Jan. 14, 1936. B. C. STICKNEY 2,027,565

TABULATING DEVICE

Filed Aug. 14, 1930 4 Sheets-Sheet 1

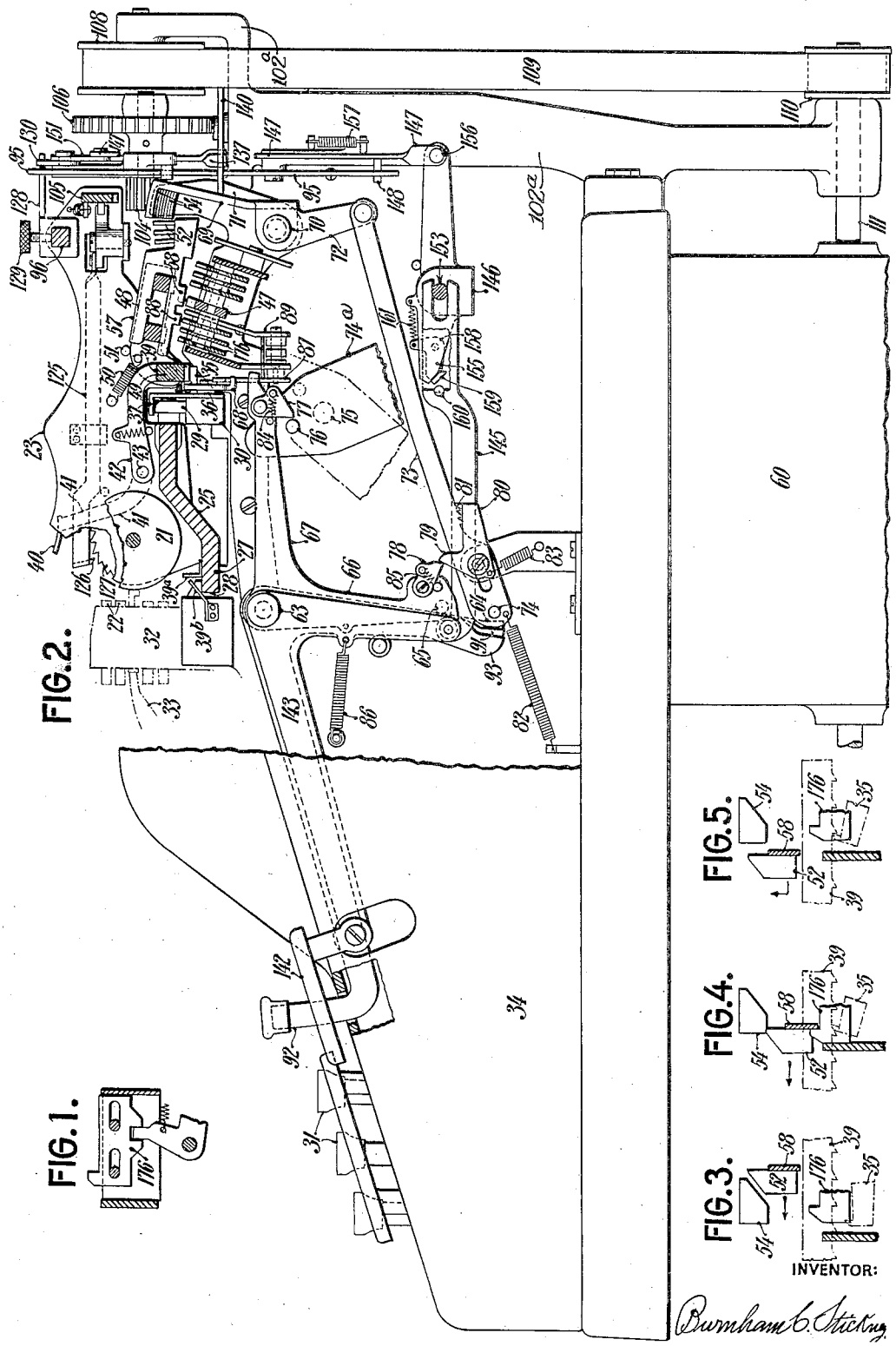

FIG. 2.

FIG. 1.

FIG. 5.

FIG. 4.

FIG. 3.

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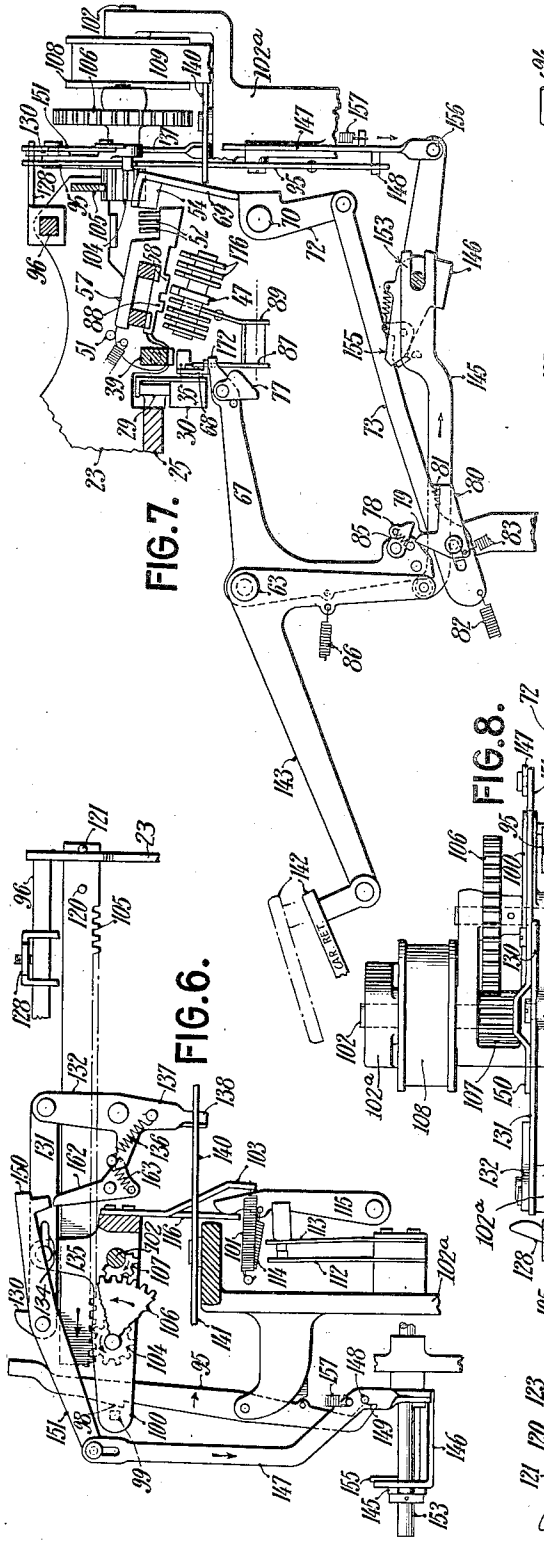

FIG. 7.

FIG. 6.

