H. L. PITMAN.

COMBINED TYPEWRITING AND COMPUTING MACHINE.

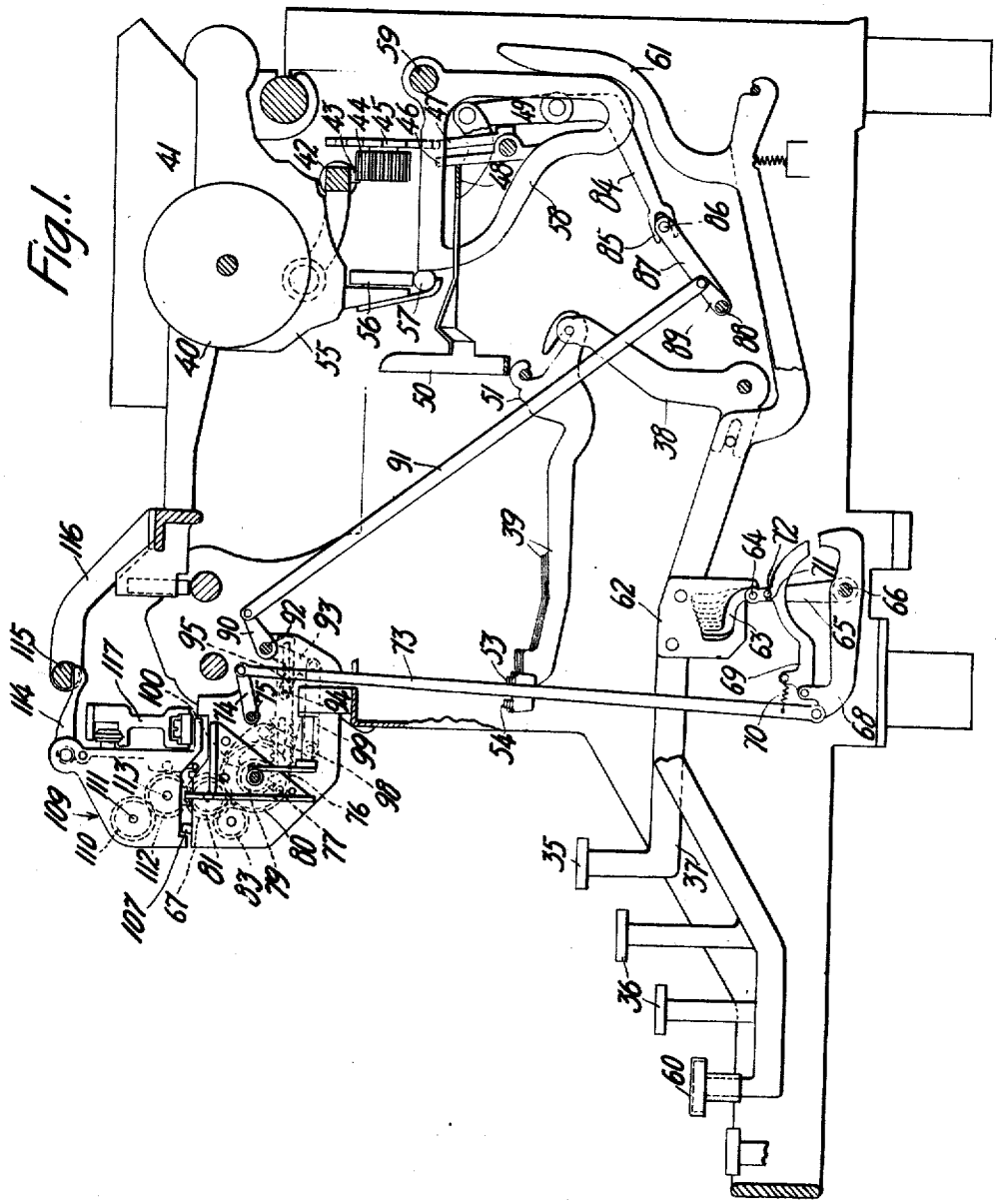
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1,354,778.

Patented Oct. 5, 1920.

3 SHEETS—SHEET 1.

Fig. 1.



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Fig. 3.

