

March 19, 1940.

O. J. SUNDSTRAND

2,194,270

COMPUTING AND PRINTING MACHINE

Filed Dec. 18, 1931

30 Sheets-Sheet 1

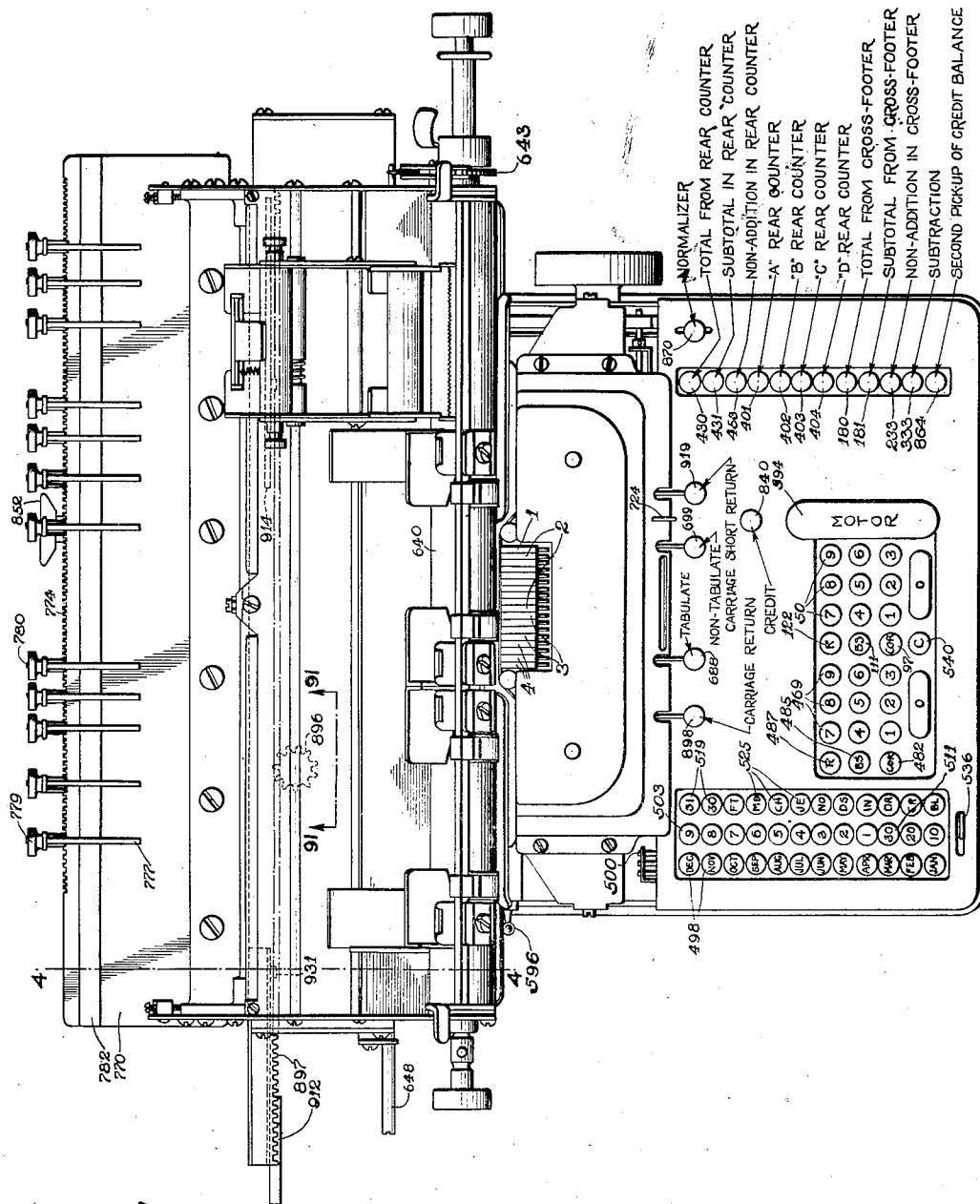


FIG. 1

Inventor
O. J. Sundstrand
By *Chas. A. Carter* *Paul A. Carter*
Attorneys

March 19, 1940.

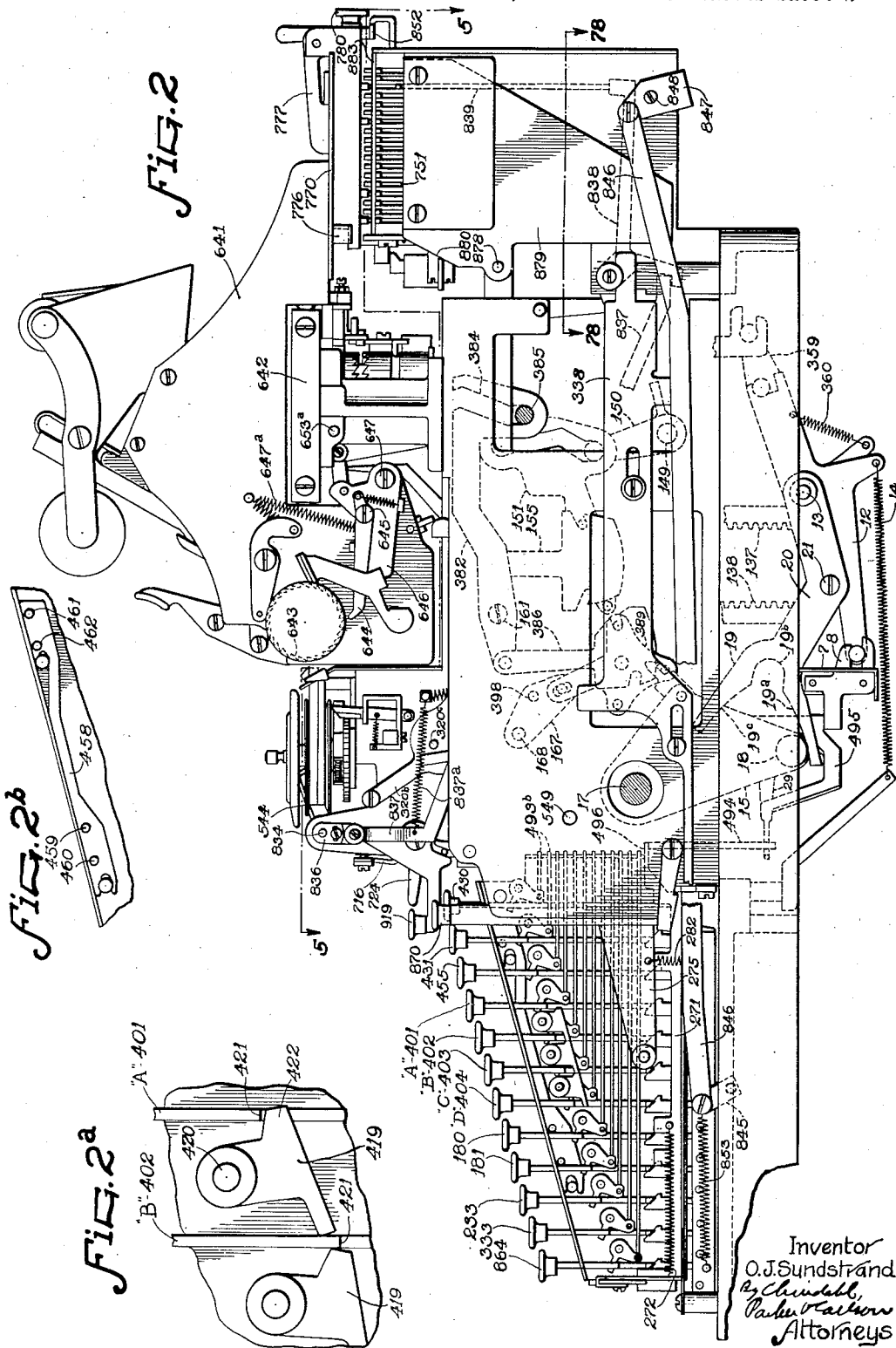
O. J. SUNDSTRAND

2,194,270

COMPUTING AND PRINTING MACHINE

Filed Dec. 18, 1931

30 Sheets-Sheet 2



March 19, 1940.

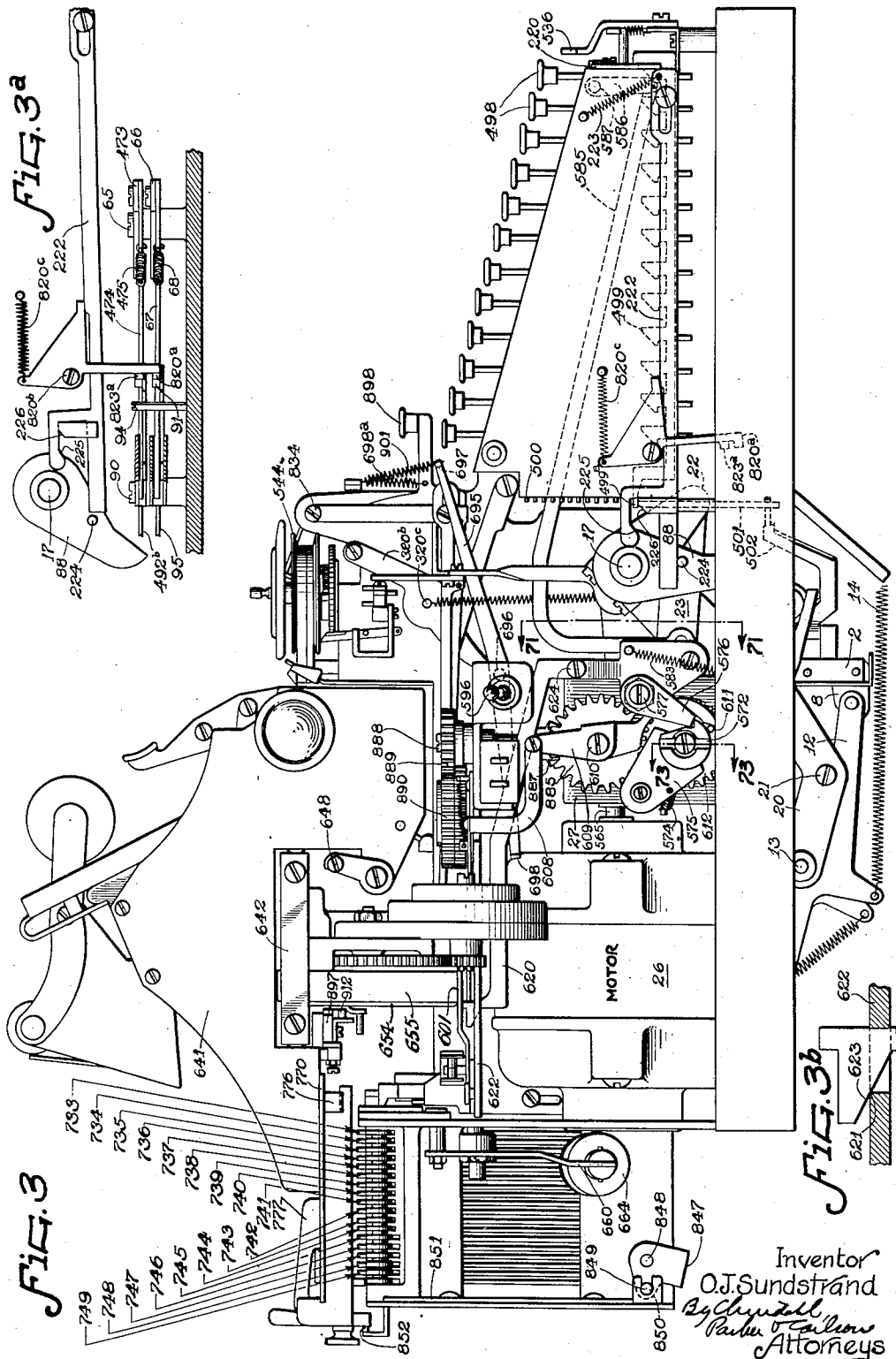
O. J. SUNDSTRAND

2,194,270

COMPUTING AND PRINTING MACHINE

Filed Dec. 18, 1931

30 Sheets-Sheet 3



March 19, 1940.