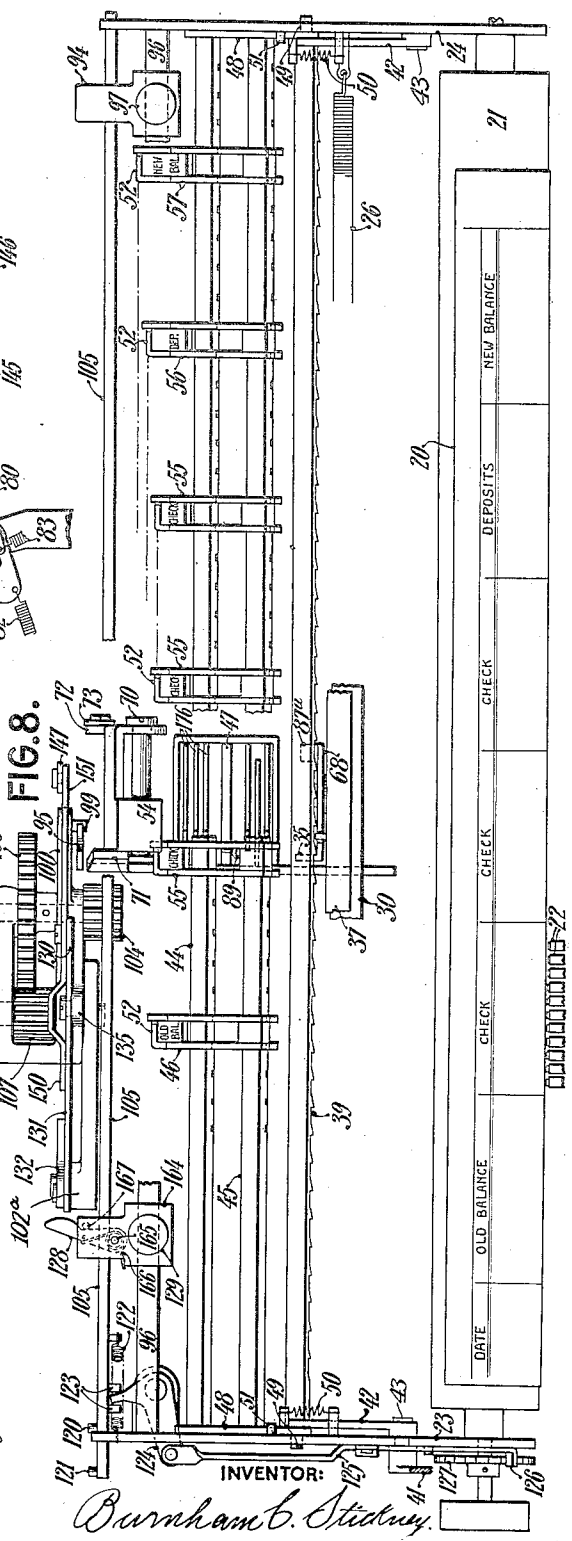

FIG. 8.

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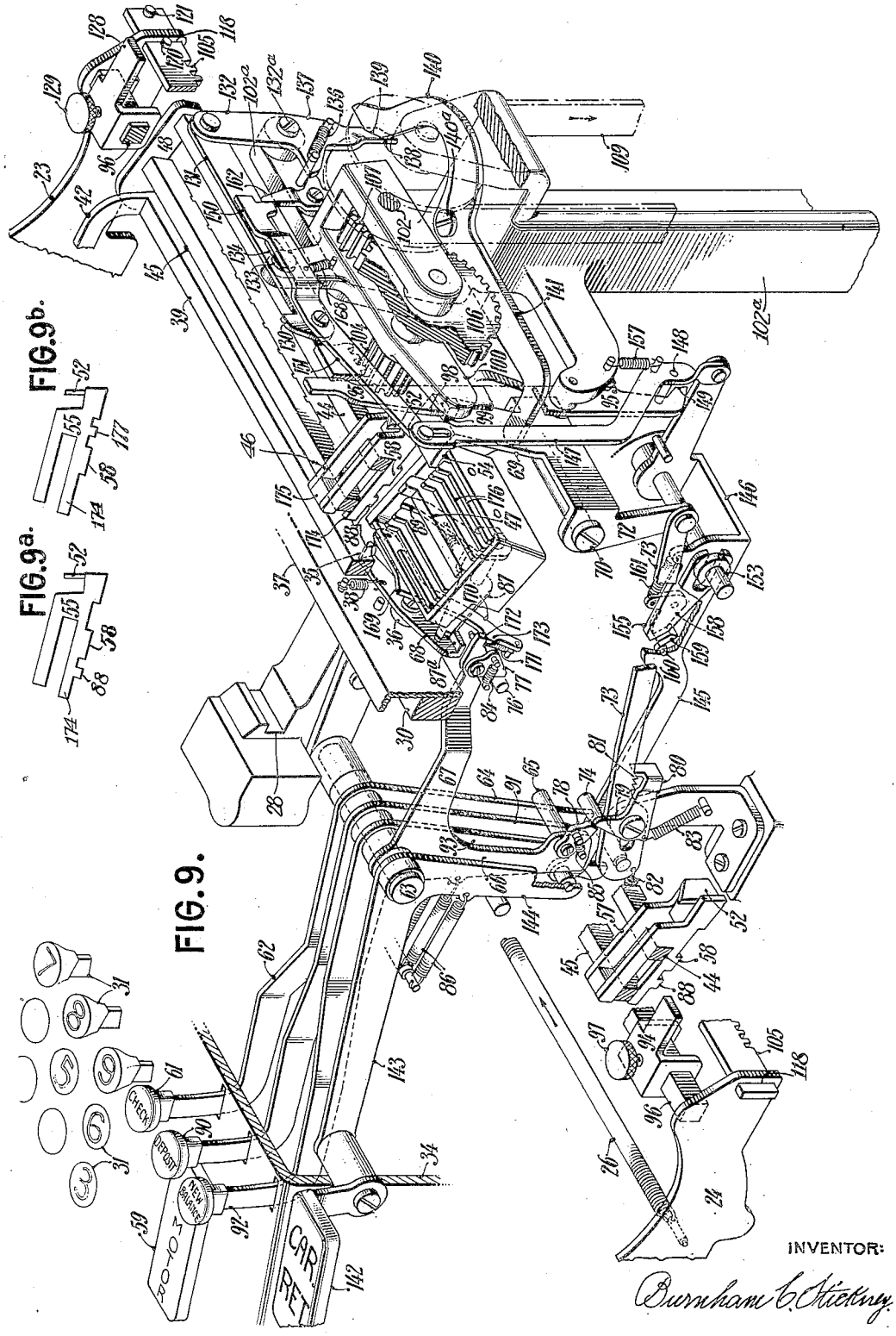

FIG. 9.

FIG. 9a.

FIG. 9b.

