine (Fig. 7), and working over a fixed index plate 193 inscribed with a series of numerals N to denote the different adjustments of the lug-bearing shaft 717[d] to effect the variety of splits as they may be established by the setting of said index hand, the left hand pointer 190[N] serving in this connection. The hand is secured, as usual, to the forward end of a rock shaft 94 journaled in the base casting of the machine and having fastened to it on the interior an arm 94[a] (Figs. 1, 7 and 8), to which is coupled a link 95 extending up for connection with the segment 91. In the present instance, this link is not directly connected to said segment as heretofore, but carries a stud 95[a] which occupies an arc-shaped slot 91[a] in an arm 91[b] which is fastened to the hub of the segment, as shown in Fig. 6. The segment is normally upheld by a spring 91[e] (Fig. 8) and the said stud normally occupies the lower end of the slot, so that in the absence of any other devices the segment would simply move in unison with the stud and the effect would be the same as in prior constructions, where the link is directly connected to the segment.

The special connection above described between the index hand and the segment provides for movement of the later independent of the index hand, as when changing the point or points of split automatically in the shifting of the carriage. To this end, the arm 91[b] has a rearward branch 91[d] formed with a series of ratchet teeth 91[e] (six in the present instance), and a pawl 96 is arranged to act upon said ratchet teeth one at a time to move the segment 91 and set the shaft 717[d]. Figs. 1 and 8 show the normal condition wherein said pawl engages the second of the ratchet teeth counting from the upper end of the series, the first tooth being engaged by a restraining pawl 97, which is adapted to hold the segment at different positions to which it is moved by the actuating pawl 96. The latter is pivotally mounted upon the forwardly extending branch of a rocking plate 98 which is journaled upon shaft 501—this being one of the familiar rock shafts of the machine proper. The familiar ink ribbon feeding lever 516, secured to said shaft 501, is in the present instance provided with a stud *y* which works between the forks 98[a] and 98[b] of the bifurcated portion of the rocking plate 98. Normally the stud is in engagement with the rear fork, as shown in Fig. 8, so that the pawl 96 is elevated. As the prime mover ends its initial stroke, said stud will act upon the forward fork and rock the plate so as to carry the pawl back over one of the ratchet teeth 91[e]. Then as the prime mover completes its final or return stroke, the stud will again act upon the rear fork, drive the pawl upward and cause it to rock the segment 91. A spring 96[c] connecting the rocking plate and pawl enforces engagement between the latter and the ratchet teeth, and the movement for setting the segment is limited by abutment of a rear branch 98[d] of the rocking plate against a fixed stud *w*.

It will be understood, of course, that when the segment is set by the turning of the index hand 190, the ratchet teeth 91[e] simply click past the pawls 96 and 97, but that when the automatic spliting operation is going on said index arm remains stationary, the slot 91[a] simply traveling along the stud 95[a]. It will be obvious therefore that the automatic effects can be varied by first setting the index arm. In the present instance the rod 717[d] is shown with six splitting lugs, and is therefore designed to be set at six different positions. In a machine of the large denominational capacity here shown (seventeen banks or rows of keys, Fig. 6) it is preferable to have a normal split and it will be noted that with the index handle all the way over to the left a split is effected between the eighth and ninth orders counting from the left, Fig. 6. See also Fig. 9. With the index hand 190 left at normal, as at Fig. 7, and the automatic splitting mechanism operable, obviously in the five successive operations of the machine following an original operation which effects the first setting of the shaft 717[d], the five different splitting conditions obtainable by the particular location of lugs upon said shaft would be successively established. Preferably a separate scale is inscribed upon the plate 193 for the automatic splitting and it does not provide for the maximum variety of effects because this would not likely be called for in the doing of cross-tabulating work. Referring to Fig. 7, the index arm 190 has a second pointer 190[A] which works in conjunction with a scale consisting of but three numerals, 1, 2 and 3, inscribed at the right-hand portion of

the plate, numeral 1 of this scale being located to correspond with the numeral 1 of the normal scale, so that when the index hand 190 is at normal its two pointers will register with the two 1's respectively. The numeral 2 of the automatic scale is in the present instance located to correspond with the numeral 4 of the scale designated as "Normal", so that the shaft 717[d] would already be set at the fourth position and an automatic action would be limited to the successive setting of the shaft at the fifth position, when the pointer 190[A] would register with the numeral 3 of the automatic scale.