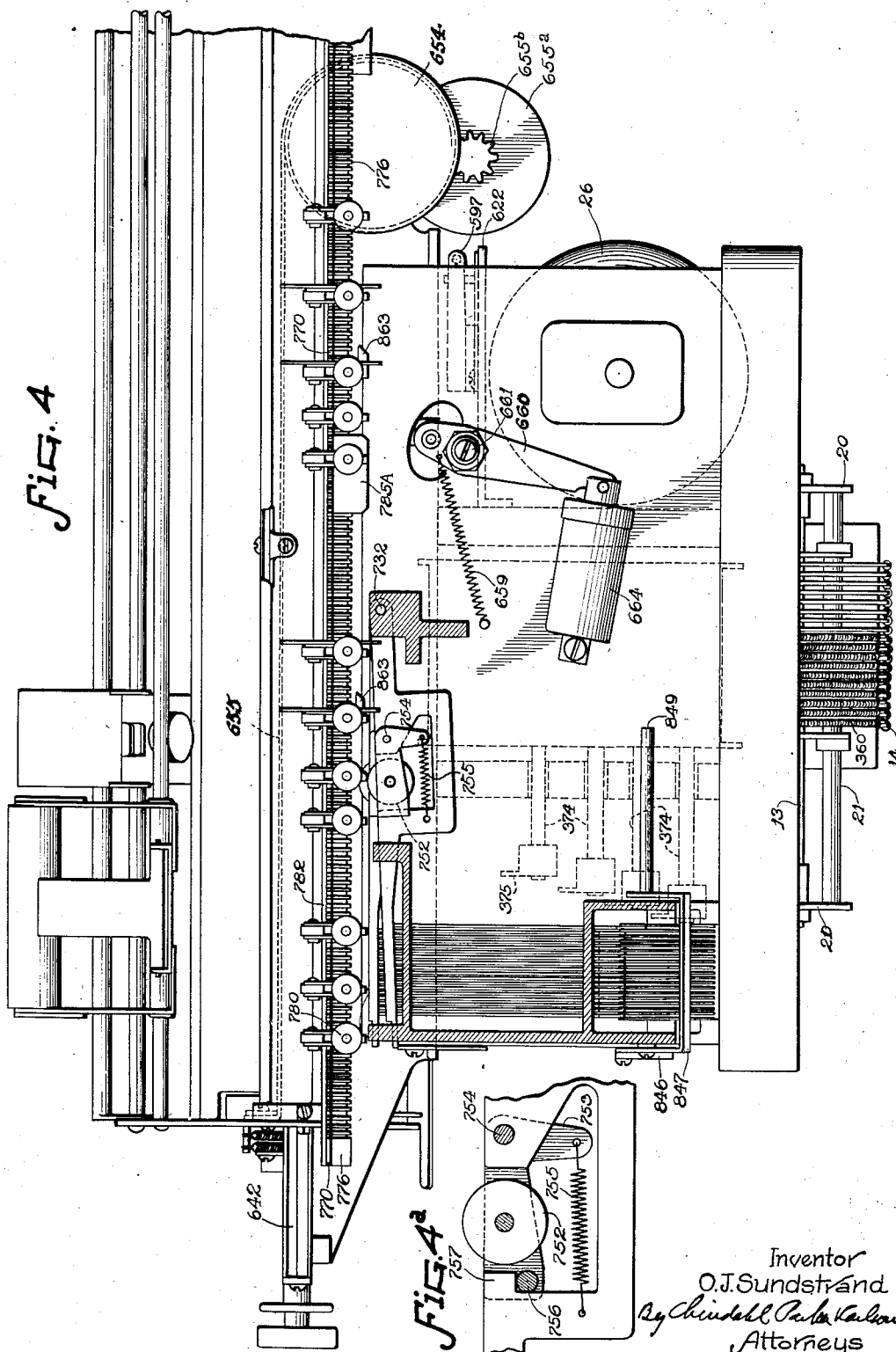
O. J. SUNDSTRAND

2,194,270

COMPUTING AND PRINTING MACHINE

Filed Dec. 18, 1931

30 Sheets-Sheet 4



March 19, 1940.

O. J. SUNDSTRAND

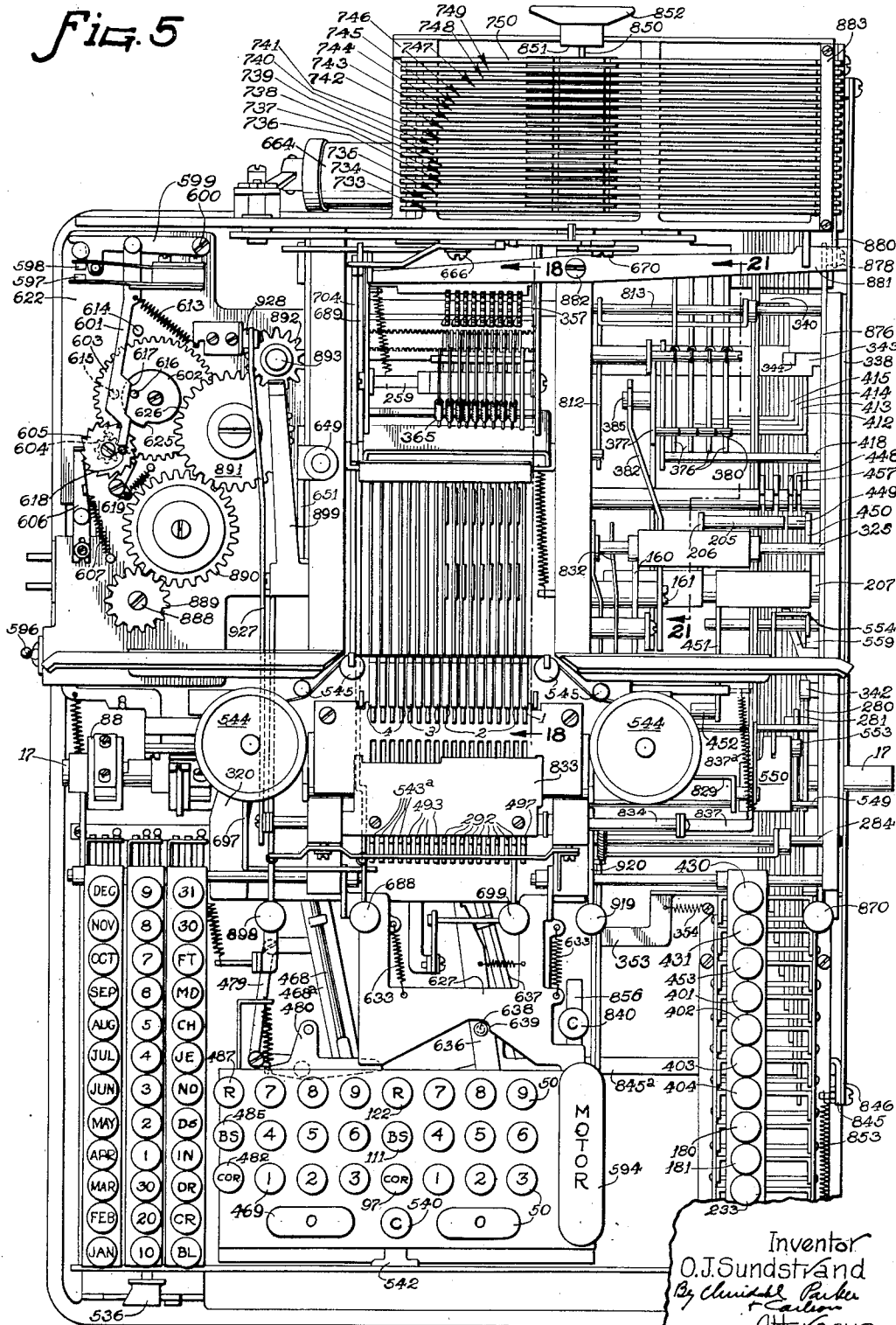
2,194,270

COMPUTING AND PRINTING MACHINE

Filed Dec. 18, 1931

30 Sheets-Sheet 5

Fig. 5



Inventor
O.J. Sundstrand
By Clivedale Parker
Carlson
Attorneys

March 19, 1940.

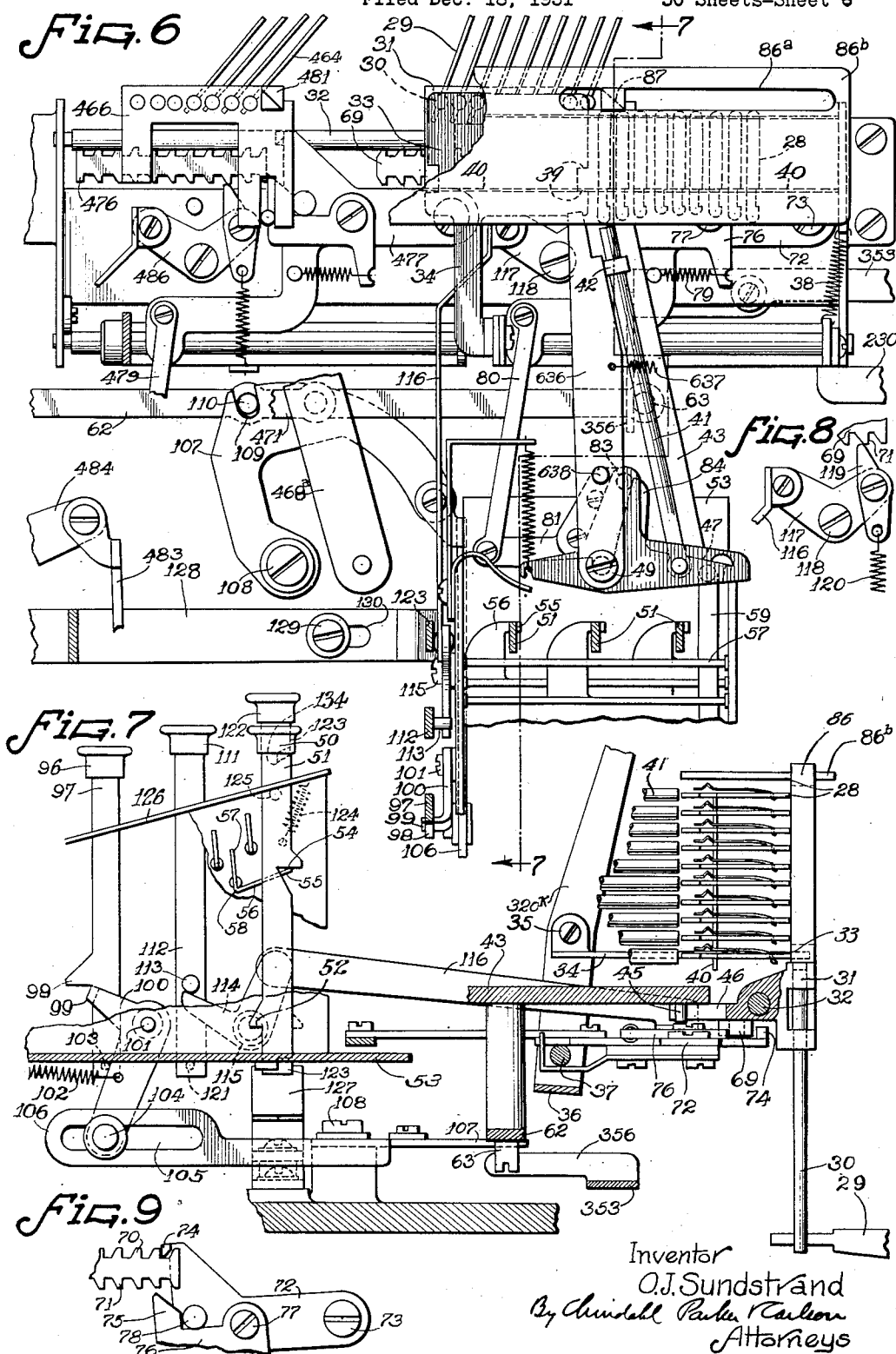
O. J. SUNDSTRAND

2,194,270

COMPUTING AND PRINTING MACHINE

Filed Dec. 18, 1931

30 Sheets-Sheet 6



March 19, 1940.