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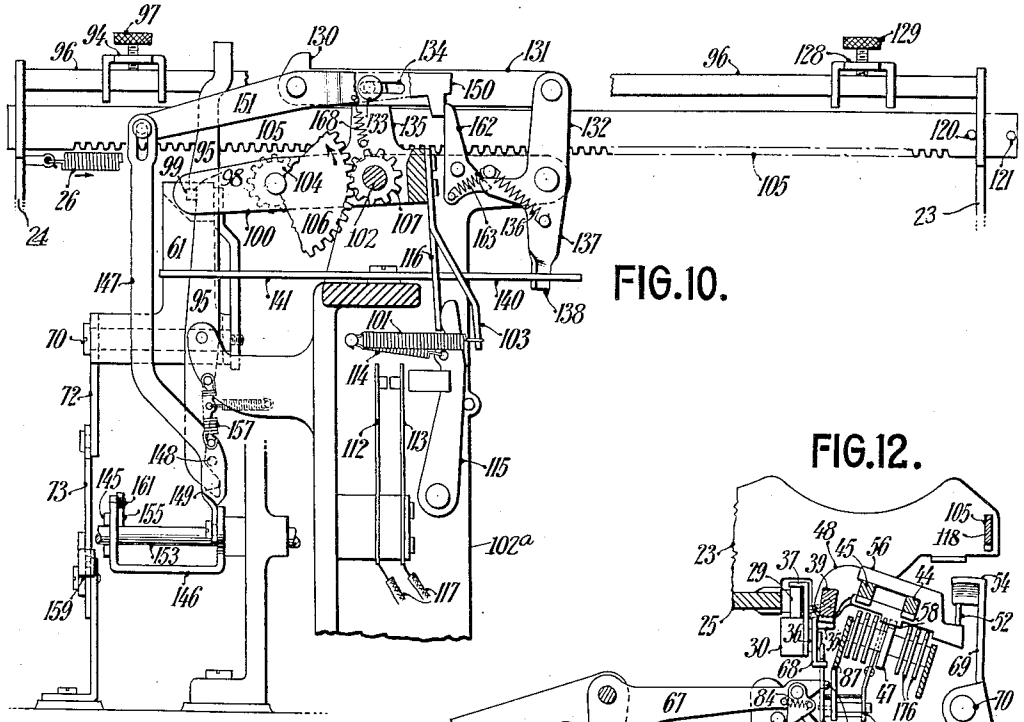

FIG.10.

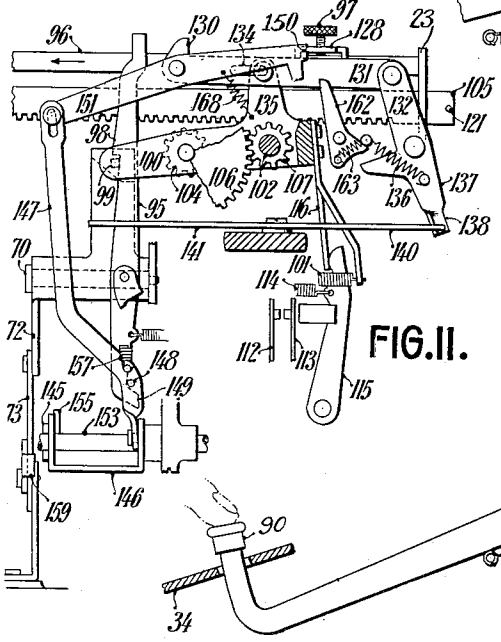

FIG.11.

FIG.12.

FIG.13.

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Patented Jan. 14, 1936 2,027,565

UNITED STATES PATENT OFFICE

2,027,565

TABULATING DEVICE

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Application August 14, 1930, Serial No. 475,171

13 Claims. (Cl. 197—176)

This invention relates to computing, bookkeeping and like machines and more particularly to novel tabulating mechanism therefor.

The invention, in the illustrative form herein described and shown is applied to the well-known Sundstrand machine as disclosed for example, in Patent No. 1,852,742 issued April 5, 1932 upon an invention of O. J. Sundstrand and application Serial No. 278,950 filed May 19, 1928 (now Patent No. 1,901,135, dated March 14, 1933), likewise disclosing an invention of said Sundstrand; although it will be understood to be equally applicable to other types of machines adapted to perform the same or similar functions.

It is an object of the invention to provide improved tabulating mechanism for machines of the class described.

Other objects and advantages will become apparent from the following description.

To the above and other ends the invention consists of certain features of construction and combinations and arrangements of parts all of which will be fully set forth herein and particularly pointed out in the claims.

In the accompanying drawings,

Figure 1 is a sectional elevation, showing part of a train that may be operated by a column-stop.

Figure 2 is a sectional elevation, from front to rear, of a Sundstrand machine provided with the present improvements.

Figures 3, 4, and 5 show certain steps in a tabulating operation looking from the front of the machine. In Figure 3 a column-stop is about to engage the tabulating cam to be depressed thereby, so as to be projected into the path of a counter-stop. At Figure 3 the carriage-holding dog is shown released. At Figure 4 the carriage is shown arrested by the engagement of the projected column-stop with the counter-stop, and the carriage-dog is shown restored to position for arresting the carriage when the latter reaches the proper point. Figure 5 shows the column-stop as having passed the tabulating cam, and also shows the dog arresting the carriage. The counter-stop may be either movable, as shown in Figures 3 to 5, or fixed. If desired, the movable device at Figures 1, 3, 4, and 5 may consist of a jack to operate a subtraction-controlling train, or any other train. Such jacks are all movable in the Sundstrand machine, but in the present invention the counter-stop does not need to be moved, if not connected to a Sundstrand train.

Figure 6 is a sectional rear elevation, illustrating the carriage-returning train in effective position, and showing means whereby the power-drive is controlled.

Figure 7 is a sectional side elevation, showing the operation of the carriage-returning key, by which is controlled the return of the carriage from the last check-column to the first check-column.

Figure 8 is a sectional plan of the improved carriage, with parts broken away to show the invention more clearly.

Figure 9 is a perspective rear view, showing generally the digit-keys, the tabulating keys, the various trains controlled thereby, and also showing some parts that are of usual construction in the Sundstrand machine.

Figures 9^a and 9^b show a variety of column-stops with different teeth or tappets, to operate different jack-trains in the Sundstrand machine.

Figure 10 is a sectional rear elevation, illustrating a carriage-returning mechanism and the trains that control it.

Figure 11 is a sectional rear view, showing the carriage-returning trains disconnected.

Figure 12 is a sectional side elevation, illustrating the manner of tabulating the carriage to the deposit-column.

Figure 13 is a sectional side elevation, showing the operation of a deposit-key, the carriage being released but not yet arrested by its deposit-column-stop.

In the well-known Sundstrand machine, a work-sheet **20** is placed upon a platen **21** to be printed upon by a row of digit-types **22**, the sheet having one column for dates, one for old balances, three columns for checks, one for deposits and one for new balances. The platen is mounted upon side bars **23**, **24** of a carriage, which also comprises a transverse horizontal frame or bar **25**, Figure 2, underlying the platen. The side bars **23**, **24** rise from the ends of the main bar **25**. The carriage is propelled by means of a helical spring **26** (Figure 9). The front edge **27** of the bar **25** forms a sliding portion to slide in guide-grooves **28** (Figs. 2 and 9) formed upon the sides of the main frame **34** of the machine. The rear support of the carriage is a roll **29**, which runs upon a track **30**, also supported upon the main frame of the machine.

The digit-types **22** are under the control of digit-keys **31**, Figures 2 and 9, the types being individually mounted in vertical sliding bars **32**

of different denominations, the types lying one under another in each bar 32. The bars normally stand in depressed positions, but each bar is elevated under control of stop mechanism (not shown), which is operated by the keys 31 as is fully disclosed in said Sundstrand application Serial No. 278,950. Each bar may rise to the point predetermined by the key. When the bars are in printing positions, hammers 33 press back the types that make up a certain transverse row, thus printing the number which has been selected by the operation of the keys 31. The parts above described are usually built in the Sundstrand machine, which is also provided with a stop carriage (not shown), which moves step by step at the operation of the keys, so as to control the denomination of every digit which is set up in the keyboard.