Of course the number and location of lugs on the shaft 717[d] and the corresponding indexing equipment can be varied extensively. As here shown in the second position of the index hand, the machine is split between both the sixth and seventh and eleventh and twelfth orders; in the third position the machine is split between the sixth and seventh orders only; in the fourth position the machine is split between the fifth and sixth and tenth and eleventh orders; in the fifth position between the seventh and eighth orders; and in the sixth position between the fourth and fifth orders.

Resetting the automatic split mechanism.—It will, of course, be understood that when the paper carriage has stepped over from column to column, and in successive operations of the machine the different splits have been established, the automatic splitting mechanism should be restored in connection with the return of the carriage to the right, so that the same series of splits will be established in connection with a second series of cross-tabulating operations. To this end, the pawls 96 and 97 are arranged to be disengaged from the ratchet teeth 91[e] by the tripping plate 73, which has already been described as controlling the release of the paper carriage for return to the right. It will be recalled that in the final operation when the carriage is in the last of its columnar positions, the carriage propelling pawl 61 is first rocked and locked out of normal position and then acts upon the said plate 73, which plate in turn acts upon the carriage restraining detent 72. The plate 73 has an ear 73[b] to which is attached a link 99 (Fig. 17), which extends upward and is offset to pass through an opening in the back panel 2 (Fig. 8), and on the inner side of the panel has a slotted portion engaging a stud upon the panel. Said link has a shoulder *v* (Fig. 17) which extends over an arm 101 secured to a rock shaft 102 at the right-hand end thereof. Said shaft is journaled in the frame sides 700 of the printing mechanism and at its left-hand end carries an arm 103 (Fig. 18) to which is connected a link 104 (Fig. 8) having a finger 104[a] extending down in front of the laterally turned lips 97[a] and 96[a] (Figs. 8 and 8[a]) on the pawls 96 and 97 respectively. Obviously these connections will result in the withdrawal of both pawls from the ratchet teeth 91[e] when the plate 73 is rocked in the final operation which releases the carriage for its return to the right. It will be recalled that said plate is latched in its rocked position and does not return to normal until the carriage is all the way back. Consequently the pawls 96 and 97 are held away from the ratchet teeth 91[e] until the carriage is back to its normal position at the right. Then the plate 73 is released and the pawls become reëngaged with the ratchet teeth 91[e], the spring 91[c] having meantime rocked the segment 91 back to normal or to such position as may have been fixed by adjustment of the index arm 190. In this connection it will be obvious that the said pawls should be also released whenever the index hand is to be reset. As in prior constructions, the shaft upon which said hand is mounted has a slight longitudinal movement in its bearings for the purpose of disengaging the stud *g* (Fig. 7) from the indexing apertures *g'* in the plate 193. This longitudinal movement of the shaft is utilized for the purpose of effecting a release of the segment 91 from the pawls 96 and 97. Thus the link 104 is connected at its forward end to the upper arm of a lever 106 (Fig. 8) whose lower arm extends in the rear of a plate 94[c] secured to the inner end of the shaft 94. When said shaft is slid forward the plate acts upon the lever and the resultant movement of the link 104 disengages the pawls 96 and 97 from the ratchet teeth 91[e].

Suspending automatic splitting action.—Provision is also made for suspending the automatic splitting action at will when cross-tabulating is to be done without any variation in the splitting. To this end a small index pointer 107 is arranged to work between two positions upon the plate 193 (Fig. 7), said pointer being fastened to a rod 107[a] (Fig. 8) and held rearward by a spring 108 surrounding said rod. The latter is connected by a pull wire 109 to the lower arm of the lever 106, said wire engaging a slot in said lever. Obviously the pulling out of the pointer 107 will have the same effect upon the lever 106 as the pulling out of the index hand 190. In order that the resultant displacement of the pawls 96 and 97 may be maintained at the will of the operator, the relation between the pointer 107 and the plate 193 is such that when said pointer is at the position marked normal (see abbreviation Nor. Fig. 7), it is held forward. Thus the small stud or pin *u* carried by said pointer and designed to fully enter the perforation *u'* in the plate 193 under the abbreviation Auto.,

is only capable of slightly entering an opening or depression in the plate under the abbreviation Nor. Consequently, the index pointer having been pulled out when in the "automatic" position and then swung over to the left to the "normal" position and released, the rod 107[a] and wire 109 remain forward and hold the lever 106 rocked and the pawls 96 and 97 displaced.