O. J. SUNDSTRAND

2,194,270

COMPUTING AND PRINTING MACHINE

Filed Dec. 18, 1931

30 Sheets-Sheet 7

Fig. 10

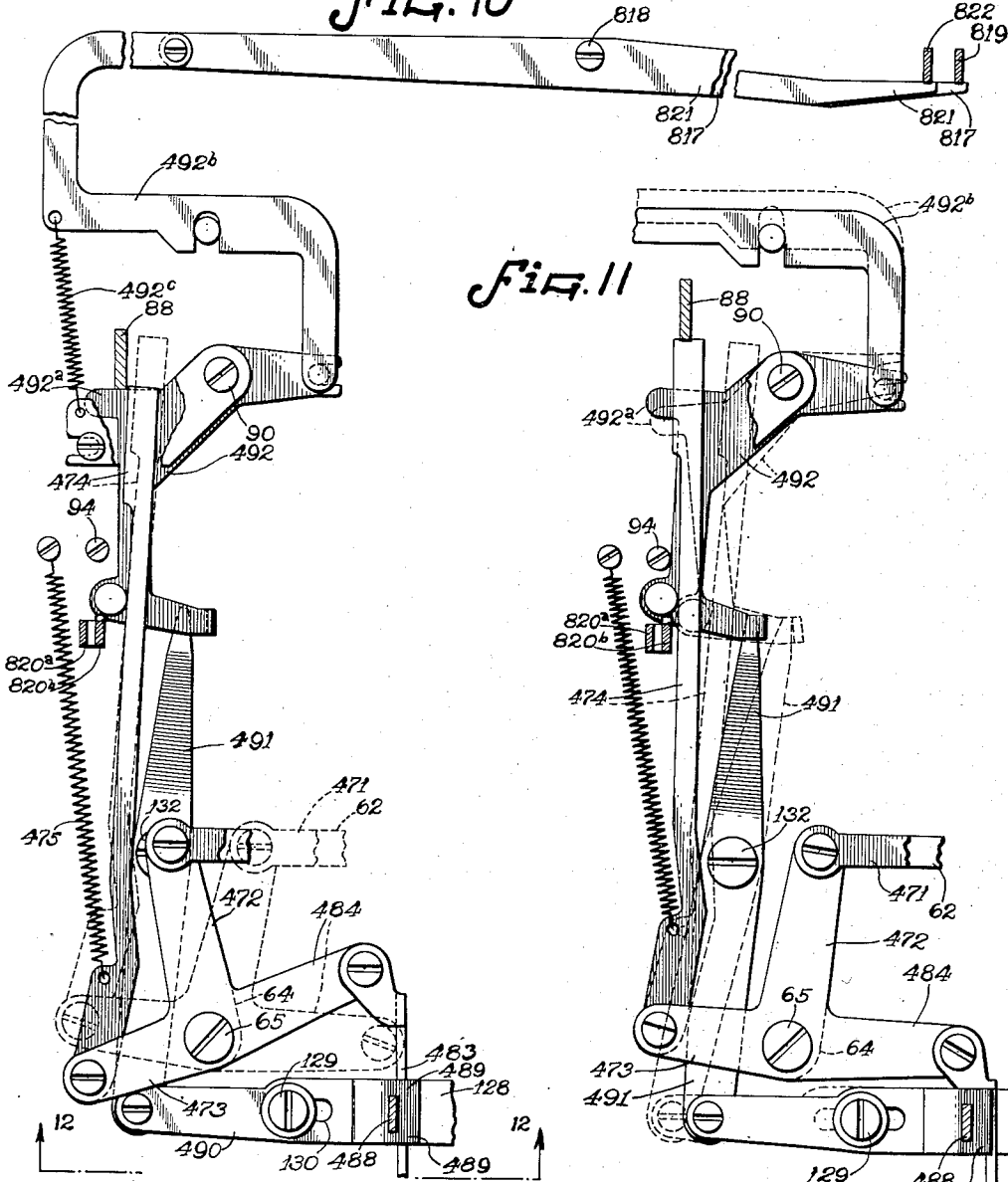
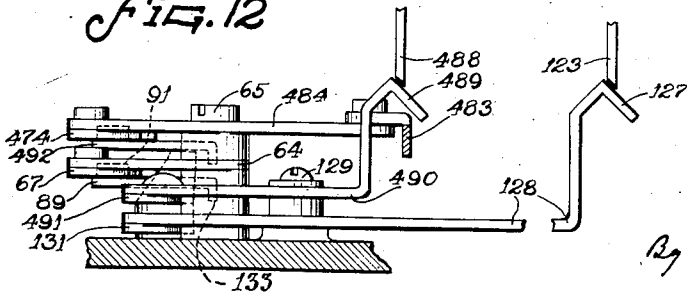


Fig. 12



Inventor
O. J. Sundstrand
By *Clindell Parker Carlson*
Attorneys

March 19, 1940.

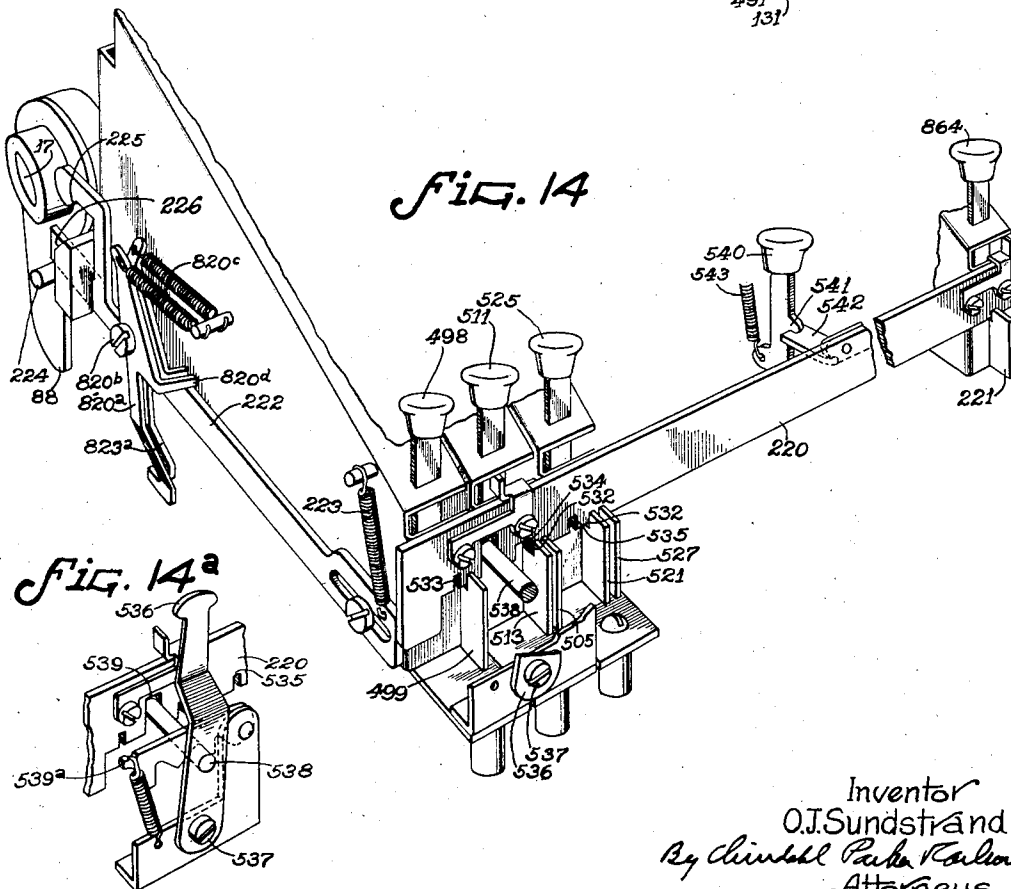
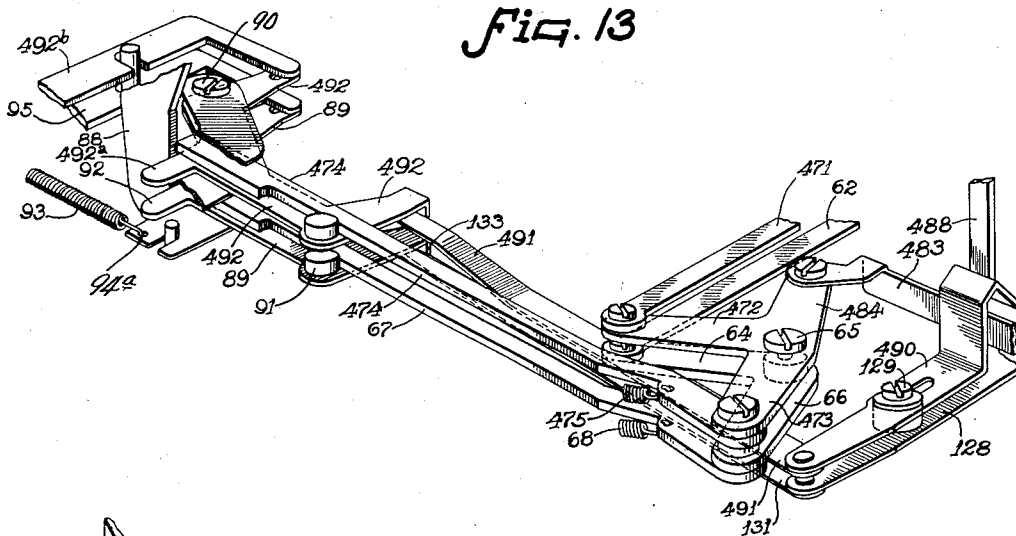
O. J. SUNDSTRAND

2,194,270

COMPUTING AND PRINTING MACHINE

Filed Dec. 18, 1931

30 Sheets-Sheet 8



Inventor
O.J.Sundstrand
By *Chimbel Park Kallan*
Attorneys

March 19, 1940.

O. J. SUNDSTRAND

2,194,270

COMPUTING AND PRINTING MACHINE

Filed Dec. 18, 1931

30 Sheets-Sheet 9

Fig. 15

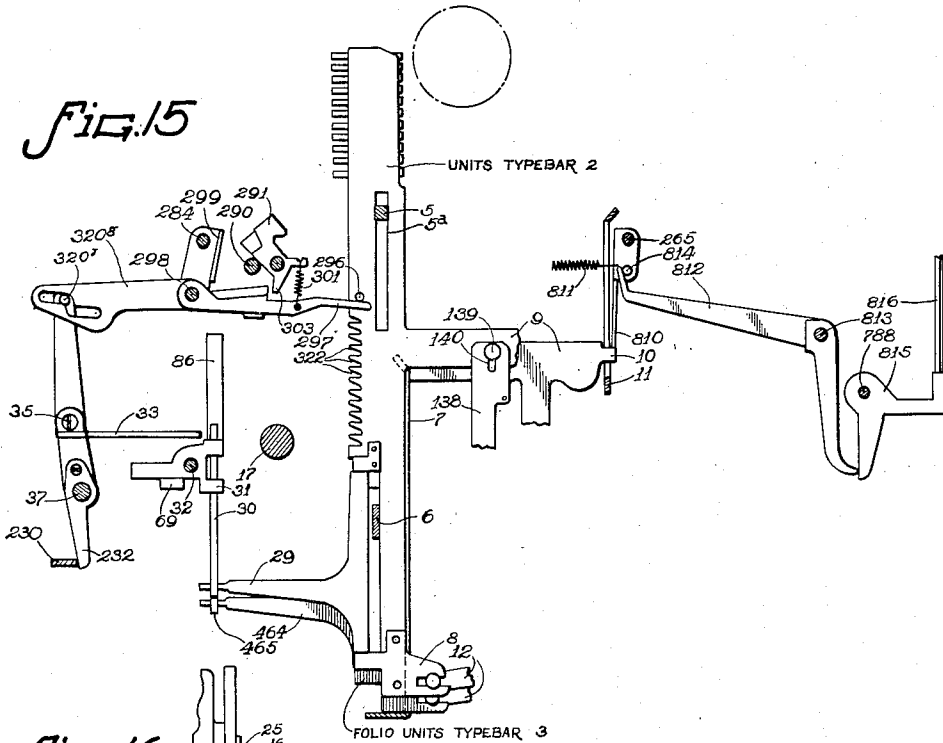


Fig. 16

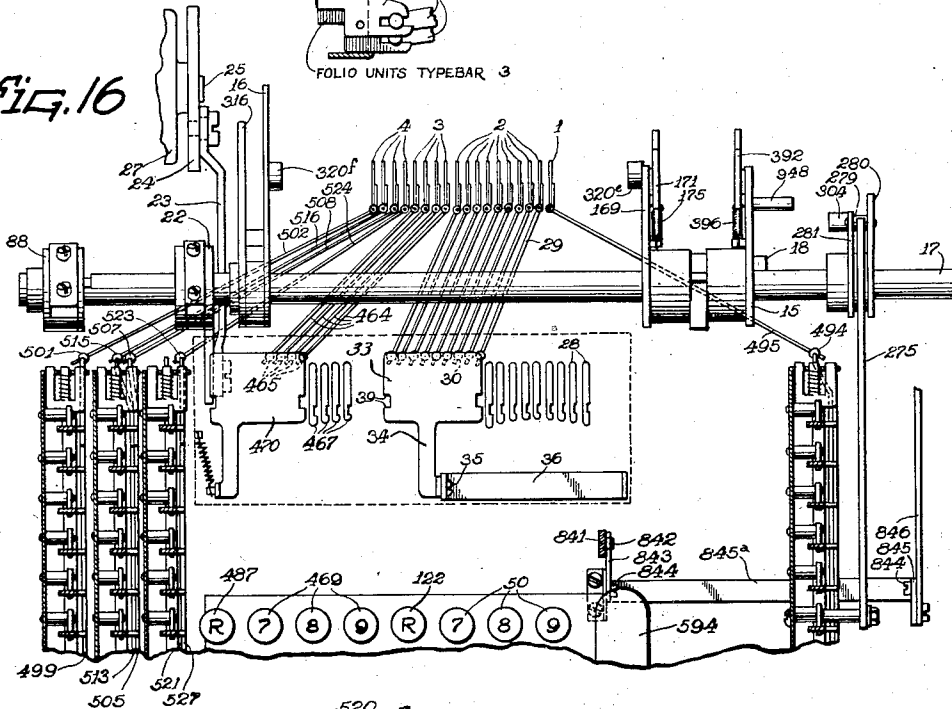
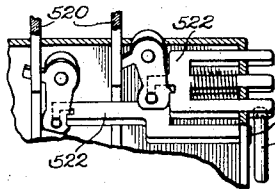


Fig. 17



Inventor
O. J. Sundstrand
By *Clintell Carter Carlson*
Attorneys

March 19, 1940.