In said Sundstrand machine, it is the practice to employ tabulator-stops which normally restrain the carriage; the latter being constantly tensioned toward the left in Figure 8, by means of its spring 26. One feature of the present improvements is the provision of a dog 35, which normally restrains the carriage. This dog is not a tabulator-stop. The tabulator-stops, according to this invention, are not normally in use. Said normal carriage-holding dog 35 is pivoted at 36 upon the rear track 30, which includes a confining flange 37 that overhangs said carriage-roll 29. This dog 35 is lifted by a spring 38 into mesh with the teeth of a rack 39. The teeth of rack 39 are beveled so as to permit the carriage to be pushed to the right freely, the dog slipping under the teeth, but capable of holding the carriage at any point to which it may be set. This is one of the features of the present invention, which renders the machine adaptable for use for different kinds of worksheets having differently-spaced columns. For convenience in locating the carriage, and setting the stops, there may be provided a scale 39^a upon the carriage, and a pointer 39^b upon the machine-frame, Figure 2.

The carriage being normally detained by said dog 35, the tabulator-stops are normally free and cannot interfere with the movement of the carriage in either direction. The carriage may at any time be released from the dog by depressing a finger-piece 40. This key 40 is on the front end of an arm 41, which is mounted on the carriage, or is connected to a release-frame consisting of a pair of arms 42 that are rigidly united to the rack 39 and hinged at 43 to the opposite ends 23, 24 of the carriage. When the key 40 is depressed, the rack 39 is lifted clear of dog 35, and the carriage may slide to the left, and may be arrested at any point upon releasing the finger-piece 40. It will be obvious that a pin 35^a limits the counter clockwise movement of dog 35 as viewed in Figure 9, so as to prevent the latter from partaking of the upward movement of rack bar 39.

The carriage is also automatically releasable from the dog by pressing the dog down, which is done at the herein-described carriage-tabulating operations.

In place of the control plate, which is designated 1010 in the Sundstrand Patent 1,756,401, with its stop-pins, etc., permanently riveted thereto, there is employed a pair of racks 44, 45 extending lengthwise of the carriage, and mounted at their ends thereon; and upon these racks is adjustably mounted a column-stop or stop-unit 46, which is marked "Old balance" at the left-hand portion of Figure 8. Assuming that the carriage has been returned to the extreme right-hand limit of its range of movement, and is thereupon advanced towards the left by the carriage-spring 26, the "Old balance" stop 46 on the carriage is utilized as a tabulator-stop for arresting the carriage in position for the types 22 to print in the old-balance column on the work-sheet 20, preferably with the two extreme left-hand types printing in the adjoining date-column. The old-balance column-stop is arrested by means of a non-traveling or stationary counter-stop 47. It will be understood that normally the traveling carriage-stop 46 is at such an elevation that it will clear the stationary counter-stop 47; but the racks 44, 45 are depressible to permit the engagement of said stops. For this purpose, the racks are fixed at their ends in a pair of swinging bars 48 that extend rearwardly on the carriage-frame sides 23, 24 from hinge-pintles 49; said end bars 48 and the column-stop racks 44, 45 forming an up-and-down swingable frame which is normally lifted by springs 50 against stops 51 provided upon the carriage.

While the carriage is being advanced by its spring 26 from its extreme right-hand limit, a beveled shoulder or cam 52 (Figs. 3 and 8) upon stop 46 encounters the under side of a stationary (non-traveling) cam, said under side or face being beveled at 54, Figures 2 and 7. Said under face inclines leftwardly and downwardly, so that as the stop-shoulder 52 advances, it is forced down by cam 54, together with the stop-unit 46, as well as the bars 44, 45 and the arms 48; thus depressing the stop 46 sufficiently to engage the stationary counter-stop 47 and arrest the carriage in position for computing and printing in the first column, marked "Old balance".

It is noted parenthetically that the column-stop 46 forms one of a set of column-stops, said set including stops for arresting the carriage for printing in the three check-columns of the work-sheet, and also including a deposit stop 56 and a new-balance stop 57. These stops have assorted lengths, to permit column-skipping, but they all are depressible by cam 54, to enable them to engage the stationary counter-stop 47 and arrest the carriage in computing and printing positions. At Figure 8 the first check-column stop 55 is shown in position for arresting the carriage at the proper location for the types 22 to print in the first check-column. These stops 46, 55, 56 and 57 may be independently adjustable along the racks 44, 45, to correspond with any desired arrangement of columns upon the work-sheet. The number of possible positions of the carriage is determined by the rack-teeth 39 in cooperation with normal holding dog 35; and the spacing of the teeth in the racks 44, 45 agrees with the pitch of the teeth 39. The dog 35 can be utilized to hold the carriage at any point for which any stop is adjusted.

Each of the stops has a carriage arresting tooth 58 to engage the stationary counter-stop 47. It will be understood, however, that inasmuch as the column-stops and racks are normally elevated, they normally escape said counter-stop 47, and normally the carriage is only held by the dog 35 and rack 39. It will be seen that the carriage is detained alternately by dog 35 and counter-stop 47.

Considering now that the carriage has been

arrested by engagement of column-stop tooth 58 with the counter-stop 47, it will be kept in mind that the carriage must remain here during the manipulation of the keyboard 31 and subsequent printing operation of the types 22. The spring 26 tensions the carriage towards the left, and the cam 54 holds down the column-stop with its tooth 58 in engagement with the stop 47. At the same time that the column-stop tooth 58 engages the counter-stop 47, it also sets the carriage-holding dog 35 in front of the succeeding tooth on the carriage-rack 39, preparatory to assuming control of the carriage after the machine has been cycled. During such cycling, the column-stop tooth 58 is released from the counter-stop 47, and this permits the carriage-propelling spring 26 to draw the carriage along a short distance idly until the next tooth of the carriage-rack 39 advances into engagement with the previously set dog 35.

As is usual in the Sundstrand machine, after the digit keys have set the type-bar-controlling devices in the various denominations, an electric circuit is closed by motor-key 59, to cause an operating motor 60 to cycle. The motor causes the number to be run into the computing wheels (not shown), and also causes the type-carrying bars 32 to be elevated in position to print the number. During the cycling of the motor, there is operated a set of type-hammers 33, to thrust the selected printing types 22 against the work-sheet 20. At a subsequent point in the cycle, the type-carriers 32 drop to normal positions. The Sundstrand motor is self-stopping at the conclusion of its cycle; and the motor-circuit is automatically opened.

During the cycling of the motor, the carriage remains under the control of the tabulating mechanism, the dog 35 and rack 39 being temporarily out of use. Near the conclusion of the cycle the stop-depressing cam 54 is automatically moved out of the path of the column-stops, this motion being effected by the general operator.

It may be explained that in the Sundstrand machine, the motor 60 reciprocates the general operator, which is represented by a lever 74ª (Fig. 2) pivoted at 75 upon the framework, and rocking first rearwardly and then forwardly. Upon this lever there is fixed a novel pin 76, which idly passes a pawl 77 during the front stroke of the main rock shaft (not shown) of the machine (i. e., the clockwise movement of the lever 74ª). Upon the return or counter-clockwise stroke of the latter, said pin 76 engages said pawl 77 and lifts arm 67, thereby swinging rearwardly arm 66 of the bell-crank. The arm 66 carries a pivoted pawl 78, that engages and rocks an arm 79 of a latch 80, to depress said latch and release it from a catch 81 that is provided upon the front end of link 73. Such release permits spring 82 to pull forward said link 73, together with arm 72, which is pivoted at 70 upon a fixture 71 and carries arm 69, the latter having thereon the cam 54. The latter is swung back by the spring 82 to its normal idle position, clear of all column-stops, as at Figures 2, 7 and 9.