Variably blocking the hammer action.— For the purpose of preventing printing action to one side of a point of splitting where the total is not desired, as, for example, in the case of a list of dates or designating numbers, a second rotary rod or shaft 191 is journaled in the frame work and carries several series of lugs *n* differently located around the shaft and corresponding in number in the several series with the numbers of numerical orders represented by latch detents to the left of different lugs *d* on the shaft 717[d]. The shaft 191 carries a gear pinion 191[a] which is in mesh with a gear sector 191[b] integral with before mentioned sector 91. Thus, the shaft 191 is always in step with the shaft 717[d] and will be set to correspond. The shaft 191 is located adjacent the forward ends of the hammer driving levers 716 and the lugs *n* are adapted to engage over horizontal edges of said levers, though normally they are out of line therewith, as illustrated in Fig. 7. It is only when a totaling operation is to be performed that any of said lugs come into line with said levers. When the total or subtotal key is depressed the shaft 191 is given a slight end-wise movement, sufficient to carry any of the lugs which have been set in the splitting adjustment over the levers so as to prevent movement thereof sufficient to drive the hammers. The connection for imparting the end-wise movement to the shaft comprises an irregular shaped thrust bar 193 (Fig. 2) which is slotted to embrace the head of a stud 191[c] screwed into the right-hand end of the shaft 191 (Fig. 7). The lower end of this thrust bar works against a cam projection 191[d], which is part of the right-side frame piece supporting the printing mechanism. Upon the forcing down of the thrust bar 193, its lower end will be deflected by reason of coaction with said cam projection, and thereby the shaft 191 will be thrust to the right for the purpose above described. The gear pinion 191[a] is made wide enough to provide for this movement while it remains in mesh with the sector 191[b]. A flat spring 191[e] normally keeps the shaft to the left. The thrust bar 193 at its upper end is coupled to an arm 140, which is secured to a rock shaft 220 extending across the machine. At the left this rock shaft carries an arm 141 which is connected by a link 142 with the total key bell-crank lever 227. (Fig. 1.) In order to provide for having this hammer blocking arrangement operative or inoperative in the taking of a total or subtotal, the arm 140 is slotted in its widened upper portion in two different lengths, as shown in Fig. 2, thus the upper portion of the slot designated *m* is of such length that the rocking of the arm under depression of the total or subtotal key will have no effect upon the thrust bar 193 if the latter's stud *n* is in line with this portion of the slot, as illustrated in Fig. 2. If, however, the upper end of the thrust bar has been forced down against the action of the spring 193[c], and said stud *n* thus brought in line with the lower and shorter portion *n'* with the slot, the forward end of the latter will, under rearward rocking of the arm 140, act against said stud *n* and force the thrust bar rearward and downward with the hammer blocking effect already described. For the purpose of controlling the adjustment of the thrust bar a bell crank lever 194 is employed, the same having a roller which bears upon a forward extension of the thrust bar and also a roller which engages a slide plate 195 formed with a cam portion. Said slide plate is set through the medium of a finger piece or knob 195[a] mounted upon a stud or post which works in slots of the keyboard plates 202—203. When the said knob is forward, as shown in Fig. 2, the hammer blocking arrangement is inoperative. By thrusting the knob rearward the cam portion of the plate 195 is caused to act upon the bell crank lever 194 and depress the forward end of the thrust bar so that when the total or subtotal is taken the hammer blocking effect may be had.