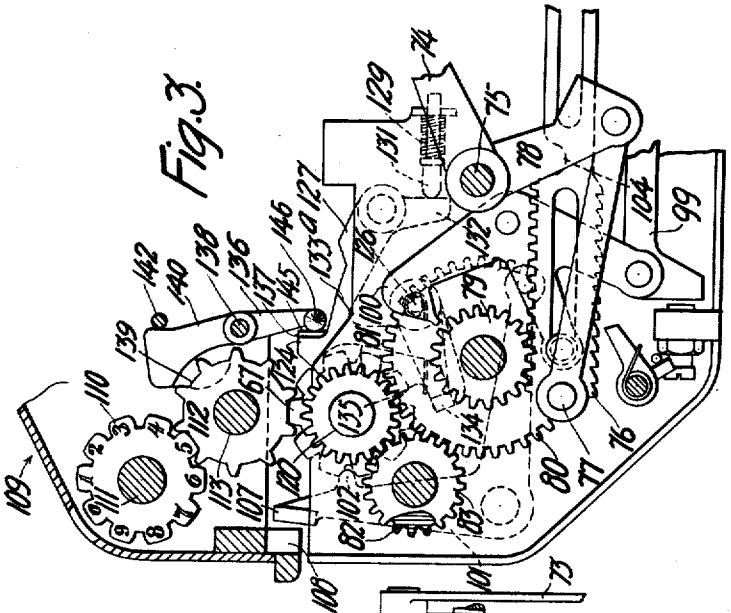
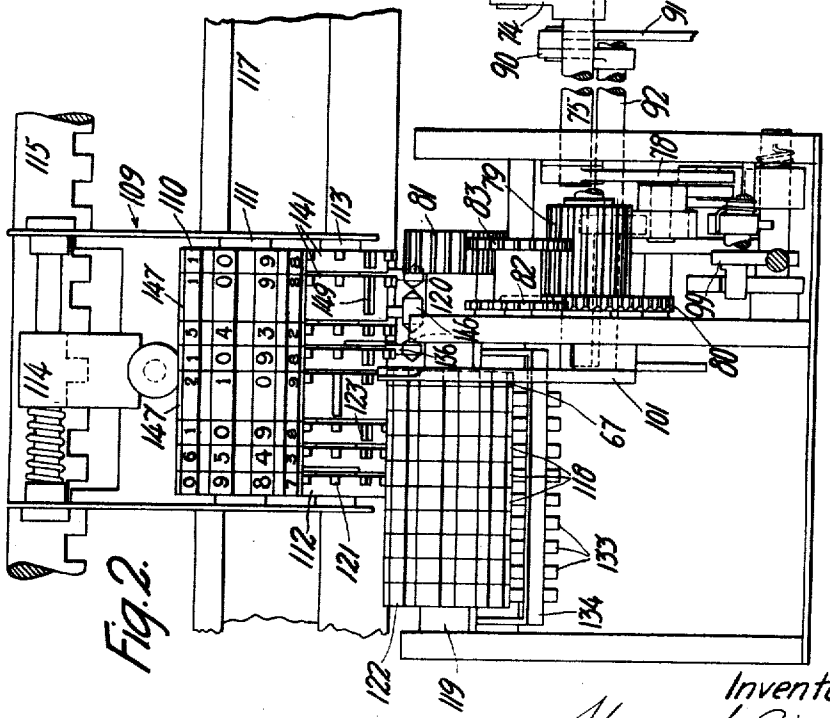


Fig. 2.