Springs 50 thereupon lift the column-stop frame 44, 45, to normal position. Since the dog 35 resumes control of the carriage, the column-stop 46 passes out of use, preparatory to bringing a subsequent stop into use.

The lever 74ª, upon completing its return to normal position restores the pin 76 to the position shown in Figure 2 and the pawl 78 is caused to ride to the left as viewed in Figure 2 over the latch arm 79 whereupon it is restored to operative position by the action of a spring 85.

It will be understood that the operation of any of the column-stop keys may reset said cam 54 forwardly to effective position, and that it will be kept there by the latch 80 that is operated by spring 83.

After an amount has been printed and added in the old-balance column, the machine is ready to handle the amount of the first check. It is desired to advance the carriage to the first check-column, which, of course, necessitates the release of the carriage from the holding dog 35, and the tabulation of the carriage to the first check-column position. For these purposes, there is depressed a check-key 61 forming part of the novel tabulating mechanism herein disclosed. To enable this key to release the carriage from holding dog 35, the key is mounted upon an arm 62 of a bell-crank, fulcrumed upon a shaft 63, having a pendent arm 64.

The arm 64 strikes movable carriage-releasing stud 65, which is in rear of 64 and is mounted upon the bottom of the arm 66, pivoted loosely upon the shaft 63. The rear end of arm 67 swings up idly for a distance and finally lifts an arm 68 that is provided upon the carriage-holding dog 35, so as to swing the arm about its pivot and withdraw the dog 35 from the carriage-rack 39, thereby releasing the carriage and permitting it to be drawn along by means of its spring 26. The dog 35 is held out by spring latch 87, which catches a flange 87ª on the dog.

Before the carriage is released, however, provision is made for co-operation of stationary cam 54 with the next column-stop 55, as the carriage tabulates. It will be remembered that the column-stop frame 44, 45 was swung up by springs 50 when the cam 54 was automatically withdrawn by the general operator.

Depression of the check-key 61 not only releases the carriage from holding dog 35, but also serves to swing forwardly the tabulating cam 54; arm 64 swinging rearwardly and pressing back the pin or stud 74, which projects from the side of the link 73, together with the link and arm 72, thereby throwing forwardly cam 54. The spring latch 80 engages teeth 81 on the link 73, and detains the cam 54 in working position. The check-key 61 gives a full stroke to the cam 54, bringing it to position to engage the next column-stop, which is 55, as at Figure 8. The cam 54 engages the cam-shoulder 52 on the column-stop 55 and forces the latter down, together with the remaining column-stops and the rack-bars 44, 45; and column-stop 55 engages the stationary counter-stop 47. At the same time the tooth 58 (of which each of the column-stops 46, 55, 56 has one) is made broad enough to engage both the carriage-arresting stop 47 and a jack 89 formed on latch 87, to depress the latter, thus releasing the dog 35, which is then held up in engagement with rack bar 39 by its spring 38 (preparatory to coming again into service at the ensuing cycling of the general operator). The cam 54 is latched in its effective position, and the carriage spring 26 holds column-stop 55 against counter-stop 47. The setting of stop 55 is accomplished by the time the check-key 61 has completed its down stroke. The key is released, and it is returned to normal position by one of the springs, indi-

cated at 86. The keyboard 31 is then manipulated to set up the amount of the first check. Thereupon the motor-key 59 is depressed to reciprocate the general operator as before and withdraw the cam 54, permitting the column-stop frame to rise, and also permitting the dog 35 to resume its control of the carriage.

In order to advance the carriage to the second check-column, said check-key 61 is depressed again, and the carriage is released as before, and it is rearrested by the tabulating cam 54, the second column-stop 55 and the counter-stop 47; the tooth 58 moving the jack 89 to release the latch 87 that detains the carriage-dog 35, as already explained. Then the amount of the second check is set up, and the motor-key is depressed to cause another cycling of the general operator. The carriage may then be tabulated to the third check-column by depressing the same key 61; and the keyboard 31 may be manipulated as before.

It is then desired to tabulate the carriage to the deposit column; and for this purpose there is required a special tabulating key 90, which is incapable of moving the tabulating cam 54 far enough to engage any of the short column-stops 46, 55 (Fig. 8), but only far enough to reach the somewhat longer stop 56. It will be understood that this deposit key 90 could have been used to skip the carriage directly to the deposit column, in case there had been only one or two checks to enter. There is considerable lost motion in the first part of the stroke of the deposit key 90. Its pendent arm 91 (corresponding with 64) stands at a considerable distance from the pin 74 on link 73. Hence, a large portion of the movement of arm 91 is idle, and the full depression of key 90 will advance said link 73 only a distance equal to two teeth 81; and then the link is latched by pawl 80. The arm 72 and the cam 54 therefore swing only far enough to reach the path of the column-stop 56, to engage the cam 52 on the latter. The effect is the same as has already been explained; the cam 54 causing the column-stop 56 to swing down, together with the column-stop frame, and causing the arrest of the carriage by the counter-stop 47, and also the release of the carriage-dog 35 from the control of its latch 87. The manipulation of the keyboard to set up the amount of the deposit may proceed, and then the general operator may be cycled as before.

It is now desired to tabulate the carriage to the new-balance column; and for this purpose there is employed a tabulating key 92, which sets the tabulating cam 54 only far enough forward to engage the tabulating stop 57, which is the longest one. The arm 93, which is operated by the key 92, occupies a position considerably forward of arms 91 and 64, as at Figure 2, so that there is much greater lost motion of key 92, and hence the link 73 is finally advanced only to the extent of one tooth 81, where it is latched by pawl 80, and the cam 54 swings forwardly only far enough to engage the cam 52 on the longest stop 57. It will be understood that if there had been no checks or deposits to be entered, the carriage could have been skipped at once to the new-balance column, without stepping it through the check and deposit columns. Or, if one, two or three checks had to be entered, and no deposit had to be made, then the manipulation of the deposit-key could have been omitted, and the carriage could have been skipped by means of the key 92 directly to the new-balance column. The digit-keys may now be manipulated and the general operator cycled as before.

At the conclusion of the cycling of the general operator in the new-balance column, the pin 76 operates through 67, 66, 65, 78, 79 to release the link 73, together with the tabulating cam 54, so that the latter is withdrawn by spring 82 from the path of the column-stops, permitting the latter to rise clear of all obstructions, preparatory to the return of the carriage.

The new-balance column being the last on the work-sheet 20, and the line of printing having therefore been completed, there is no need for the carriage to remain at the left-hand end of its travel; and preferably it is returned at once, automatically, preparatory to printing another line. To this end, the tooth 58 is made narrower on the new-balance column-stop 57, as at Fig. 2 so as not to engage the jack 89, and hence the carriage-dog 35 remains held out by the spring latch 87. The carriage-driving spring 26 therefore is permitted to effect a further advance of the carriage, that is, until an adjustable lug 94 (Figs. 8 and 10) thereon strikes the carriage-returning lever 95. This lug 94 fits upon rod 96, which extends from end to end of the carriage, and is held by adjustable screw 97.