Normalizing the machine throughout.— In addition to the manipulating devices already described for establishing normal conditions for different departments of the machine, such, for example, as the key 35[a] which cuts out the automatic accumulator shift and the index pointer 107 which cuts out the automatic splitting action, I provide a special key 205 (Fig. 2) which stands just forward of the key 35[a], and whose depression results in disabling the automatic accumulator shifting mechanism, the automatic splitting mechanism and the automatic carriage shifting mechanism and at the same time renders operative the line spacing mechanism, so that the line spacing may occur with the paper carriage in any columnar position for single column work. The said key 205 surmounts an irregularly shaped stem 205[a] which is normally upheld by a spring 205[c], the stem being notched and capable of a slight rocking movement, so that the key may be latched down in the familiar way. Said stem is slotted to embrace a frame stud *t* and below the slotted portion is jointed to an upwardly extending branch of a bar 206, whose central portion

extends horizontally and alongside the enlarged or widened lower end 35′ of the key stem 35. This horizontal portion of the bar overlies the same stud 34^d upon which said key stem 35 operates, and it will be recalled that the action of the latter upon the stud serves to disable the accumulator shifting mechanism by depressing the shield or guard 23. Obviously depression of the key 205 will have the same effect.

The disabling of the automatic splitting mechanism by depression of the key 205 is accomplished by having the stud or pin 34^b (Figs. 8 and 18) project in the rear of an angular branch 101^a of the arm 101. It will be remembered that the stud 34^b transmits motion from the rock shaft 34 to the rock shaft 25 for the purpose of disabling the accumulator shifting mechanism. This stud by acting upon said branch 101^a will obviously rock the shaft 102 and disengage the pawls 96 and 97 from the ratchet teeth 91^e the same as when said shaft is rocked by the plate or link 99 acting upon the main part of the arm 101.

The disabling of the carriage shifting mechanism by depression of the key 205 is brought about in such manner as the disabling of similar mechanism by a somewhat similar key in the construction disclosed by aforesaid Patent 924,118. Thus a depending branch of the bar 206 (Fig. 2) has a cam slot engaged by a stud r of a lever 209 which is pivoted upon a frame stud q, the latter also engaged by a slotted portion of the depending arm of the bar 206 for guiding purposes. Depression of the bar by the key 205 obviously results in the rocking of the lever 209. This lever has a forked lower end which embraces the extremity of a horizontally arranged bell crank lever 210 (Fig. 2^a), one arm of which lever is in operative engagement with a clutch collar 211 splined to drive shaft 100. The hub of the beveled gear wheel 67 supplies the other member of the clutch. The movement of the bell crank lever produced by the before mentioned rocking of the lever 209 unclutches the said gear wheel from the shaft 100 and thus disconnects the carriage shifting mechanism. In order to guard against any accidental action of said carriage shifting mechanism when thus disconnected, the bell crank lever 210 is formed with an additional arm 210^a which has a lug at the end adapted to enter a hole in the gear wheel 67, so as to lock said wheel and the connected parts when the key 205 is down.

The remaining function of the key 205, to wit, that of establishing line-spacing connection without regard to the columnar position of the carriage, is accomplished as follows: The rear part of the bar 206 extends upward and rearward and terminates in a laterally turned ear 206^c (Fig. 2) adjacent the back panel 2 and carrying a stud 206^d which projects through a vertical slot 2^c in the said back panel (Fig. 17), said stud occupying a short slot in one end of a lever 216. This lever is pivoted intermediate its ends to the back panel and at the other end carries a roller stud 216^a which is adapted to act upon a catch 217 pivoted to an ear of the plate 87 and adapted to take under one of the fingers 89^b of the plate 89 when acted upon by said roller stud with the obvious effect of operatively coupling the two line-space plates. A spring 218 connects said catch to said lever and normally holds the catch retracted, and abutment of a lower arm of the catch against the wide edge of the plate 87 limits the retraction.