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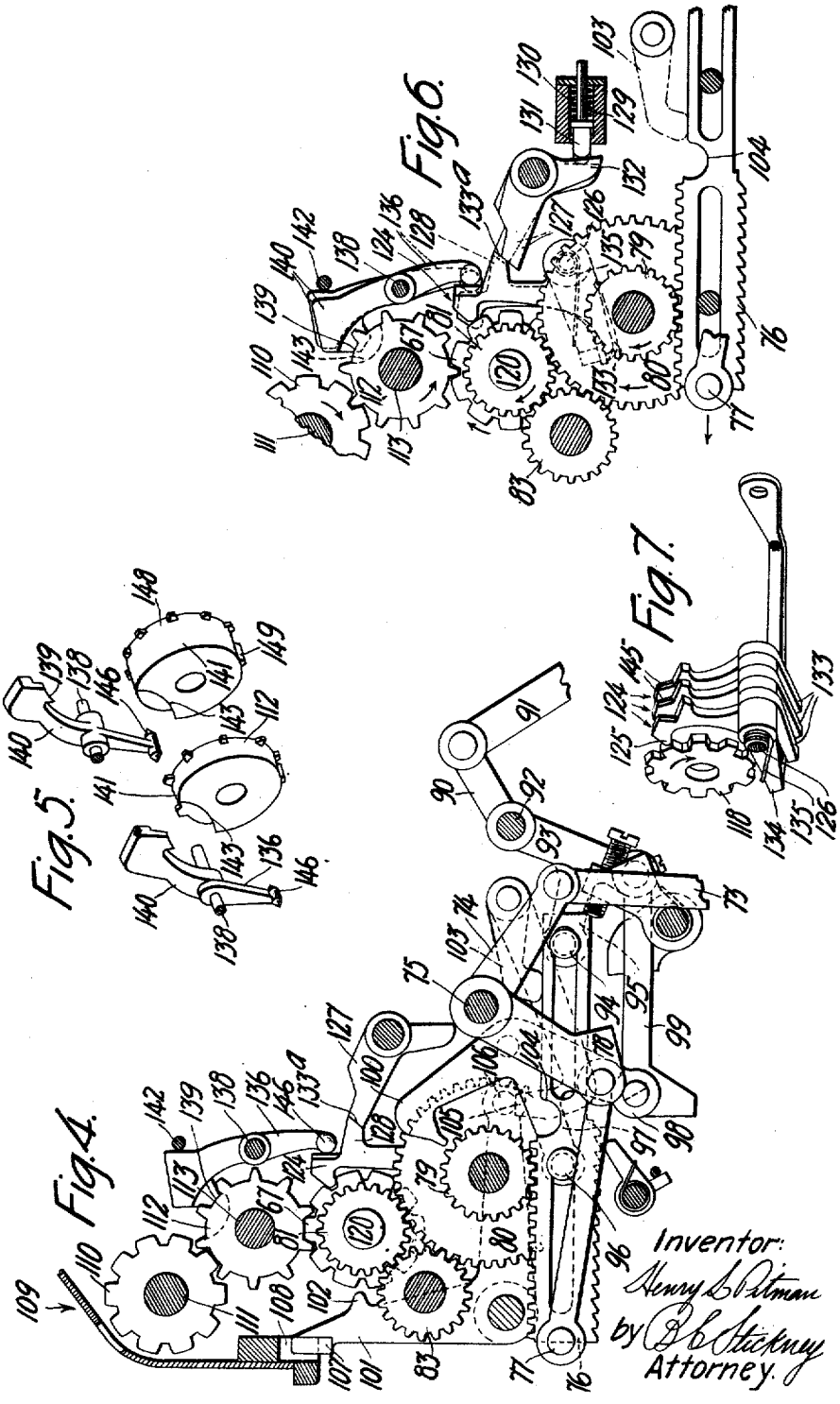
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3 SHEETS—SHEET 3.



UNITED STATES PATENT OFFICE.

HENRY L. PITMAN, OF ELIZABETH, NEW JERSEY, ASSIGNOR TO UNDERWOOD COMPUTING MACHINE COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

COMBINED TYPEWRITING AND COMPUTING MACHINE.

1,354,778. Specification of Letters Patent. Patented Oct. 5, 1920.

Original application filed April 28, 1915, Serial No. 24,390. Divided and this application filed February 8, 1919. Serial No. 275,700.

To all whom it may concern:

Be it known that I, HENRY L. PITMAN, a citizen of the United States, residing in Elizabeth, in the county of Union and State of New Jersey, have invented certain new and useful Improvements in Combined Typewriting and Computing Machines, of which the following is a specification.

This invention relates to computing machines, and is herein disclosed as embodied in the carry-over mechanism of a combined typewriting and computing machine of the addendagraph type, being a division of my co-pending application, No. 24,390, filed April 28, 1915 (now Patent No. 1,308,506, dated July 1, 1919). In such machines the totalizer is usually mounted on a traveling typewriter carriage and comprises dial wheels and computing wheels. As the typewriter carriage travels the totalizer brings its computing wheels *seriatim* into mesh with a master wheel, which is usually key-driven, and with carry-over wheels which extend in an array to the left of the master wheel.