The lever 95 has a latch 98 (Figure 11) which normally holds down a pin 99 upon a spring-elevated swing frame 100. When 95 is moved to the right at Figure 9, the swing frame 100 becomes unlatched and is raised by its spring 101, which is attached to the end of arm 103 that extends down from the swing frame. The frame swings upon axis 102. The lifting of the frame brings a pinion 104 thereon into mesh with carriage-return rack 105, which extends the length of the carriage, so that when the pinion is revolved the carriage is returned. Fixed to the pinion is a gear 106, with which meshes a pinion 107, which is coaxial with 102. The axis 102 is in the form of a shaft, which also carries a pulley 108, that is driven by a belt 109 and pulley 110 (Figure 2), the latter being mounted on shaft 111 of motor 60.

It will be understood that at the conclusion of the cycling of the general operator, its circuit was automatically opened, as the motor was no longer needed to drive the general operator. The described lifting of the swing frame 100, however, has the effect of closing a circuit through the same motor, to cause it to drive the carriage-returning pulley 110, so that the carriage may be returned to the beginning of its run. It will be understood that the pulley 110 revolves idly unless the pinion 104 is in mesh with the rack 105. The carriage-returning swing frame 100 includes contacts 112 and 113, normally open. A spring 114 tends to move an arm 115 to close said contacts; but 115 is normally held out of use by means of an arm 116 that is fixed to the swing frame 100, as at Figure 6. The upward swinging of frame 100 permits the spring 114 to swing the arm 115 to the left at Figure 10, thereby closing the motor-circuit 117, for returning the carriage.

At the starting of the carriage-returning train, the rack 105 is moved endwise to the left for line-spacing, as viewed in the rear view, Figure 10, this movement being independent of the carriage. The rack is mounted in guide openings 118 (Fig. 9) in the end plates 23 and 24 of said carriage, and the play of the rack is limited by stops 120 and 121. The rack is held in normal position on

the carriage by a spring 122 (Fig. 8), but by means of lugs 123 it engages a bell-crank 124, mounted on the carriage, and connected to a forwardly-extending link 125, which has a tooth 126 on its front end, Figure 2, to catch in the notches of a line-space wheel 127 that is provided on the platen 21. Thus the work-sheet will be line spaced, together with the usual record-sheet upon which all the entries are manifolded for a succession of work-sheets.

The return motion of the carriage (toward the right as viewed in Fig. 8) continues until an adjustable lug 128, secured upon rod 96 by means of screw 129, encounters a projection 130 upon a gear-disconnecting train, and thereby swings down the frame 100. The projection 130 is provided upon a horizontal link 131 (Fig. 9) which is pivoted upon a rocker-arm 132. The rocker arm 132 is pivoted at 132a on the frame member 102a, the link 131 has a pin-and-slot connection at 133 and 134 with an arm 135 that rises from the swing frame 100, so that the endwise leftward movement of the link 131 at Figure 10 may depress frame 100 around pivot 102, thus dropping the pinion 104 from the rack 105, so that the carriage is no longer driven in return direction. The frame 100 is held depressed by the locking shoulder 98. Inasmuch as rack 105 is now released, it will be returned to its normal position by spring 122, together with the line-spacing train. The Sundstrand machine is usually provided with stops to limit the possible travel of the carriage in each direction.

By the dropping of the swing frame 100, the arm 116 is caused to withdraw the circuit-closing arm 115, thereby opening the circuit 117, so that the motor may come to rest. The carriage is therefore brought under the control of the driving spring 26, which is tensioned to advance the carriage in tabulating direction.

Since it is desired that the carriage, upon being returned, shall resume its position for printing in the first or old-balance column upon the work-sheet, the carriage-returning mechanism is provided with means to utilize the hereinbefore-described tabulating mechanism at this stage, for positioning the carriage by means of the first column-stop 46. It will be observed that said stop 46 does not arrest the carriage while the latter is moving in return direction.

The carriage, while returning, overruns to a certain extent, and passes by the column-stop 46. But the train which disconnects the carriage-returning gears is also effective to depress column-stop 46 into position to arrest the carriage at the old-balance column. There need not be a stop for positively arresting the return travel of the carriage. It will be seen that the carriage passes by the old-balance column, and will therefore recoil under the impulse of its spring 26, until it reaches said old-balance column-stop 46.

To bring the tabulating mechanism into use, for the purpose just mentioned, the link 131 is given an idle motion, which is equal to the length of the slot 134, before the end of the slot engages the pin 133 and swings downwardly the frame 100. During this idle motion of the link 131 to the left in Figure 10, arm 132 is swung to the left against the tension of spring 136. This arm 132 is part of a lever that has a depending arm 137 formed with a cam 138. At its lower end, Figures 9 and 10, this cam engages a bevel 139 that is formed on a horizontal lever-arm 140, which is pivoted at 140a on the frame member 102a, said lever extending forwardly at 141 to press forward the arm 69, which swings the tabulating cam 54 forward to its full extent, so that it is in a position to engage the cam 52 on the first column stop 46.

The tabulating cam 54 is latched in this position by the latch 80, and the column stop 46 is provided with tooth 58 to unlatch the dog 35 at the time that the carriage is located in the old balance position by the engagement of tooth 58 with stationary counter-stop 47.

It will be understood that the dog 35 remains locked against movement into engagement with rack 39 when the carriage moves into the new balance position because the tooth 58 on the column stop defining the new balance position is not sufficiently long to contact the arm 89 of the dog latch 87. Hence cycling of the machine in the new balance position serves to immediately free the carriage for leftward movement to permit actuation of the carriage return mechanism as a result of which the carriage is restored to its initial or old-balance position in readiness for the printing of a new line.

The number of checks to be entered varies, and there sometimes may be many more than three, but they may all be typed in the three check-columns, by printing the amounts one under another in said columns, before proceeding to the deposit and new-balance columns.

After printing three checks in the first line, therefore, the carriage may be returned, and the platen may be line-spaced preparatory to entering another check in the first check-column. For this purpose, the operator depresses a carriage-return key 142 (Figure 9), depressing an arm 143 of a bell-crank lever that is pivoted on 63 by the side of the other bell-crank levers, and that has a pendent arm 144, whose office is to operate or trip the aforesaid arm 95, 98, and release the swing-frame 100 of the carriage-returning gear-train. This permits spring 101 to elevate said swing-frame 100, and to carry the carriage-returning pinion 104 into mesh with the rack 105, and close the motor-circuit, thereby line-spacing the platen and returning the carriage. The train from the carriage-return key 142 to the releasing arm or lever 95, 98, includes a link 145, which is pressed rearwardly by the arm 144, and operates a bail-form lever 146, in a manner hereinafter explained, to depress a link 147; the latter having a pin 148 (Figure 9) engaging cam 149 formed in the lower end of the lever 95, 98, swinging said lever, and freeing the pin 99 and the swing-frame 100, for the described upward swinging movement, to return the carriage.

The carriage is desired to come finally to position for printing in the first check-column; but in its return movement it overruns that position a little, and at that stage the motor is disconnected, and its circuit is opened, and the tabulating cam 54 is swung forward a full stroke, to enable it to intercept the carriage, as the latter is given a recoil by its spring 26, the interception of the carriage being effected by the stop 55 (Figure 8).