Examples of work.—Referring to Fig. 23: This gives an example of tabulating work of which the machine is capable where three columns are desired and an automatic splitting action, also elimination in one columnar position. In the first columnar position the lot number is printed without accumulation, this example representing tabulated municipal accounts. In the second columnar position two splits occur, since the series of operations were started with the index hand 190 at normal and with the automatic splitting equipment effective. It will be understood that the first operation would advance the segment 91 during the return stroke of the operating handle and thereby change adjustment from the single split between the eighth and ninth orders to two splits between the sixth and seventh and eleventh and twelfth orders. Furthermore the roller 33 will have passed beyond the cam arm 43 so that during the second operation with the carriage in the second columnar position accumulation would occur. It will be understood that items for three separate columns are printed simultaneously in this second operation, the first item being the tax, the second the discount and the third the net amount. During this second operation there is a further advance of the segment 91, so that the split adjustment would again change, this time effecting a single split between the sixth and seventh orders. Furthermore, the counter shifting arrangement being operative, the counter or accumulator which registered the items printed during the second operation would be out of action and the other counter or accumulator brought into action. Upon different sections of this other accumulator would be registered the Park maintenance item and a previously computed total. At the conclusion of this third operation the carriage would return automatically to the left and the automatic splitting mechanism would be restored to normal and then the same operations would be gone through with again. It will be obvious that footings of

totals would be obtainable for the several columns of the second and third columnar positions, as illustrated in the example of work.

Fig. 24 illustrates a similar example, representing tabulations of factory work. The only thing to be especially noted here is that the automatic splitting is different from that in the example of work shown in Fig. 23. This is brought about by setting the index hand 40 at the 2 position on the "automatic" scale. This corresponds with the 3 position upon the "normal" scale and effects a split between the sixth and seventh orders which, however, has no particular significance in the example considering that only a single item is set up in the first operation employing the keys at the right. At the conclusion of this first operation the segment 91 will have been advanced from the third to the fourth position and splits established between the fifth and sixth and tenth and eleventh orders. Then at the conclusion of this second operation the segment 91 will be again advanced and a split established between the seventh and eighth orders.

In both the above examples a special sign appears with the items printed in the last columnar position of the carriage, to denote their accumulation in the lower counter, this sign-printing being accomplished by an equipment such as that disclosed in Patent No. 1,018,285, issued February 20th, 1912, on the invention of Nelson White, which also provides for characterizing the totals to denote the counter registering them as in these examples.

Fig. 25 illustrates work with the machine normalized throughout as to elimination of automatic carriage shift, automatic counter shift, and automatic split shift, but with the hammer blocking equipment set. It will be understood, of course, that in order to put the machine in condition for such work it is merely necessary to depress the key 205 and push back the knob 195[a].

Of course examples of work of which the machine is capable might be multiplied indefinitely, since, not only is the automatic splitting arrangement susceptible of varied use and arranged to be used or not—and the automatic counters shift and carriage shift optional with the user—but also the carriage rods which carry the tabulating devices, such as roller 33 and the fingers 70, 70[a], 70[b] and 71, may be interchanged with others, carrying differently set devices, or the setting of the devices upon the same rods can be varied. However, the examples given are thought to be sufficient, since they represent work calling into play all of the features which characterize the present invention.

I claim—

1. In a machine of the class described, the combination of setting up devices, two accumulators, a prime mover and actuating connections therefrom to said accumulators, means actuated by said prime mover in successive operations thereof to provide for alternate actuation of the two accumulators, a laterally shiftable paper carriage, and means set thereby which disables the last-specified means.

2. In a machine of the class described, the combination of setting up devices, racks, two sets of adding pinions, duplex controlling devices for causing engagement and disengagement of racks and pinions, means for alternating effectiveness of the set of controlling devices, a prime mover, connections therefrom to said last-mentioned means, a laterally shiftable paper carriage, and means set thereby to disable the said prime mover connections.

3. In a machine of the class described, the combination of setting up devices, racks, two sets of adding pinions, duplex controlling devices for causing engagement and disengagement of racks and pinions, means for alternating effectiveness of the sets of controlling devices, including a rocking member with opposed engaging portions, a prime mover and a lever oscillated thereby and carrying a reversible thrust-piece to alternately act upon the engaging portions of said rocking member.