According to the present invention, the carry-over wheels may be normally held against turning by a series of detents, and the computing wheels may coöperate with a series of locking arms, one for each computing wheel, so that, as the totalizer travels along said locking arms, it may engage *seriatim* with the detents to control the turning of the carry-over wheels. Since the detents may be provided with pointed engaging noses, the locking arms may be effective through said detents to aline their wheels in carrying over through the carry-over wheels, thus taking up any spiraling due to lost motion. Other devices may cooperate with the detents in order to enable the smooth and effective working of the carry-over mechanism.

Other features and advantages will hereinafter appear.

Figure 1 is a sectional side view, largely diagrammatic, of an Underwood addendagraph, showing the present invention as applied thereto.

Fig. 2 is an enlarged front view of a totalizer with its front removed, and showing its relation to the carry-over wheels when the master wheel is in engagement with an intermediate computing wheel.

Fig. 3 is a sectional side view of the parts seen in Fig. 2, showing the parts at rest.

Fig. 4 is a view similar to Fig. 3, showing the parts at the end of running in a large digit.

Fig. 5 is a spaced perspective view, showing the relationship of the two kinds of locking arms to the two kinds of computing wheels.

Fig. 6 is a view similar to Fig. 4, but showing the computing devices inserting the digit and in the act of carrying-over.

Fig. 7 is a perspective view of a carry-over wheel and some adjacent carry-over detents, as seen from the rear.

Numeral keys 35 and character keys 36 depress key-levers 37, to rock bell-cranks 38, to swing type-bars 39 up rearwardly against the front side of a platen 40 mounted to rotate on a carriage 41. The carriage 41 travels step by step at the striking of the keys under the control of an escapement mechanism indicated in general at 42, and including a rack bar 43, pivotally mounted on the carriage 41, and engaging a pinion 44 connected for movement with an escapement wheel 45, which is controlled by a pair of dogs 46 and 47, one of which is fixed and the other of which is movable. The dogs 46 and 47 are actuated by a universal frame 48, supported for back-and-forth reciprocation on a swinging frame 49, and provided with a universal bar 50, which lies in the path of heels 51 provided on the type-bars 39, so that when any of the latter come up to strike the work-sheet on the platen 40, the universal frame 48 will be oscillated to permit a single step movement of the carriage 41 under the control of the escapement wheel 45.

The type-bars 39 for the numeral keys 35, as well as the character keys 36, are provided with two sets of characters 53 and 54, so that they each control selectively the writing of two different characters. In the case of the numeral keys, the digits or numbers are usually written by the lower-case type 53, while some other characters are written by the upper-case type 54. To effect the change from writing normally lower-case characters to writing upper-case characters, the platen 40 is mounted to be shifted from a lower-case position to an upper-case position. For this purpose, it is mounted in an

inner carriage 55, shiftably mounted in the main carriage 41. The inner carriage 55 is provided with one or more rollers 56, resting on the shift rail 57 of a shift frame 58 pivoted to rock about the axis of a shaft 59. The shift frame 58 may be rocked for upper-case printing by one or more shift keys 60, which may be of the temporary and semi-permanent type such as is usually found in the Underwood typewriting machine. The levers of the keys 60 are each provided with an arm 61, which extends up into engagement with one of the arms of the shift frame 58 so as to engage the same and rock the rail 57 upwardly, and thus bring the line of print of the platen 40 opposite the upper-case type 54 on the type-bars 39 when the latter are swung to their printing position.

The typewriting mechanism thus far considered is well known in the Underwood typewriting machine, and in itself forms no part of the present invention, but combines and coöperates with the computing mechanism which will now be described, to form a combined typewriting and computing machine giving concomitant computing and typewriting actions for the same numbers by the striking of a single set of numeral keys.