O. J. SUNDSTRAND

2,194,270

COMPUTING AND PRINTING MACHINE

Filed Dec. 18, 1931

30 Sheets—Sheet 10

FIG. 18

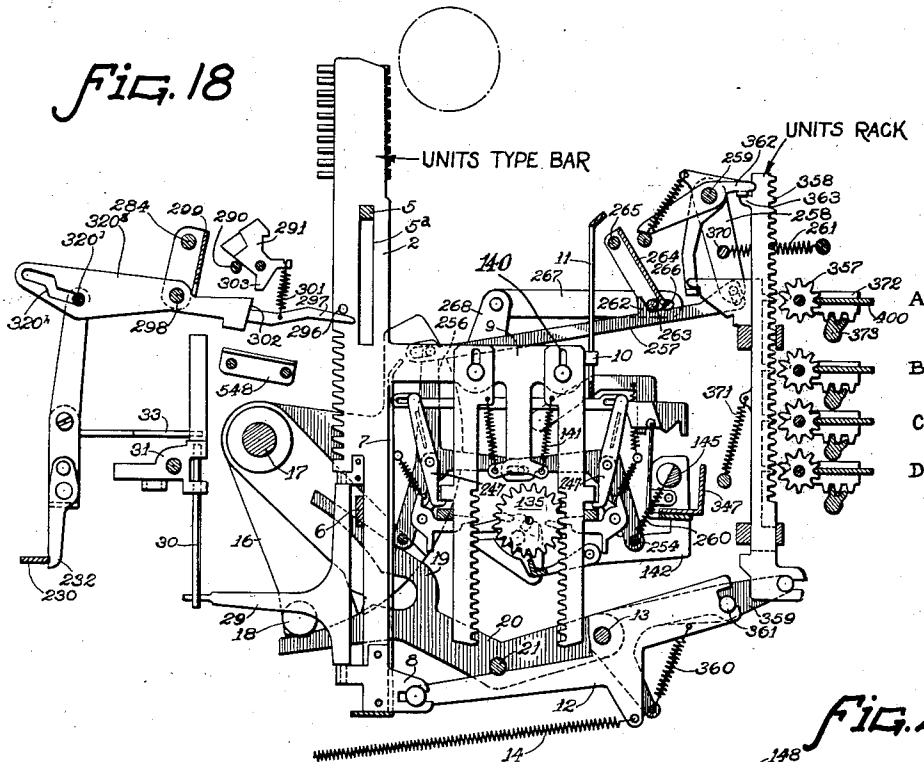


FIG. 19

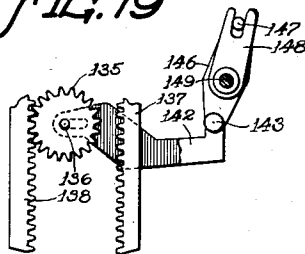
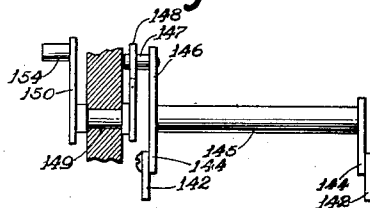


FIG. 20



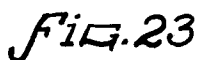
O. J. SUNDSTRAND

COMPUTING AND PRINTING MACHINE

Filed Dec. 18, 1931

30 Sheets-Sheet 11

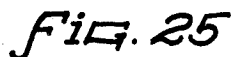
ADDITION (*Beginning of forward stroke*)



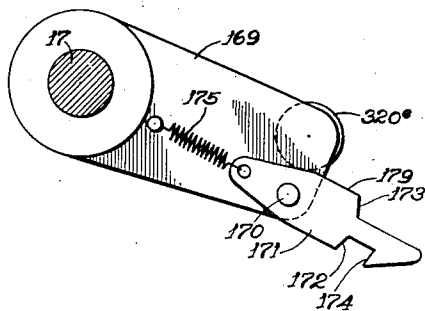
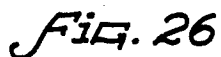
ADDITION (*Beginning of
return stroke.*)



NON-ADDITION



NON-ADDITION (Ending of
return stroke)



Inventor
O.J. Sundstrand
By *Arvidable Parker Carlson*
Attorneys

March 19, 1940.

O. J. SUNDSTRAND

2,194,270

COMPUTING AND PRINTING MACHINE

Filed Dec. 18, 1931

30 Sheets-Sheet 12

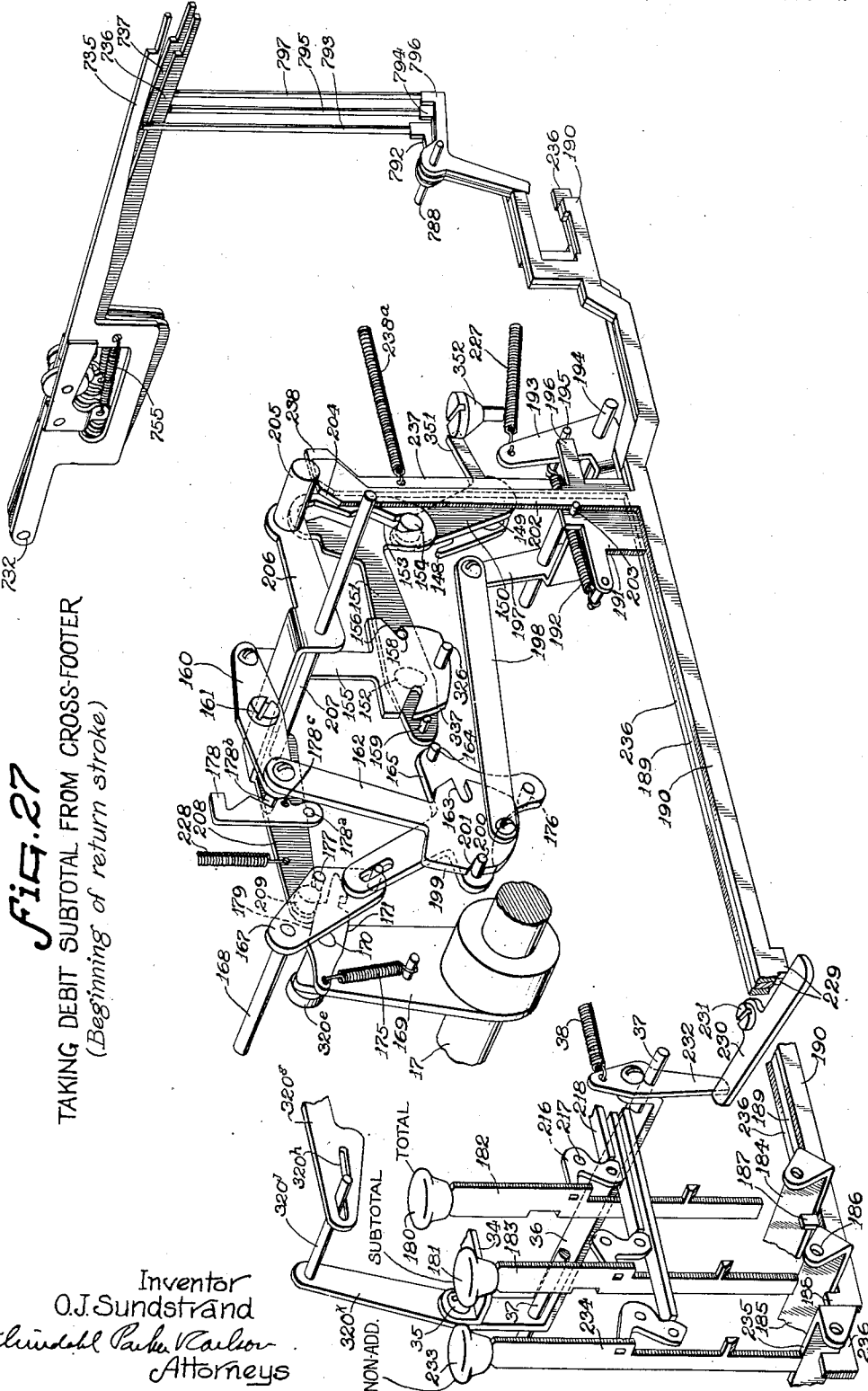


FIG. 27

TAKING DEBIT SUBTOTAL FROM CROSS-FOOTER
(Beginning of return stroke.)

Inventor
O.J. Sundstrand
By Charles Parker Carlson
Attorneys

March 19, 1940.

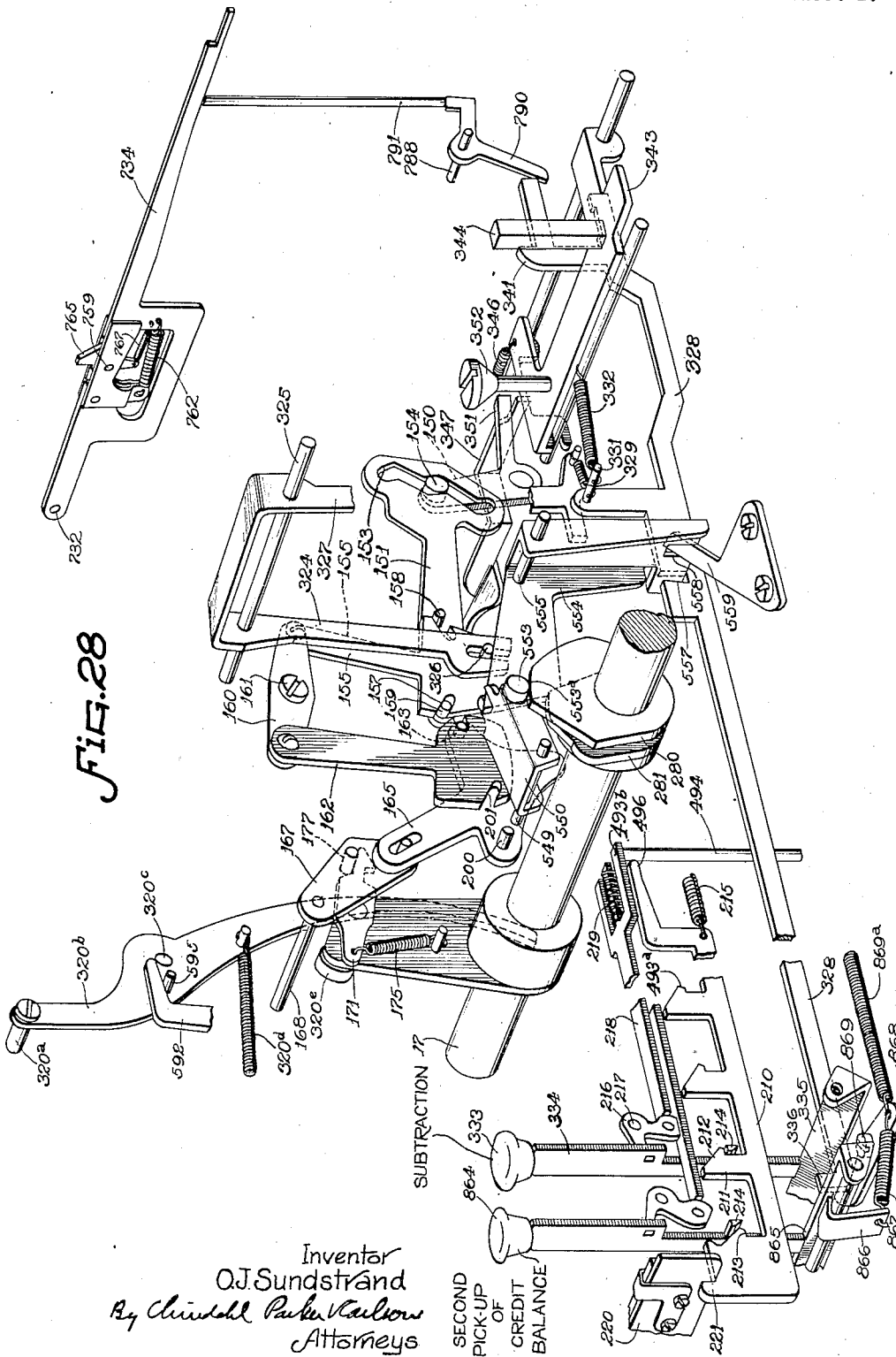
O. J. SUNDSTRAND

2,194,270

COMPUTING AND PRINTING MACHINE

Filed Dec. 18, 1931

30 Sheets-Sheet 13



March 19, 1940.