4. In a machine of the class described, the combination of setting up devices, racks, two sets of adding pinions, duplex controlling devices for causing engagement and disengagement of racks and pinions, means for alternating effectiveness of the set of controlling devices, including a rocking plate with a V-shaped portion and substantially radial shoulders on opposite side thereof; a prime mover; and a lever oscillated thereby and carrying a reversible thrust-piece adapted to engage said plate on opposite sides of its V-shaped portion and alternately act upon the radial shoulders to rock the plate first one way and then the other in successive operation of the prime mover.

5. In a machine of the class described, the combination of setting up devices, racks, two sets of adding pinions, duplex controlling devices for causing engagement and disengagement of racks and pinions, means for alternating effectiveness of the set of controlling devices, including a rocking member with opposed engaging portions; a prime mover; a lever arranged to be actuated by the latter and carrying a thrust piece to alternately act upon the engaging portions of said rocking member; a spring applied to said lever; and interlocking devices between the prime mover and the means which govern effectiveness of the aforesaid controlling devices.

6. In a machine of the class described, the combination of setting up devices, racks, two sets of adding pinions, duplex controlling devices for causing engagement and disengagement of racks and pinions, means for alternating effectiveness of the set of controlling devices, including a rocking member with opposed engaging portions; a prime mover; a lever oscillated thereby and carrying a reversible thrust-piece to alternately act upon the engaging portions of said rocking member; and a shield or guard settable to prevent effective engagement between the latter and the thrust piece.

7. In a machine of the class described, the combination of setting up devices, racks, two sets of adding pinions, duplex controlling devices for causing engagement and disengagement of racks and pinions, means for alternating effectiveness of the set of controlling devices, including a rocking member with opposed engaging portions; a prime mover; a lever oscillated thereby and carrying a reversible thrust-piece to alternately act upon the engaging portions of said rocking member; a guard or shield settable to prevent effective engagement between the latter and the thrust piece; a laterally shiftable paper carriage; and means for setting the guard or shield by said paper carriage.

8. In a machine of the class described, the combination of setting up devices, racks, two sets of adding pinions, duplex controlling devices for causing engagement and disengagement of racks and pinions, means for alternating effectiveness of the set of controlling devices, including a rocking member with opposed engaging portions; a prime mover; a lever oscillated thereby and carrying a reversible thrust-piece to alternately act upon the engaging portions of said rocking member; a guard or shield settable to prevent effective engagement between the latter and the thrust-piece; a laterally shiftable paper carriage; and means for setting the guard or shield by said paper carriage, said means comprising a pivoted arm engaging the shield or guard and coacting cam members on the carriage and connected to said arm.

9. In a machine of the class described, the combination of setting up devices; two accumulators; a prime mover and actuating connections therefrom to said accumulators; means actuated by said prime mover in successive operations thereof to provide alternate actuation of the two accumulators; a laterally shiftable paper carriage; means set thereby which disables the last-specified means; and manipulative means for accomplishing such disablement at will independently of the carriage.

10. In a machine of the class described, the combination of setting-up devices; racks; two sets of adding pinions; duplex controlling devices for causing engagement and disengagement of racks and pinions; means for alternating effectiveness of the set of controlling devices, including a rocking member with opposed engaging portions; a prime mover; a lever oscillated thereby and carrying a reversible thrust-piece to alternately act upon the engaging portions of said rocking member; a guard or shield settable to prevent effective engagement between the latter and the thrust-piece; a laterally shiftable paper carriage; means for setting the guard or shield by said paper carriage and a key and connections for setting the guard or shield independently of the carriage.

11. In a machine of the class described, the combination of setting-up devices, racks, two sets of adding pinions, duplex controlling devices for causing engagement and disengagement of racks and pinions, means for alternating effectiveness of the set of controlling devices, including a rocking plate with a V-shaped portion and substantially radial shoulders on opposite side thereof; a prime mover; a lever oscillated thereby and carrying a reversible thrust-piece adapted to engage said plate on opposite sides of its V-shaped portion and alternately act upon the radial shoulders to rock the plate first one way and then the other in successive operation of the prime mover, and a guard plate movable to interpose deflecting edges in the path of the thrust piece beyond the engaging portion of the rocking plate.