For effecting computations, as herein disclose, there is provided on each of the numeral-key-levers from "1" to "9" a differential cam-plate 62, each cam-plate having an open-ended slot 63, said slot ends being in alinement with each other and with a bail 64, which is universal to all the cam-plates. The bail 64 also comprises ends 65, by which it is fast to a rock shaft 66. The bail 64 forms part of an oscillating mechanism, which is oscillated by the cam-slots 63 at the depressions of the numeral keys to an extent depending on the numeral key depressed, and the varied oscillations are adapted to be carried to a master wheel 67 and to turn it to an extent depending on the key depressed, as will hereinafter appear. The connections for accomplishing this include an arm 68 journaled on the rock shaft 66, and adapted to be normally connected to rock with the bail 64 by means of a stirrup 69, which is normally drawn upward by means of a spring 70, so that the forked arms 71 of the stirrup will engage on the opposite sides of a pin 72, thus causing arms 71 to rock with the bail 64. The purpose of the stirrup is fully set forth in the application No. 24,390.

Whenever the arm 68 rocks, it draws down with it a link 73, thereby drawing down a rock arm 74, because the link 73 is pivoted both to the arm 68 and the arm 74, with the result that the arm 74 rocks a rock shaft 75 to an extent depending upon the numeral key depressed, and this shaft is adapted to turn the master wheel 67 by means of a rack 76, which is connected by a pivot 77 and a rock arm 78 to the shaft 75.

To enable the rack bar 76 to turn the master wheel, it is normally in mesh with a pinion 79 fast to driving pinion 80, which turns the master wheel 67 either backwardly or forwardly, because the pinion 80 is adapted to mesh either with pinion 81, fast to the master wheel, or with pinion 82, fast to a pinion 83, which, in turn, meshes with the pinion 81 and drives the master wheel in the reverse direction.

When a key is depressed, the rack bar 76 is driven forward to turn the pinion 79 to an amount determined by the key depressed, and then the rack bar is lowered out of mesh with the pinion 79 because the actuated type-bar, in approaching the platen, causes the universal bar 50 to remove the rack bar 76 to a point where it will stand clear of the pinion 79. To do this, the rock frame 49 is provided with a downward projection 84, having a hook 85 to embrace pin 86 on a rock arm 87, so that the backward movement of the universal bar will lift this rock arm 87 and cause the rock arm to lower the rack 76. The connections between the rock arm 87 and the rack 76 include a rock shaft 88, which carries a second rock arm 89, said latter rock arm adapted to rock a third rock arm 90 by means of a link 91 pivoted to both of them. The rock arm 90 is fast to a shaft 92, which latter operates a quasi-parallel motion device, including a rock arm 93, having a stud 94 upon a projection 95, said stud forming one slide upon which the rack bar 76 slides. To further guide the rack bar 76, there is provided a second stud 96 upon a rock arm 97, having a bell-crank extension 98. In order to cause the two studs 94 and 96 to move approximately parallel to each other, the bell-crank arm 98 and the rock arm 93 are connected by a link 99. All these connections are set forth in considerable detail in the aforesaid application.

In order to hold the master wheel against accidental turning when the rack bar 76 is clear of the pinion 79, there is provided a detent 100, which is swung into engagement with the pinion 79 at the movement of the rack bar away from the pinion 79, because the detent 100 is formed as an extension of the rock arm 97. Since the slots 63 are double-faced cams, the rack bar 76 is positively prevented from overthrow, and is fully brought to rest, long before the end of the key-stroke, because the upper ends of the slots 63 are formed substantially straight, with the result that the key-lever arrests the rack bar and thereby arrests the master wheel against overthrow.

The master wheel is detained against ac-

cidental turning because the locking arm 101, having a V-shaped lug 102, normally meshes between the teeth of the master wheel 67. When, however, the rack-bar 76 moves forward, it causes a follower 103 to ride out of a recess 104 in the rack-bar, thereby lifting the follower 103 and causing it to lift an arm 105, which underlies a bell-crank extension 106 of the locking arm 101. This unlocks the master wheel, so that the master wheel may assist in camming the arm 101 forward, and, at the same time, a forward extension 107 of the locking arm 101 may enter between teeth 108 on the totalizer 109, thus locking the totalizer against movement while the master wheel is turning.