O. J. SUNDSTRAND

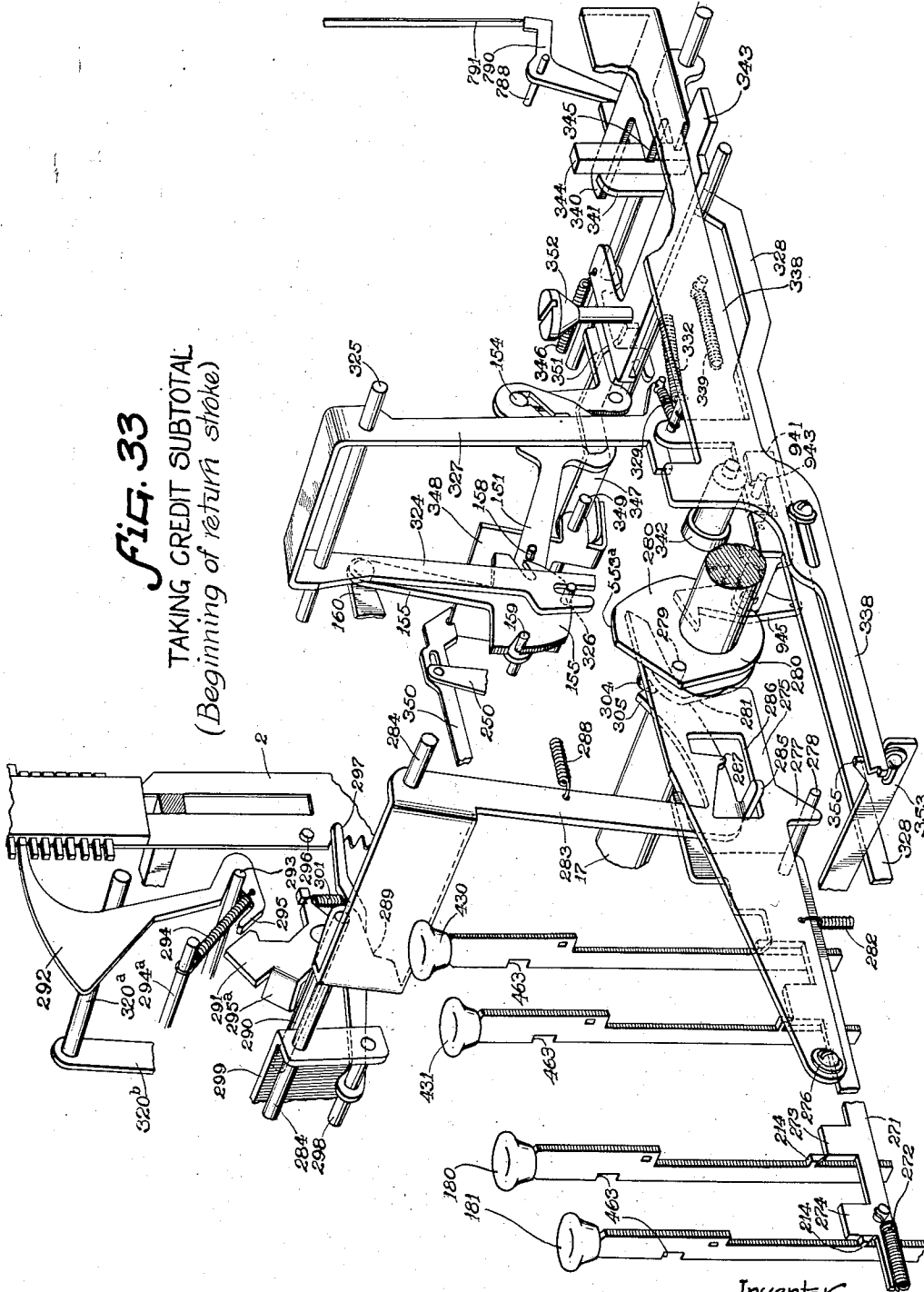
2,194,270

COMPUTING AND PRINTING MACHINE

Filed Dec. 18, 1931

30 Sheets-Sheet 15

FIG. 33
TAKING CREDIT SUBTOTAL
(Beginning of return stroke)



Inventor
O. J. Sundstrand
By *Charles R. Carlson*
Attorneys

March 19, 1940.

O. J. SUNDSTRAND

2,194,270

COMPUTING AND PRINTING MACHINE

Filed Dec. 18, 1931

30 Sheets-Sheet 16

Fig. 34

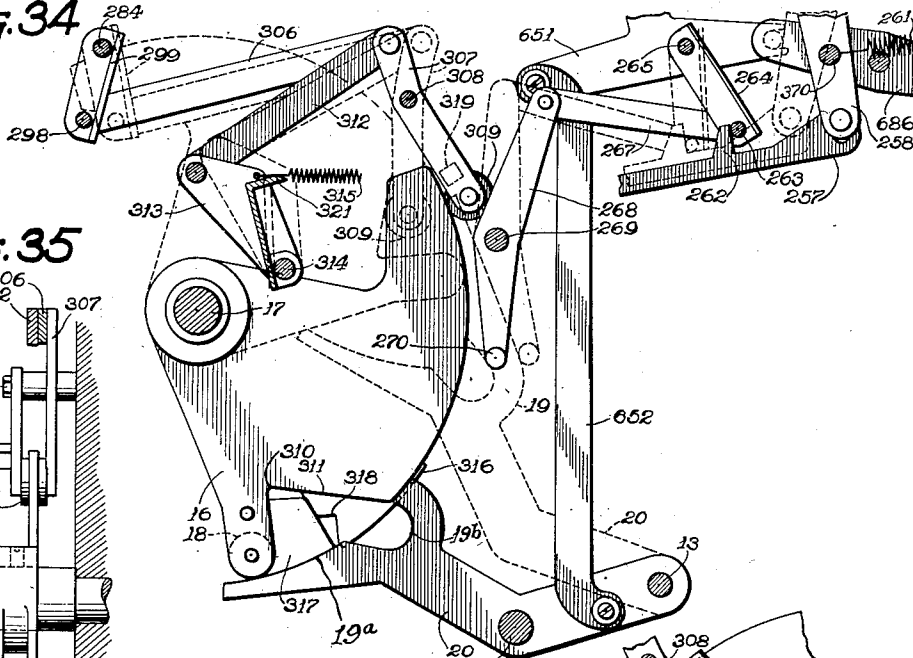


Fig. 35

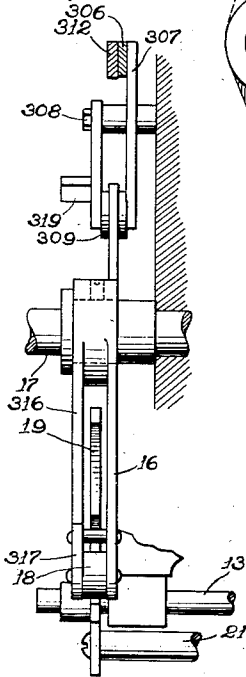


Fig. 36

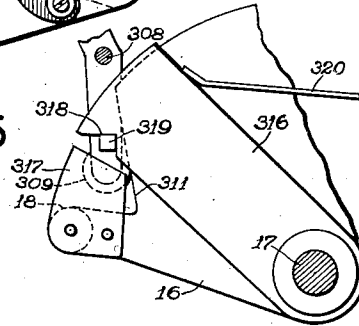


Fig. 37

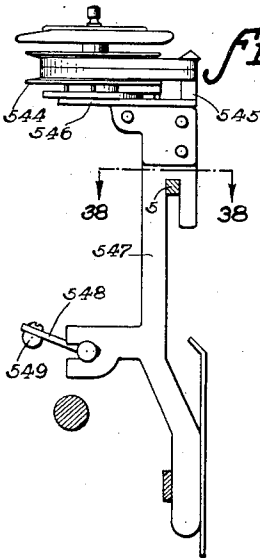
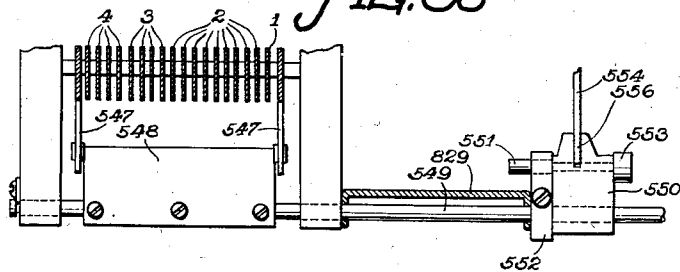


Fig. 38



Inventor
O. J. Sundstrand
By *Clifford R. Carlson*
Attorneys

March 19, 1940.

O. J. SUNDSTRAND

2,194,270

COMPUTING AND PRINTING MACHINE

Filed Dec. 18, 1931

30 Sheets-Sheet 18

FIG. 44

*Beginning of return stroke
in a subtracting
cycle.*

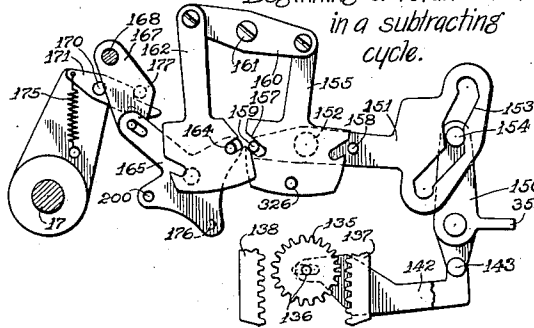


FIG. 45

*Beginning a subtracting
cycle following a subtracting
cycle.*

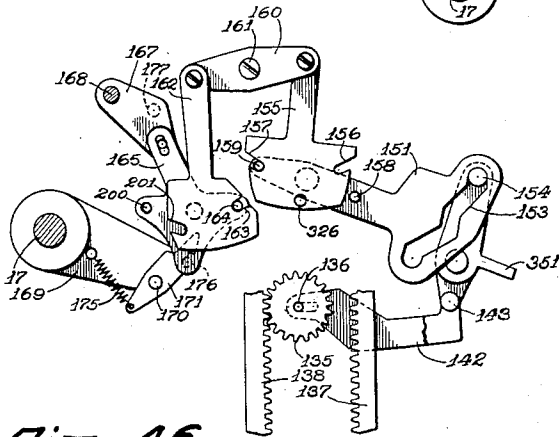


FIG. 46

*Beginning of forward stroke
in taking credit subtotal or
total following a
credit subtotal*

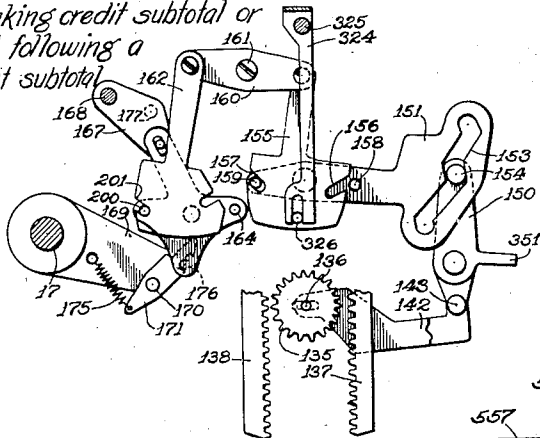


FIG. 48

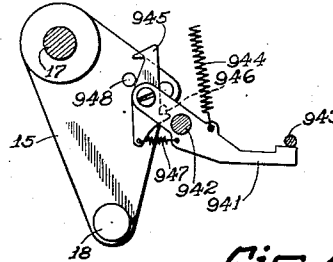


FIG. 49

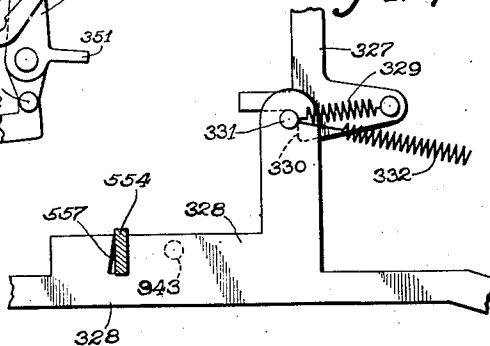
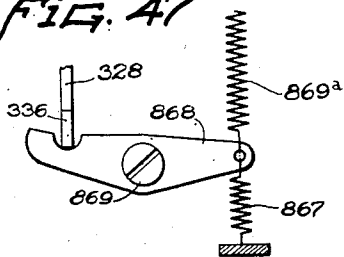


FIG. 47



Inventor
O. J. Sundstrand
By *Chindell Parker Carlson*
Attorneys

March 19, 1940.