When the returning carriage is approaching or passing the first check-column position, as just set forth, it becomes automatically disconnected from the carriage-returning gear-train. This disconnection is accomplished by the aforesaid adjustable lug 128 on the carriage, which strikes the end of a raised interponent 150, Figure 6, which is effective in place of 130, and at an

earlier movement in the return movement of the carriage. It will be perceived that said interponent 150 was raised into the path of the carriage-lug 128 by the operation of the carriage-return key 142. It has already been pointed out that the carriage-return link 145 operates the bail-lever 146, and pulls down the link 147. This link pulls down the lever-arm 151, and raises the interponent 150, which forms one arm of said lever.

The carriage-return key 142 does not need to be held down, because the lever 151 is latched up by means of a spring pawl 162, Figure 6. The interponent 150 therefore remains elevated until it is reached by the returning carriage-lug 128, which drives the interponent 150 endwise and carries the link 131 on which the interponent is pivoted to the left at Figure 10, until the end of its slot 134 engages the pin 133 on arm 135, and thereby swings down the swing-frame 100 and releases the carriage-returning pinion 104 from the rack 105, to stop the return drive of the carriage; the motor-circuit being automatically disconnected by the operation of the arm 115, as already set forth.

It may be explained that the backward thrust of the link 145, which has a slot-and-pin support at 153, has the effect of camming upwardly an arm 155 (Fig. 2) which forms part of the bail-lever 146, and thereby positioning the rear arm of said lever, to which is pivoted at 156 the lower end of link 147. For this purpose a trip-connection is provided between the camming link 145 and said lever-arm 155, so that at the conclusion of the lever-stroke it may return independently of the link 145. This return is effected by a spring 157 pulling upon said link 147.

Pivoted upon the lever-arm 155 is trip 158, formed at its front end with a cam in the form of an inclined flange 159 that is engageable by a pin 160 on link 145. This flange is held by a spring 161 against the forward end of the arm 155, to afford a support for the trip. The pin 160, as it moves rearwardly in the machine, bears against the under side of flange 159, and presses the same up, thereby swinging the arm and lever. The pin 160 then passes rearwardly under the end of flange 159 of the trip. The flange 159 projects laterally from the trip, beyond the side of the arm, and it is this projecting part that is engaged by the pin 160. The pin, as it returns forwardly, lifts the trip idly, and passes under it, and then permits the trip to fall, together with the arm and lever, under the tension of spring 157.

At the operation of bail-lever 146, the interponent 150 is lifted thereby, said interponent being latched up by latch 162 (Figure 6), so that the attention of the operator is not needed to hold down the carriage-return key; but the same may be released at once.

The latch 162 normally stands in the position shown in Fig. 10 and is snapped to the left by spring 163, when the interponent 150 rises; the latter remaining latched up by 162 (Figure 6) until the lug 128 on the returning carriage thrusts the interponent 150 to the left from the position in Figure 6 to the position at Figure 11. Said lug 128 may have a yielding construction, so that after it has thrust the interponent 150 and released the carriage from its driving train, there is opportunity given for the carriage to proceed idly a short additional distance by momentum, before a recoil is effected by its spring 26. The lug 128 is mounted upon a block 164, being pivoted thereto at 165, and normally urged to the right at Figure 8 by means of a strong spring 166, that holds the lug 128 normally against a stop 167 provided upon the adjustable block or guide 164.

At the recoil of the carriage that is effected by driving spring 26, the lug 128 is caused by its spring 166 to rotate and resume its normal position upon block 164. Then the interponent 150 is swung down by its returning spring 168 (Figs. 9 and 10), until said interponent drops to the left of the latch 162. The interponent carries the latch to the right until it reaches normal position, Figure 10, against the tension of spring 163.

Thus an additional check may be entered in the first check-column, and additional checks also in the second and third check-columns; and, if desired, the carriage may again be returned to the first check-column, for entering still more checks, in the manner just described. After all the checks have been entered, the carriage may be tabulated to the deposit column, or to the new-balance column.

If, at any early stage, the carriage is tabulated to a check-column, and it is found not necessary to enter any amount in said column, the motor-key 59 may be depressed and the general operator cycled, thus withdrawing the tabulating cam 54, whereupon the carriage may be tabulated to the desired column by means of any of the selecting keys 61, 90, 92 (Fig. 9).

However, the necessity may be avoided of cycling the general operator under such circumstances, as provision is made whereby any of said keys 61, 90, 92 may cause withdrawal of the tabulating cam 54. Any key can operate the stud 65, which, by means of spring-pawl 78, releases the latch 79, 80, and the spring 82 pulls the link 73 forwardly, and swings the tabulating cam 54 rearwardly, permitting the column-stops to rise clear of the carriage.

Although the carriage is thus freed of the tabulating stops, it still remains under the control of the detaining dog 35, which is held up by its spring 38, and hence cannot jump until the selected key is depressed enough farther to take up the lost motion between the arm 69 and the dog-arm 68. The key, therefore, does not release the dog 35 until the very last part of the key-stroke. While the arm 67 is moving up towards dog-arm 68, the pendent arm 64, 91 or 93 is pressing rearwardly the cross-pin 74 on link 73, and hence swinging the cam 54 forward to the desired extent. The cam therefore reaches carriage-controlling position just as soon as the pawl or dog releases the carriage.

In order to guard against accident in the operation just described, a pallet 169 may be pivoted at its right-hand end upon a fixture (Figure 9) in position to intercept the approaching column-stop when any of the tabulator-keys are depressed. The pallet has an arm 170, connected by a spring 171 to arm 67. This spring tends to lift the pallet into the path of the column-stop, so that if the dog 35 should release the rack too soon, the column-stop and carriage will be detained by the pallet. The pallet is withdrawn by means of a finger 172 upon the rear end of arm 67, which engages a shoulder 173 upon the pallet. The pallet 169 rises into the path of a projection 174 upon that column-stop by which it is intended that the carriage shall eventually be arrested at this operation. The pallet 169 is therefore effective regardless of the position to which the column-stop has been adjusted upon its racks. Each of

the column-stops, except 57, is provided with this projection 174 (Figure 9).

Each column-stop may consist of parallel blades fixed upon spacer-blocks 175, so that the blades may enter adjacent notches in the racks.

In the standard Sundstrand machine are provided various jacks or slides 176 (Figs. 1 and 2), forming a rearwardly-extending row, these jacks taking part in the various functions of the machine, such, for example, as non-printing, subtracting, non-adding, selective register-control, and multiplication by repeated addition. Any one or more of these jacks may be operated by the described column-stops, by simply forming the main blade thereof with one or more teeth 88, 177 in addition to 58, teeth 88, 177 being properly located to engage any desired jack or jacks in a set; these teeth taking the place of the arrays of studs which are fixed in the swinging control plate in said Sundstrand patent, and being adapted to control all the jacks selectively, thereby conditioning the machine in various ways at the arrest of the carriage in its several column-positions. The adjustability of the column-stops presents an advantage over said fixed Sundstrand studs, because the machine operations may be made to take place at various points selectively in the travel of the carriage, by merely readjusting the column-stops having the controls 88, 177. An assortment of column-stops may be kept on hand by the owner of the machine, from which he may select a variety of stops with the desired controls 88, 177 for any kind of work, so that the services of a machinist are rendered unnecessary in conditioning the machine for a new kind of work.