The master wheel 67 is adapted to turn the dial wheels 110 because said wheels, which are journaled on a shaft 111 of the totalizer, are constantly in mesh with computing wheels 112, journaled on a shaft 113 of the totalizer, said computing wheels engaging the master wheel *seriatim* as they travel along with the typewriter carriage. In order to cause the totalizer to travel along with the typewriter carriage, it is provided with an arm 114 which may engage with a rack-bar 115 carried upon arms 116 fast to the frame of the typewriter carriage, and the totalizer may travel on rails 117. As the totalizer thus travels along with the typewriter carriage, the computing wheels not only mesh *seriatim* with the master wheel 67, but also mesh *seriatim* with a series of carry-over wheels 118, journaled on an extension 119 of the master-wheel shaft 120.

As herein disclosed, each numeral or dial wheel 110 is made as a twenty-toothed wheel having the spaces between alternate teeth filled in solid, so that it is in appearance a ten-toothed wheel having broad teeth and narrow spaces between the teeth. The computing wheels 112, in order to mesh with the dial wheels, are twenty-toothed wheels having alternate teeth removed, so that they appear like ten-toothed wheels having narrow teeth and wide spaces between the teeth. In order to enable the master wheel and the carry-over wheels to mesh with the computing wheels, the master wheel and the carry-over wheels are formed substantially like the dial wheels, that is, in appearance, having ten broad teeth and one narrow tooth in between each broad tooth.

In order to effect carry-overs, each computing wheel 112, when the typewriter carriage is at rest, normally has two short teeth 121 lying one in front of and one behind the tooth 122 of the carry-over wheel or of the master wheel. Each computing wheel comprises a flat portion lying (as viewed in Fig. 2) to the right of the short teeth 121, but one tooth 123 in the circumference of each carry-over wheel is long enough to extend across the flat portion, so that, as the computing wheel effects one revolution, the long tooth 123 will overlap and engage and turn the adjacent carry-over wheel one-tenth of a revolution, with the result that said carry-over wheel in turning will turn the other computing wheel with which it engages by means of the short teeth 121 on that computing wheel, thereby turning its dial wheel 110 one unit space. This effects a carry-over.

In order to hold the carry-over wheels 118 alined, each one has a detent 124 normally pressing against it, said detent having a V-shaped point 125 adapted to lie between the teeth, but to be easily cammed out when the carry-over wheel starts to turn. The detents 124 are all journaled on a common shaft 126, and each is pressed against its carry-over wheel because a bell-crank arm 127, bearing against a lug 128 of the detent at its rear, is continually thrust forward and upward by means of a light coiled spring 129, confined within an opening 130 and bearing against a plunger 131, which, in turn, bears against a bell-crank extension 132 of the detent 124. For convenience in construction, the arms 127 engage the lugs 128 by means of slanting faces 133ª, which form cams for camming the detents forwardly. This angle of contact between the cam-surfaces 133ª may also be such that the bell-cranks may be rocked against the opposing efforts of their light springs 129, by the detents 124 when cammed out of engaging relation between the teeth of any of the carry-over wheels which are rotated to effect a carry. In order to hold the detent strongly in position, to enable the carry-over wheels to resist accidental turning very strongly, each of the detents 124 is provided with a forwardly-extending bell-crank arm 133, which underlies a bail 134, common to all the arms and journaled on the shaft 126 and held down upon the arms by means of a fairly strong spring 135. Since the bail 134 is common to all the detents 124, the camming out of any detent at the turning of any carry-over wheel will lift the bail 134, taking the entire load of the spring 135, thus enabling the spring 135 to be much stronger than each of a series of springs 129 of the same strength could be, owing to the fact that a series of strong springs 129 would put a heavy load upon the wheels in carrying-over.

In order to positively hold the detents 124 against turning accidentally at the lifting of the bail 134 and thereby carrying-over on a higher dial wheel 110, there are provided positive locking arms 136, adapted to bear against the upper extremities 137 of the detents 124. These locking arms are all journaled on a single shaft 138, extending across

the totalizer casing, so that they travel with the totalizer, and they are normally held against movement because each one comprises an arcuate face 139 on an upper extension 140, each face 139 adapted to bear against a smooth portion 141 of the computing wheel 112 with which it is associated. When held by the smooth portion 141 each locking arm bears against a fixed rod 142, which holds it against movement.