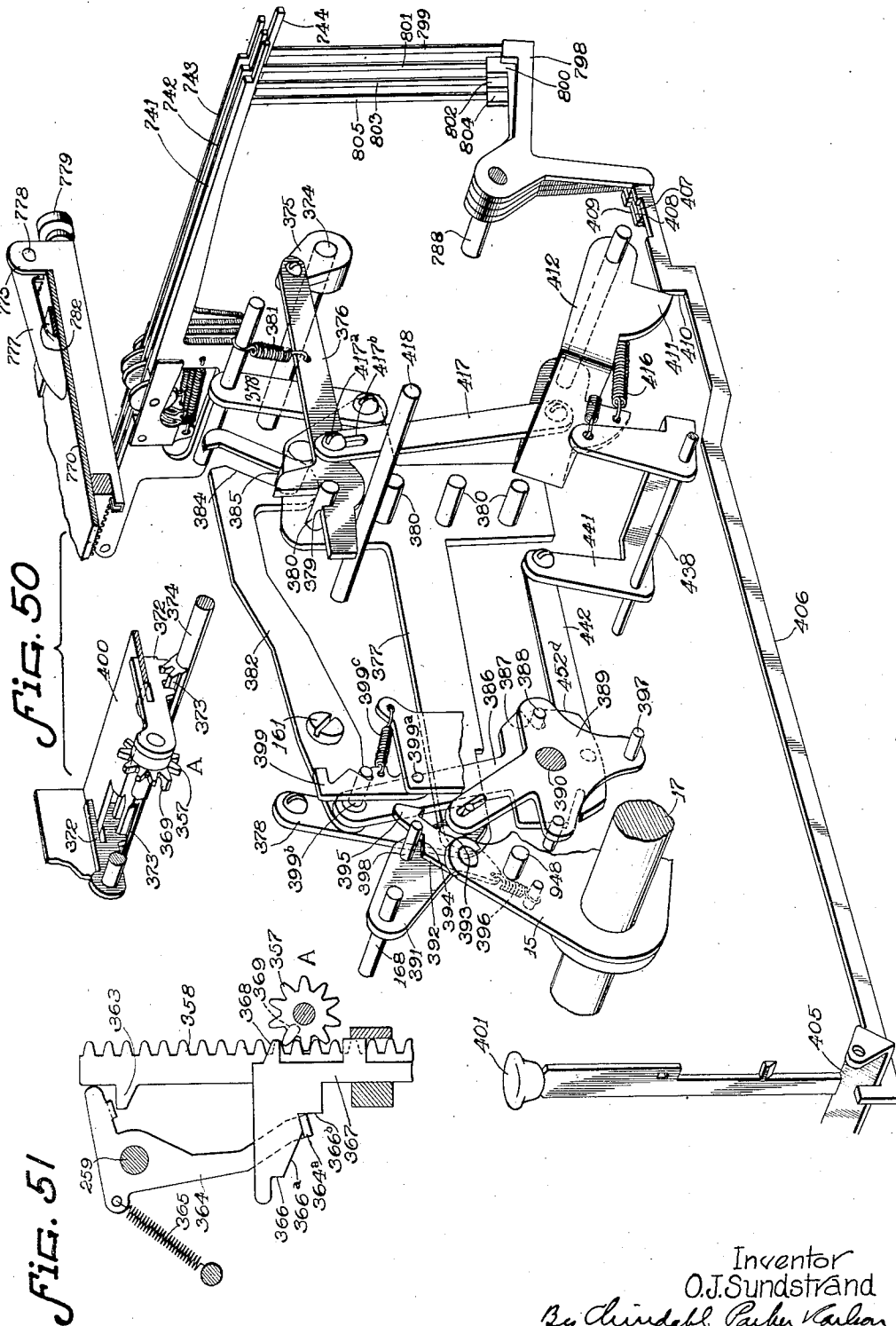
O. J. SUNDSTRAND

2,194,270

COMPUTING AND PRINTING MACHINE

Filed Dec. 18, 1931

30 Sheets-Sheet 19



Inventor
O.J. Sundstrand
By *Chindell Parker Carlson*
Attorneys

March 19, 1940.

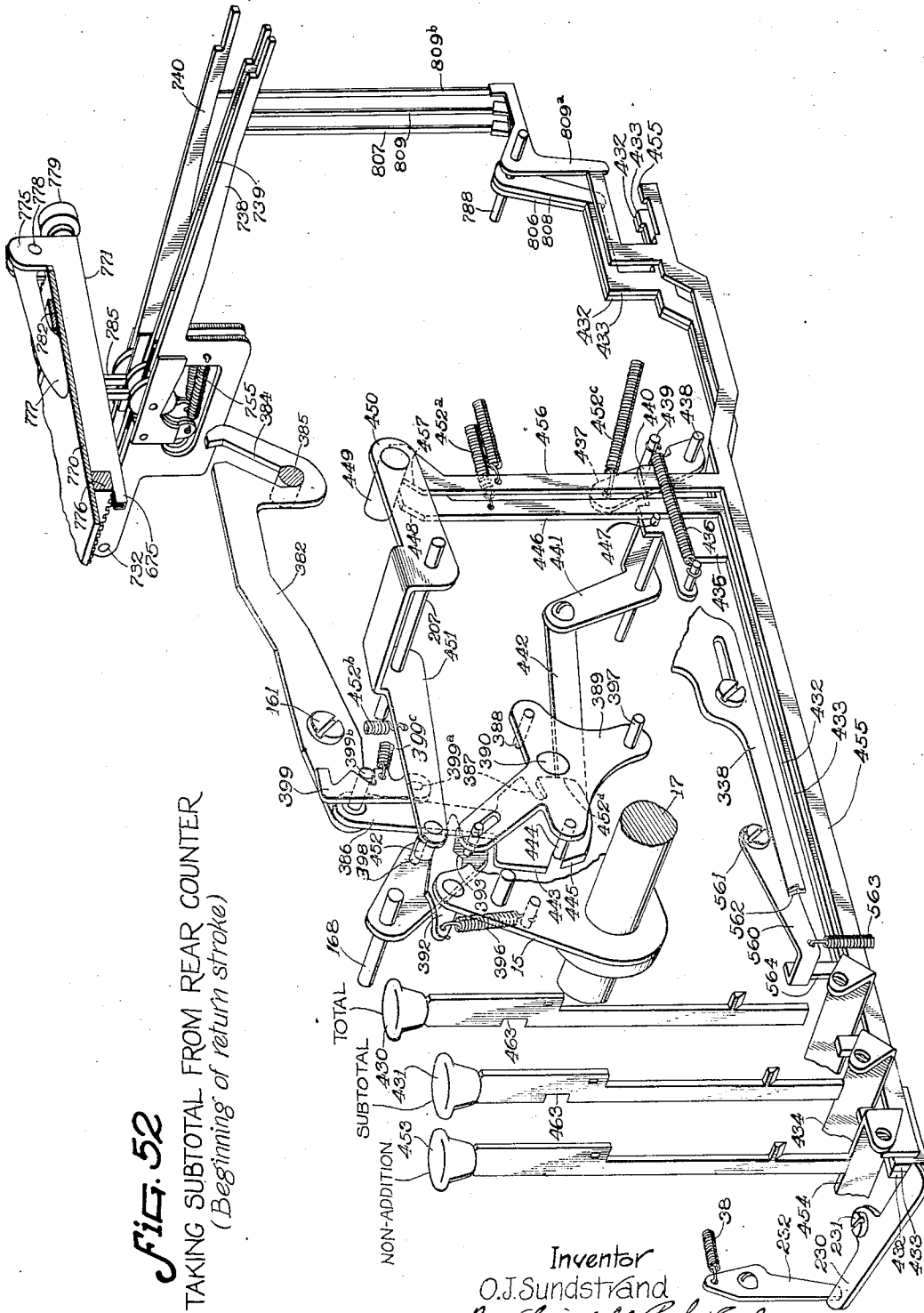
O. J. SUNDSTRAND

2,194,270

COMPUTING AND PRINTING MACHINE

Filed Dec. 18, 1931

30 Sheets-Sheet 20



Inventor
O.J. Sundstrand
By Chinabell Parker Carlson
Attorneys

March 19, 1940.

O. J. SUNDSTRAND

2,194,270

COMPUTING AND PRINTING MACHINE

Filed Dec. 18, 1931

30 Sheets-Sheet 21

Fig. 53

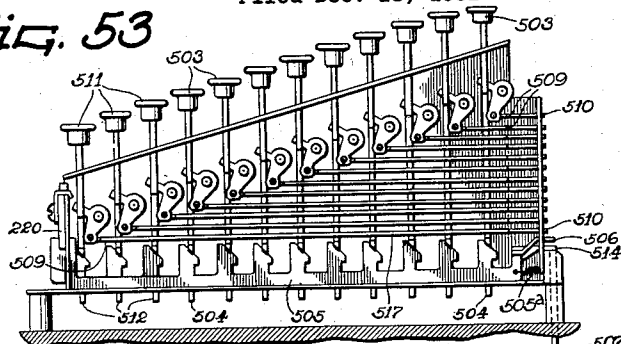


Fig. 54

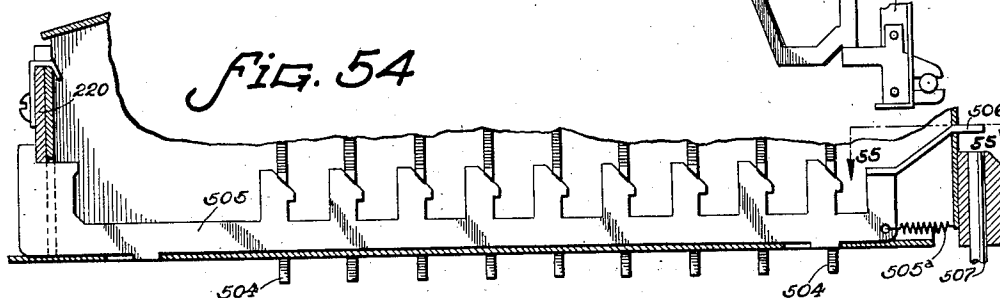


Fig. 56

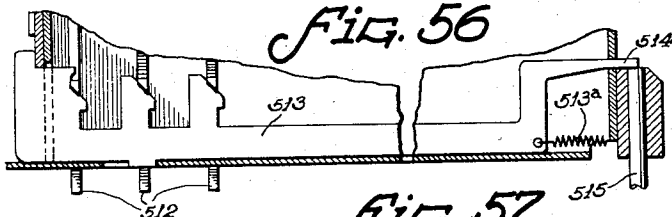


Fig. 55

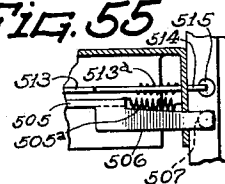


Fig. 57

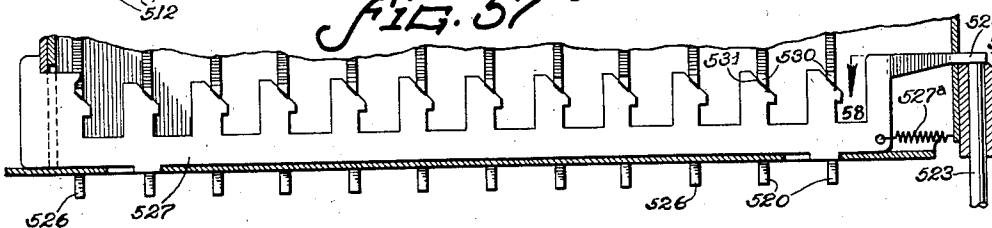


Fig. 59

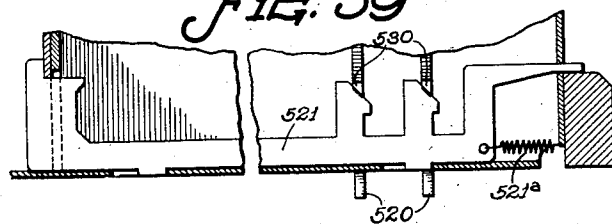
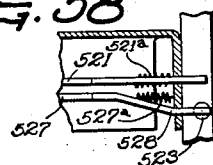


Fig. 58



Inventor
O. J. Sundstrand
By *Charles R. Carlson*
Attorneys

March 19, 1940.