12. In a machine of the class described, the combination of setting-up devices, racks, two sets of adding pinions, duplex controlling devices for causing engagement and disengagement of racks and pinions, means for alternating effectiveness of the set of controlling devices, a prime mover, connections therefrom to said last-mentioned means, a laterally shiftable paper carriage, means set thereby to disable the said prime mover connections, and means also set by the carriage for disabling the normally effective set of controlling devices whereby to keep racks and adding pinions disengaged.

13. In a machine of the class described, the combination of setting-up devices, racks, two sets of adding pinions, duplex controlling devices for causing engagement and disengagement of racks and pinions, means for alternating effectiveness of the set of controlling devices, including a rocking member with opposed engaging portions; a prime mover; a lever oscillated thereby and carrying a reversible thrust-piece to alternately act upon the engaging portions of said rocking member, a guard or shield settable to prevent effective engagement between the latter and the thrust-piece; a lat-

erally shiftable paper carriage; means for setting the guard or shield by said paper carriage, said means comprising a pivoted arm engaging the shield or guard and coacting cam members on the carriage and connected to said arm, and means for disabling the normally effective set of controlling devices whereby to keep racks and adding pinions disengaged, said latter means including a cam member adapted to coöperate with the same carriage cam member which serves to set the shield or guard.

14. In a machine of the class described, the combination of printing mechanism having automatic cipher supplying means and provisions for variably eliminating ciphers for multi-column work; of a prime mover and connections therefrom for automatically varying the point or points of suspension of automatic cipher supply.

15. In a machine of the class described, the combination with printing mechanism having automatic cipher supplying means and provisions for variably eliminating ciphers for multi-column work; of a prime mover and connections therefrom for automatically varying the point or points of suspension of automatic cipher supply, a laterally shiftable paper carriage, means controlled by the prime mover for shifting the same, and means controlled by said last-mentioned means for resetting the said prime mover connections.

16. In a machine of the class described, the combination with printing mechanism having automatic cipher supplying means for multi-column work; of a laterally shiftable paper carriage; means for shifting the same from column to column; and means for automatically changing the point or points of suspension of cipher supply incidental to shifting of the paper carriage.

17. In a machine of the class described, the combination with printing mechanism having automatic cipher supplying means and provisions for variably eliminating ciphers for multi-column work; of a prime mover and connections therefrom for automatically varying the point or points of suspension of cipher supply, and manipulating means for disabling at will the said connections.

18. In a machine of the class described, the combination with printing mechanism having automatic cipher supplying means and provisions for variably eliminating ciphers for multi-column work; of a prime mover and connections therefrom for automatically varying the point or points of suspension of automatic cipher supply, together with manipulative means for varying said point or points at will.

19. In a machine of the class described, the combination with printing mechanism having automatic cipher supplying means and provisions for variably eliminating ciphers for multi-column work; of a prime mover and connections therefrom for automatically varying the point or points of suspension of automatic cipher supply, together with manipulative means for varying said point or points at will, and provisions for resetting the automatic varying means by said manipulative means.

20. In a machine of the class described, the combination with printing hammers, individual latches therefor, couplings between latches, a lug-bearing shaft to varyingly displace couplings, a sector to turn the shaft, a ratchet unified with the sector, a pawl to actuate the ratchet and sector, a prime mover, and means for reciprocating the pawl by said prime mover.

21. In a machine of the class described, the combination with printing hammers, individual latches therefor, couplings between latches, a lug-bearing shaft to varyingly displace couplings, a sector to turn the shaft, a ratchet and slotted arm unified with the sector, a pawl to actuate the ratchet and sector, a prime mover, means for reciprocating the pawl by said prime mover, and an index handle having a connection occupying the slot of the aforesaid arm.

22. In a machine of the class described, the combination with printing hammers, individual latches therefor, couplings between latches, a lug-bearing shaft to varyingly displace couplings, a sector to turn the shaft, a ratchet and slotted arm unified with the sector, a pawl to actuate the ratchet and sector, a prime mover, means for reciprocating the pawl by said prime mover, a pawl displacing member, and an index handle having a connection occupying the slot of the aforesaid arm and being also operatively connected with said pawl-displacing member.