It will be evident from the above description that any one of the column selecting keys, that is, the several check keys, the deposit key or new-balance key may be operated to differentially move the link 73 and thereby selectively position the cam 54 for cooperation with the column stop identified with that column in which it is desired to arrest the movement of the carriage. It will likewise be apparent that whereas the ratchet teeth of the bar 39 are positioned somewhat to the right of the respective positions in which the carriage is brought to rest to define columnar spacing, that this is solely a matter of mechanical adjustment to prevent the possibility of dog 35 engaging the downwardly projecting ends of any of the teeth of the rack bar and thus possibly permitting the carriage to move an appreciable amount after being released by the column stop.

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. In a machine of the class described, the combination of a laterally movable paper carriage, means normally tending to advance the carriage, a pair of stop means, one of said last mentioned means being effective to arrest the advancing movement of said carriage in a columnar position thereof, the second being effective to hold the carriage in said position, manual means effective to disable one of said stop means and to condition the other of said stop means for operation in a subsequent column, a part actuated in every cyclic operation of the machine, and means actuated by said part as an incident to disable the second of said stop means.

2. In a machine of the class described, the combination of a laterally shiftable carriage, means to move the carriage in an advancing direction, a lever arranged to be actuated by a prime mover, a manually enabled columnar stop, a second, automatically enabled stop, means actuated by said lever to render said columnar stop ineffective and manual means to render said second stop ineffective.

3. A machine of the class described, comprising in combination, a laterally movable carriage, means constantly tending to move the carriage, a stop to arrest the carriage in one position, a second stop to hold the carriage in said position, means automatically actuated as an incident to cycling the machine to disable the first mentioned stop and a single manipulative means to disable the second stop to permit movement of the carriage from said position and to condition the first stop to arrest the carriage in an advanced position.

4. In a machine of the class described, the combination of a laterally shiftable paper carriage, means to propel the carriage in an advancing direction, a plurality of spaced column stop means on said carriage, said stop means being effective to arrest the advancing movement of said carriage to define columnar positions thereof, a stop on the machine adapted to hold said carriage in columnar position after arrest and release thereof by one of said column stops, a lever operated as an incident to arresting of said carriage by said column stop means to render the stop on the machine effective, a cam on the machine effective to condition any one of said stop means to arrest the carriage in predetermined columnar positions, a plurality of manipulative means, connections between said manipulative means and said cam effective to differentially move the cam to condition the latter to operate selected ones of said column stops, means operated as an incident to actuation of any one of said manipulative means to disable the stop on the machine, a part adapted to be actuated by a prime mover, and means actuated by said part in every cyclic operation of the machine to disable said cam.

5. In a machine of the class described, the combination of a laterally shiftable paper carriage, means to propel the carriage in an advancing direction, a plurality of spaced column stops on said carriage, said stops being effective to arrest the advancing movement of said carriage to define columnar positions thereof, a stop on the machine adapted to hold said carriage in columnar position after arrest and release thereof by one of said column stops, means operated as an incident to arresting said carriage by any one of said column stops to render the stop on the machine effective, means on the machine adapted to be variably moved to selectively condition said column stops to arrest the carriage in predetermined columnar positions, a plurality of manipulative means, a differentially operable connection between said manipulative means and said cam effective to variably move the cam to condition the latter to operate selected ones of said column stops, means operated by any one of said manipulative means to disable the stop on the machine, a part adapted to be actuated by a prime mover, and means actuated by said part in every cyclic operation of the machine to disable said cam.

6. In a machine of the class described, the combination of a laterally movable carriage, means to propel the carriage, a plurality of nor-

mally disabled column stops adapted to arrest the carriage in columnar positions, a normally enabled stop effective to hold the carriage in columnar and intermediate positions, a member differentially conditioned by any one of a plurality of manipulative means to enable a predetermined one of said column stops and means actuated as an incident to operation of any one of said manipulative means to disable said normally enabled stop.

7. In a machine of the class described, the combination of a laterally movable carriage, means acting to move the carriage, a plurality of stops defining columnar positions of said carriage, a member effective to selectively project said stops into position to arrest said carriage in columnar positions, a plurality of manipulative means independently operable to condition said member to project particular ones of said stops, a prime mover, a part actuated by said prime mover in every cyclic operation of the machine and means operated by said part to disable said member.

8. In a machine of the class described, the combination of a laterally movable carriage, a plurality of column stops carried by said carriage and adapted to define columnar positions thereof, a stop on the machine to cooperate with said column stops, means to propel said carriage in an advancing direction to effect columnar spacing, means normally tending to move said column stops out of position to engage said machine stop, means operable to selectively project said column stops into position to engage said machine stop, a plurality of manipulative elements and connections between said elements and said projecting means to differentially move said projecting means to selectively project said stops.

9. In a machine of the class described, the combination of a laterally movable carriage, means acting to move the carriage, a plurality of stops defining columnar positions of said carriage, means normally tending to disable said stops, a member effective to selectively project said stops into position to arrest the movement of said carriage in predetermined columnar positions, a plurality of manipulative means individually identified with predetermined columnar positions of the carriage, and a part differentially actuated by said manipulative means to condition said member to project the stop corresponding to the predetermined columnar position identified with the means manipulated.

10. In a machine of the class described, a general operator, a paper carriage, a rack on said carriage, a releasable dog on the machine normally tending to engage said rack, carriage tabulating mechanism including a movable frame on the carriage, column stops on the said frame, a machine stop, means for shifting any one of said column stops into the path of said machine stop, a catch to retain said stop shifting means in effective position and a pawl actuated by said general operator at the concluding portion of a cyclic operation of the machine to disable said catch to permit said frame to move the column stops out of the path of the machine stop.

11. In a machine of the class described, the combination of a paper carriage, a general operator, a rack on said carriage, a releasable dog on the machine normally tending to engage said rack to detain the carriage, a stationary stop on the machine, a pivoted rack on the carriage, a column stop on said rack, means tending to move said rack to a position to maintain said column stop out of the path of the machine stop, means to operate said last mentioned rack to move said column stop into the path of said machine stop, said last mentioned means including a normally retracted cam and means actuated by the general operator at the conclusion of a cyclic movement thereof to withdraw said cam.

12. A machine of the class described, comprising in combination, a tensioned paper carriage, a rack on the carriage, a releasable dog normally tending to engage said rack to prevent movement of the carriage relative to the machine, a spring-actuated frame on the carriage, a plurality of stops on said frame to define columnar positions of the carriage, a stop on the machine, manual means effective to cause said frame to be shifted to position one of said columnar stops to co-act with said machine stop and to disable said dog, means actuated by said columnar stop as an incident to co-acting with said machine stop to re-enable said dog, and machine actuated means to disable said column stop positioning means.

13. A machine of the class described, comprising in combination, a tensioned paper carriage, a carriage rack, a releasable dog normally engaging said rack to detain the carriage, column stops, a rack provided upon the carriage along which the column stops are independently adjustable, a stationary counter stop, means for shifting any of said column stops into engagement with said counter stop and mechanically detaining the arrested carriage during the cycling of the machine, means to automatically return the column stop to normal position and to restore the carriage to the control of said dog, a key actuated carriage return train, said train including means moved by said key and automatically latched in effective position for silencing the carriage returning train before the returning carriage reaches the first column, the carriage being permitted to overrun the first column, tabulating means operable by the carriage returning mechanism for arresting the carriage at the second column upon its recoil, and means to automatically unlatch said silencing means.

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