O. J. SUNDSTRAND

2,194,270

COMPUTING AND PRINTING MACHINE

Filed Dec. 18, 1931

30 Sheets-Sheet 22

Fig. 60

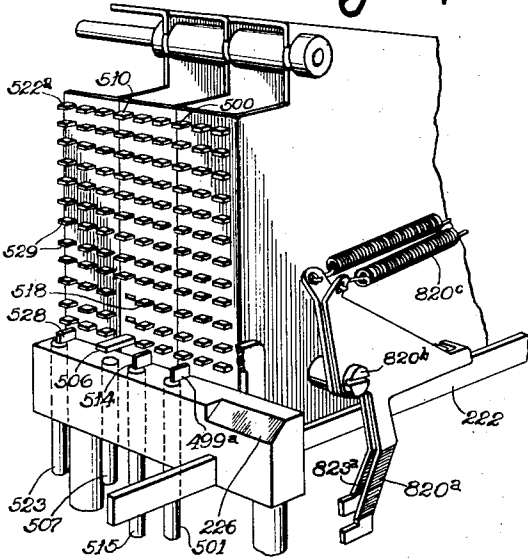


Fig. 61

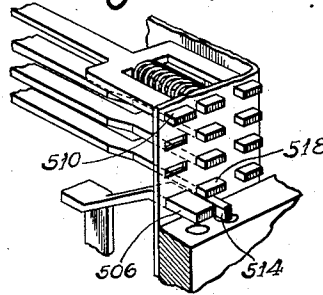


Fig. 62

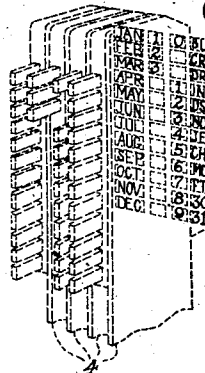
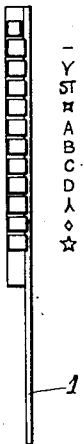


Fig. 63



- BLANK
 Y SUBTRACTION
 ST NON-ADDITION IN CROSS-FOOTER
 H SUBTOTAL FROM CROSS-FOOTER
 A TOTAL FROM CROSS-FOOTER
 B REAR COUNTER
 C REAR COUNTER
 D REAR COUNTER
 A REAR COUNTER
 A NON-ADDITION IN REAR COUNTER
 ♦ SUBTOTAL FROM REAR COUNTER
 ☆ TOTAL FROM REAR COUNTER

Inventor
 O. J. Sundstrand
 By *Chindell Parker Carlson*
 Attorneys

March 19, 1940.

O. J. SUNDSTRAND

2,194,270

COMPUTING AND PRINTING MACHINE

Filed Dec. 18, 1931

30 Sheets-Sheet 23

Fig. 64^a

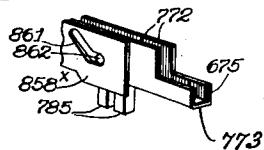


Fig. 64

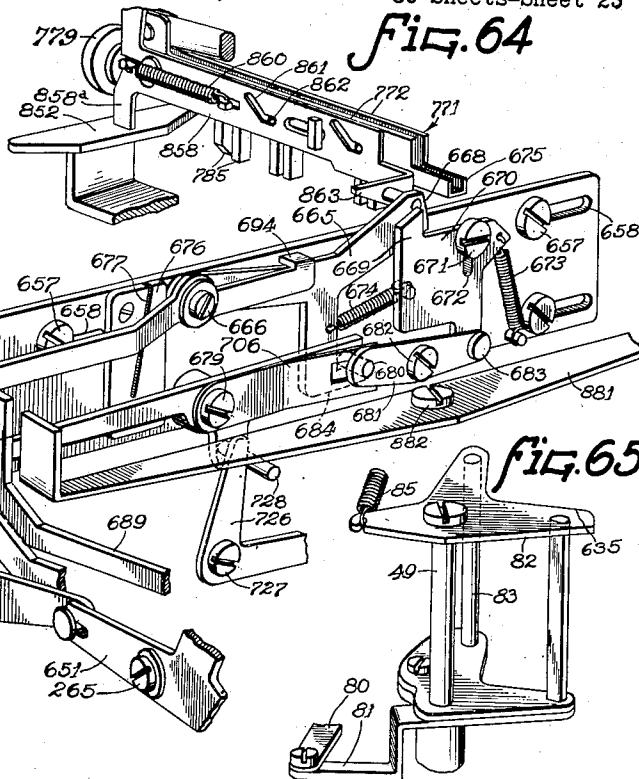


Fig. 65

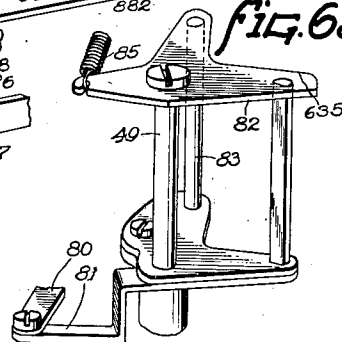


Fig. 66

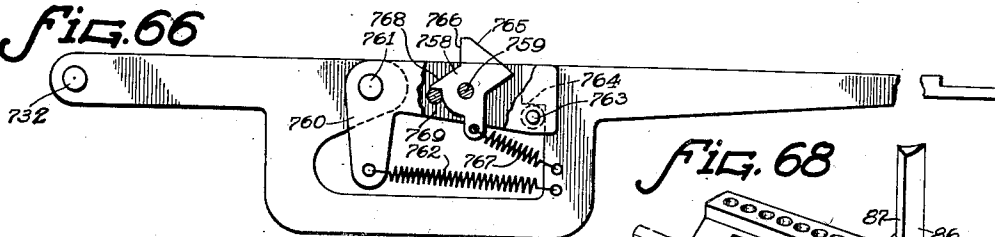


Fig. 68

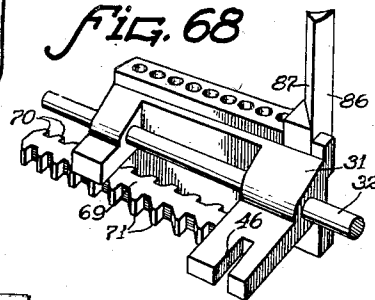


Fig. 67

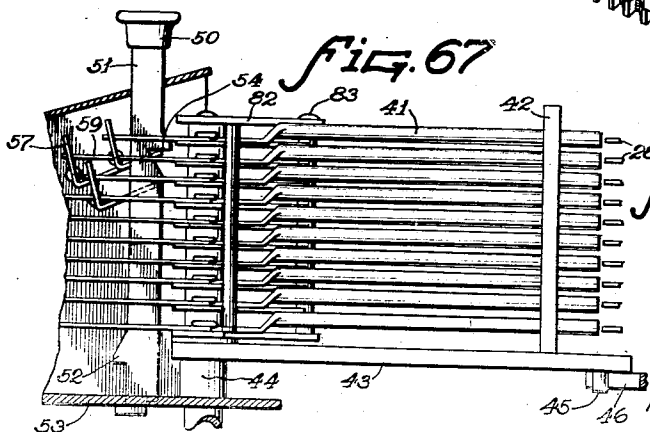
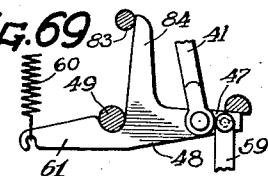


Fig. 69



Inventor
O. J. Sundstrand
By *Clint Dahl* *Parker Carlson*
Attorneys

March 19, 1940.

O. J. SUNDSTRAND

2,194,270

COMPUTING AND PRINTING MACHINE

Filed Dec. 18, 1931

30 Sheets-Sheet 24

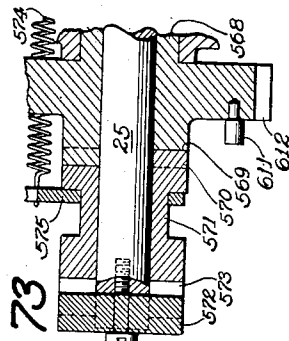


FIG. 73

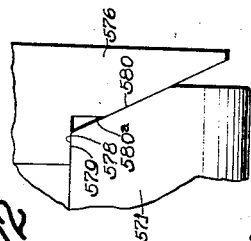


FIG. 72

FIG. 71

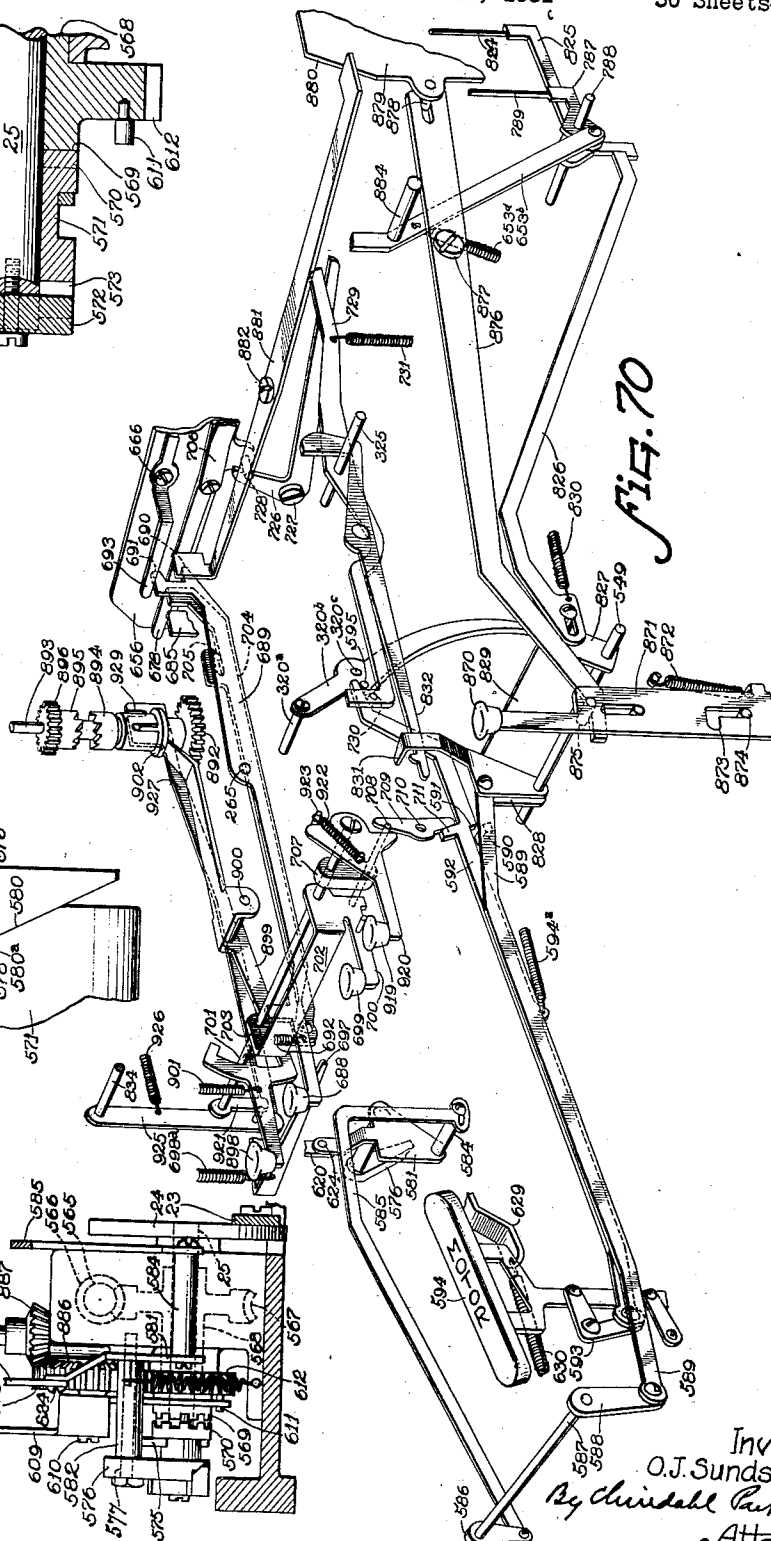
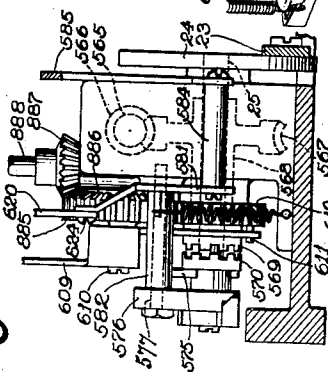


FIG. 70

Inventor
O. J. Sundstrand
By *Christie Parker*
Attorneys

March 19, 1940.