23. In a machine of the class described, the combination with printing hammers, individual latches therefor, couplings between latches, a lug-bearing shaft to varyingly displace couplings, a sector to turn the shaft, a ratchet unified with the sector, a pawl to actuate the ratchet and sector, a prime mover, means for reciprocating the pawl by said prime mover, a pawl displacing member, a laterally movable paper carriage, means controlled by the prime mover for shifting the latter, and means controlled by the last-mentioned means for operating said pawl-displacing member.

24. In a machine of the class described, the combination with printing mechanism having automatic cipher supplying means and provision for variably eliminating ciphers for multi-column work; of a laterally shiftable paper carriage; means for shifting the same from column to column, means for automatically changing the point or points of suspension of cipher supply incidental

to shifting of the paper carriage, means for automatically returning the carriage from its final columnar position, and means for resetting the automatic cipher suspension means as an incident to such automatic return of the carriage.

25. In a machine of the class described, the combination with printing hammers, individual latches therefor, couplings between latches, a lug-bearing shaft to varyingly displace couplings, a sector to turn the shaft, a ratchet unified with the sector, a pawl to actuate the ratchet and sector, a prime mover, means for reciprocating the pawl by said prime mover, a pawl-displacing member, a laterally movable paper carriage, means for shifting the same from column to column in successive operations of the prime mover, means for automatically returning the carriage from its final columnar position, and means operated incidentally to such automatic return for operating said pawl-displacing member.

26. In a machine of the class described, the combination with printing hammers, individual latches therefor, couplings between latches, a lug-bearing shaft to varyingly displace couplings, a sector to turn the shaft, a ratchet and slotted arm unified with the sector, a pawl to actuate the ratchet and sector, a prime mover, means for reciprocating the pawl by said prime mover, a pawl-displacing member, a laterally movable paper carriage, means controlled by the prime mover for shifting the latter, means controlled by the last-mentioned means for operating said pawl-displacing member, and an index handle operatively connected to the aforesaid slotted arm and to the aforesaid pawl-displacing member.

27. In a machine of the class described, the combination with printing hammers, individual latches therefor, couplings between latches, a lug-bearing shaft to varyingly displace couplings, a sector to turn the shaft, a ratchet and slotted arm unified with the sector, a pawl to actuate the ratchet and sector, a prime mover, means for reciprocating the pawl by said prime mover, a pawl displacing member, a laterally movable paper carriage, means controlled by the prime mover for shifting the latter, means controlled by the last-mentioned means for operating said pawl-displacing member, an index handle operatively connected to the aforesaid slotted arm and to the aforesaid pawl-displacing member, and a manipulative device also operatively connected to the latter for holding it indefinitely displaced.

28. In a machine of the class described, the combination with printing hammers, individual latches therefor, couplings between latches, a lug-bearing shaft to varyingly displace couplings, a sector to turn the shaft, a ratchet unified with the sector, a pawl to actuate the ratchet and sector, a prime mover, means for reciprocating the pawl by said prime mover, a pawl-displacing member, a laterally movable paper carriage having tabulating fingers, a reciprocating pawl adapted to act upon certain of the same for propelling the carriage from column to column, a detent for holding the carriage at the different columnar positions through engagement with such fingers, a latch for holding the carriage-propelling pawl as displaced by another of said fingers, a rocking plate for displacing the detent under actuation by said pawl when so latched, and an operative connection between said plate and the aforesaid member for displacing the sector-actuating pawl.

29. In a machine of the class described, the combination of setting-up devices, two accumulators, a prime mover and actuating connections therefrom to said accumulators, means actuated by said prime mover in successive operations thereof for alternately vitalizing the two accumulators, printing mechanism having automatic cipher supplying means and provisions for variably eliminating ciphers for multi-column work, connections from the prime mover for automatically varying the point or points of suspension of cipher supply; a laterally shiftable paper carriage; means actuated by the prime mover for shifting the same from column to column; line-spacing mechanism normally disabled; means for rendering said mechanism operative when the carriage is in its final columnar position; and a normalizing key and connections for rendering said line-spacing mechanism operative with the carriage in other than such position, for disabling the automatic cipher-suspension means, and for disabling the means which alternately vitalizes the two accumulators.

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Witnesses:
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