In order to release the locking arms 136, so that they may release their detents 124, each computing wheel has its smooth portion cut away, forming a depression or socket, as shown at 143, Fig. 5, to enable the locking arm to be swung inwardly toward the center of the computing wheel, so that its lower end swings backwardly, as shown for the near arm in Fig. 6, in which figure it will be seen that the arm is allowing its detent 124 to be swung outwardly to permit a carry-over to take place. As soon as the carry-over is completed, the locking arm again rides on the smooth periphery 141, because the cutaway portion 143 is so proportioned as to release the arm only during the moment of carrying-over. In order to enable the locking arms 136 to easily and certainly slide past the detents 124, the upper ends of the detents are provided with cam backs 145, which are engaged by the double cam-shaped knobs 146 at the lower ends of the arms 136. As will appear from Fig. 5, the locking arms 136 have their upper ends 140 offset from their lower ends, so that each locking arm is effective on the detent 124 of the carry-over wheel which turns the next higher computing wheel.

In order to provide for pointing-off places, certain of the dial wheels 110, denoted by the reference numeral 147, in Fig. 2, are made broad enough to cover two letter-spaces in the feed of the typewriter carriage, and the computing wheels 148, Fig. 5, with which they mesh, are made correspondingly wide. To enable these computing wheels 148 to properly carry-over, they are provided with special broad teeth 149, extending not only to the adjacent carry-over wheel, but also across that carry-over wheel and into engagement with the carry-over wheel next above, thus enabling the computing wheel to carry-over onto the proper dial wheel. In order to enable the locking arms for the computing wheels 148 to control the detents 124 for both the carry-over wheels thus engaged, the locking arms therefor are provided with extra long knobs 146, Figs. 5 and 2, said knobs serving to engage the two adjacent carry-over-wheel detents 124. Since the knobs are of this length, the offset described above, for the locking arms 136, is not needed for the locking arms having the long knobs 146.

Variations may be resorted to within the scope of the invention, and portions of the improvements may be used without others.

Having thus described my invention, I claim:

1. The combination with computing wheels, of carry-over wheels for said computing wheels, detents individual to said carry-over wheels, major spring means for holding said detents to their work, said major spring means made ineffective on all the detents when ineffective on any one, and minor spring means, separately effective on each detent, for preventing accidental releasings of said detents.

2. The combination with computing wheels, of carry-over wheels for said computing wheels, a plurality of detents for said carry-over wheels, a strong spring means common to all of said detents acting on said detents to cause them to justify said carry-over wheels, and light spring means individual to each detent supplementing the action of said strong spring means when the latter is ineffective on some of said detents.

3. The combination with computing wheels, of carry-over wheels for said computing wheels, detents for said carry-over wheels, arms on said detents, a bail universal to all of said arms, and a spring acting on said bail to cause the same to operate any or all of said detents to justify said carry-over wheels.

4. The combination with computing wheels, of carry-over wheels for said computing wheels, detents for said carry-over wheels, arms on said detents, a bail universal to all of said arms, a spring acting on said bail to cause the same to operate any or all of said detents to justify said carry-over wheels, a bell-crank individual to each of said detents, and means tending to cause each of said bell-cranks to maintain the associated detent in locking engagement with the corresponding carry-over wheel.

5. The combination with computing wheels, of carry-over wheels for said computing wheels, detents for said carry-over wheels, bell-cranks for said detents, said detents and said bell-cranks having engaging cam surfaces, and spring-pressed members engaging said bell-cranks to lightly hold said detents to their work.

6. The combination with computing wheels, of carry-over wheels for said computing wheels, detents for said carry-over wheels, arms on said detents, a bail overlying all of said arms, a spring acting on said bail to cause said detents to lock said carry-over wheels, extensions on said detents having cam surfaces, bell-cranks having cam surfaces to engage the cam surfaces of said detents, and spring-pressed plungers, one individual to each of said bell-cranks, arranged to maintain the associated detent

against accidental displacement relative to its carry-over wheel.

7. The combination with computing wheels, of carry-over wheels, said computing wheels and said carry-over wheels having a relative traveling movement, detents for said carry-over wheels, and locks for said detents controlled from said computing wheels, said locks and said detents having a relative traveling movement.

8. The combination with computing wheels, of carry-over wheels for said computing wheels, detents for said carry-over wheels, spring means universal to said detents for strongly urging said detents to their work, spring means for individually, lightly urging said detents to their work, and a lock normally positively holding each of said detents to its work, said lock individually released to effect each carry-over.

9. The combination with computing wheels, of carry-over wheels for said computing wheels, detents for said carry-over wheels, spring means universal to said detents for strongly urging said detents to their work, spring means for individually, lightly urging said detents to their work, a lock positively holding each of said detents to its work, and a locking surface on each computing wheel normally holding the detent of the adjacent wheel locked, said computing wheels each having a socket therein to permit a movement of the associated lock, and thus a movement of the corresponding detent when a computing wheel has completed a revolution.

10. The combination with computing wheels, of carry-over wheels for said computing wheels, detents for said carry-over wheels, and locks for said detents, said computing wheels and said carry-over wheels having a relative traveling movement, said locks and said detents also having a relative traveling movement, and said locks and said detents having coöperating beveled surfaces to permit of the unobstructed relative movement therebetween.

11. The combination with computing wheels, of carry-over wheels for said computing wheels, detents for said carry-over wheels, and locks for said detents, bearing at one end on said detents and at the other end on the solid peripheries of said computing wheels, said computing wheels having depressions to admit of the movement of said locks and thus to permit the releasing of said detents.

12. The combination with a totalizer including a carriage and computing wheels, of carry-over wheels for said computing wheels, individual detents for said carry-over wheels, said carry-over wheels being stationary and said computing wheels traveling with said carriage, and a series of locks traveling with said carriage and coming one by one into engagement with said detents to hold them to their work.

13. The combination with computing wheels and carry-over wheels relatively to which they travel, of means normally holding said carry-over wheels, and a device whereby any computing wheel locks the higher carry-over wheel when brought to position by travel to be effective to turn it.

14. The combination with computing wheels and carry-over wheels relatively to which they travel, of detents normally engaging said carry-over wheels, devices whereby any computing wheel locks the detent of the next higher carry-over wheel when brought to position by travel to be effective to turn it, and means normally holding all of the detents locked but adapted to be released when any carry-over wheel becomes effective to carry over.

15. The combination with computing wheels, of carry-over wheels for said computing wheels, detents for said carry-over wheels, locks for said detents, bearing at one end on said detents and at the other end on the solid peripheries of said computing wheels, said computing wheels having depressions to admit of the movement of said locks and thus to permit the releasing of said detents, a carriage in which said computing wheels are journaled, and which carries them past the carry-over wheels, and a shaft, in said carriage, on which said locks are journaled.

16. The combination with a totalizer comprising wide and narrow computing wheels, of a master wheel, carry-over wheels, all of identical width, a carriage for effecting relative movement between the computing wheels and master and carry-over wheels, carry-over teeth on the wide computing wheels extending over to a second carry-over wheel, a detent for each of said carry-over wheels, a holding device associated with each narrow computing wheel adapted to be effective on one of said detents, and a holding device associated with each broad computing wheel adapted to be effective on the next two detents.

17. The combination with a totalizer comprising wide and narrow computing wheels, of a master wheel, carry-over wheels, all of identical width, a carriage for effecting relative movement between the computing wheels and master and carry-over wheels, carry-over teeth on the wide computing wheels extending over to a second carry-over wheel, means whereby each narrow computing wheel in the computing zone holds its carry-over wheel locked unless turning it, and means whereby each wide computing wheel in the computing zone holds the next two carry-over wheels locked unless turning them.

18. The combination with a totalizer com-

prising wide and narrow computing wheels, of a master wheel, carry-over wheels, all of identical width, a carriage for effecting relative movement between the computing wheels and master and carry-over wheels, carry-over teeth on the wide computing wheels extending over to a second carry-over wheel, a detent for each of said carry-over wheels, a locking arm bearing on the periphery of each narrow computing wheel adapted to lock its carry-over wheel by its detent, and to be released in carrying over, and a locking arm bearing on the periphery of each wide computing wheel adapted to lock the detents of the two next carry-over wheels and to be released in carrying over.

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Witnesses:
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EDITH B. LIBBEY.