O. J. SUNDSTRAND

2,194,270

COMPUTING AND PRINTING MACHINE

Filed Dec. 18, 1931

30 Sheets-Sheet 25

Fig. 74

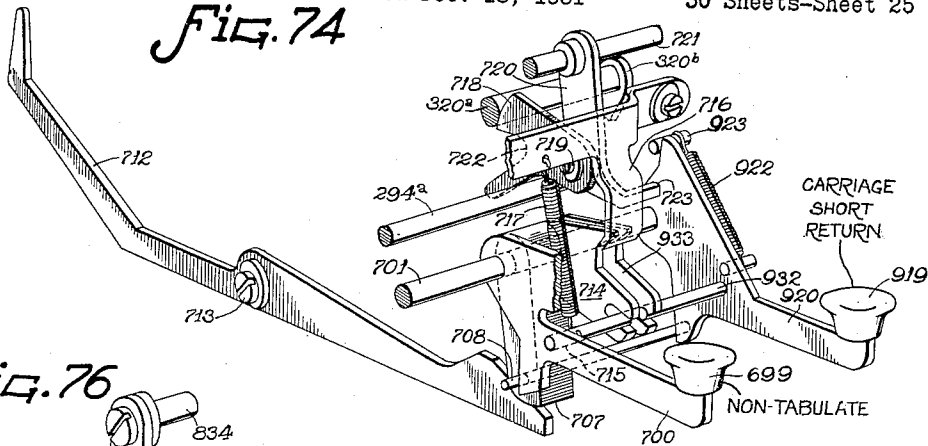


Fig. 76

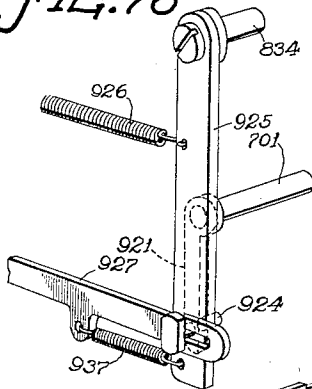


Fig. 75

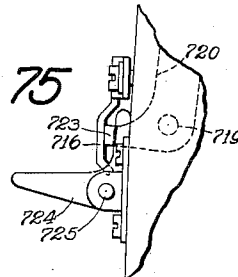
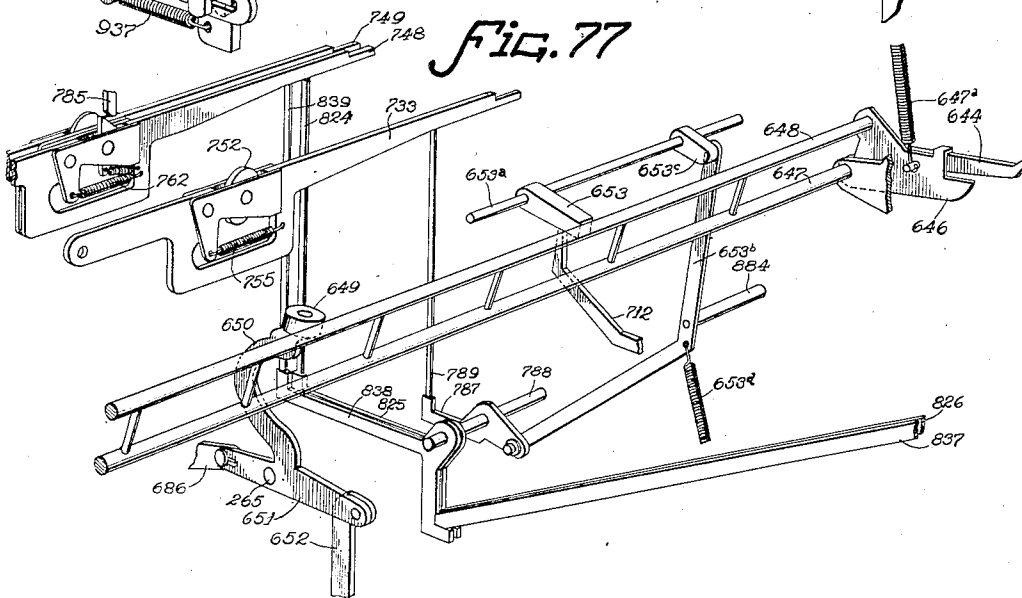


Fig. 77



Inventor
O.J. Sundstrand
By *Charles E. Carter*
Attorneys

March 19, 1940.

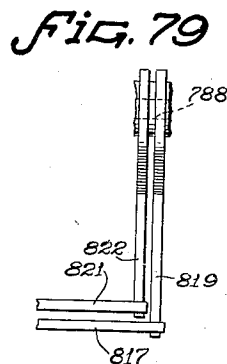
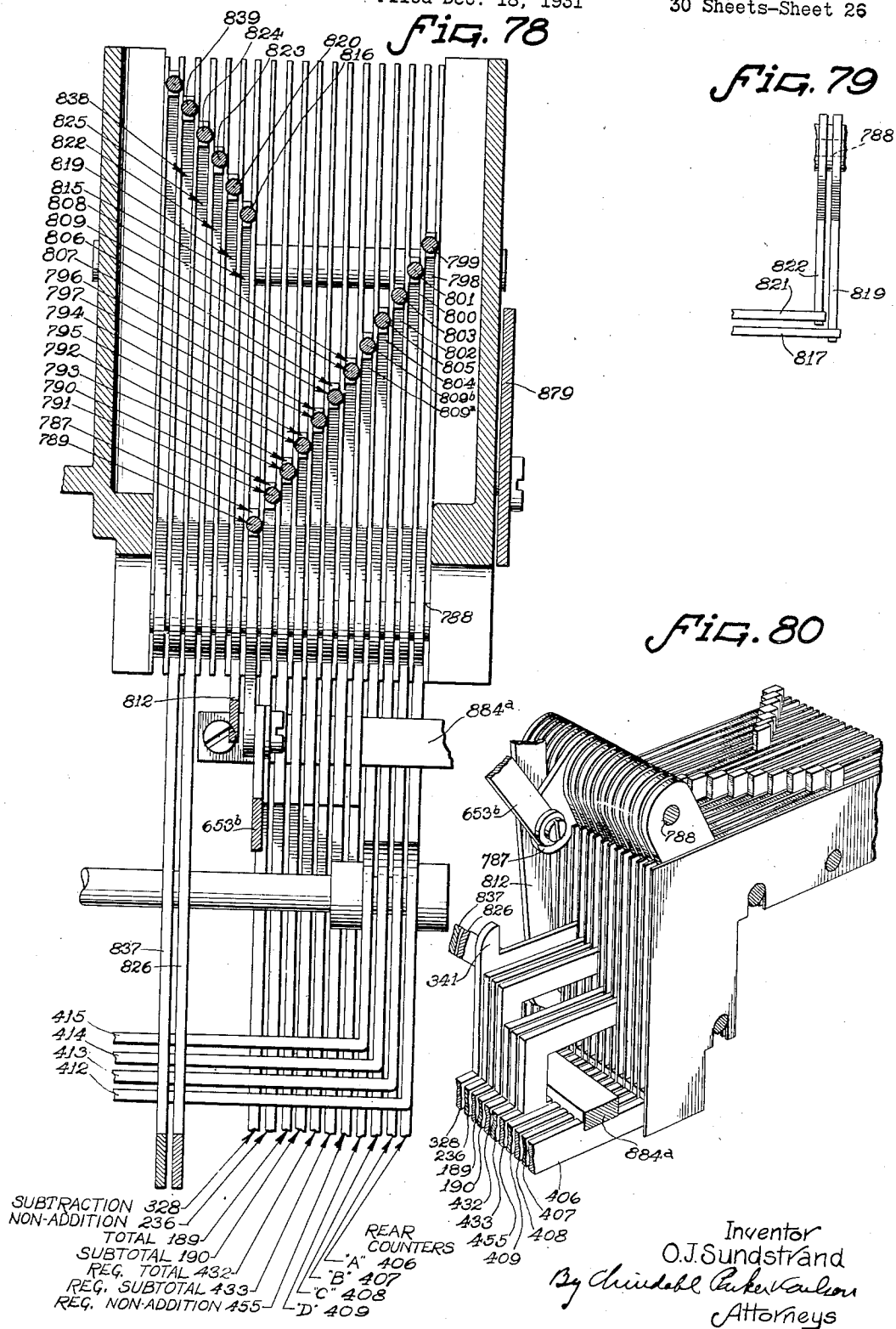
O. J. SUNDSTRAND

2,194,270

COMPUTING AND PRINTING MACHINE

Filed Dec. 18, 1931

30 Sheets-Sheet 26



March 19, 1940.

O. J. SUNDSTRAND

2,194,270

COMPUTING AND PRINTING MACHINE

Filed Dec. 18, 1931

30 Sheets-Sheet 27

Fig. 81

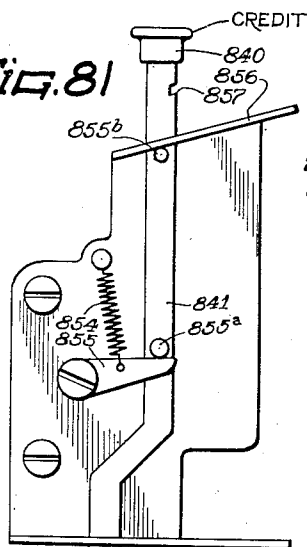


Fig. 83

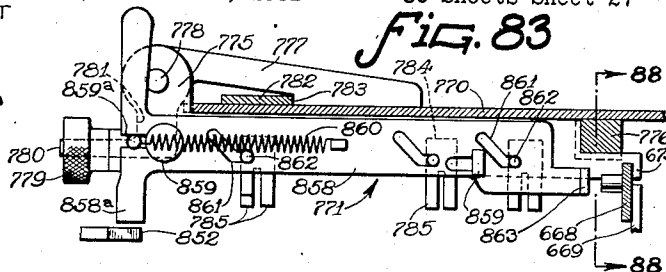


Fig. 84

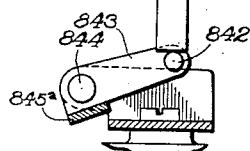
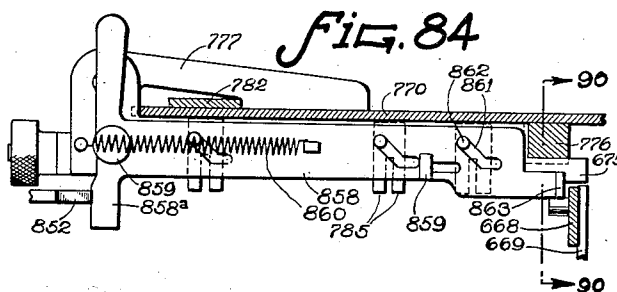


Fig. 82

Fig. 85

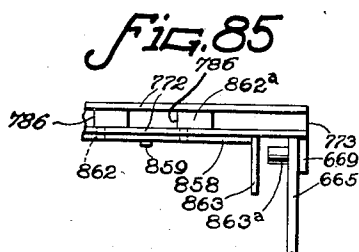


Fig. 86

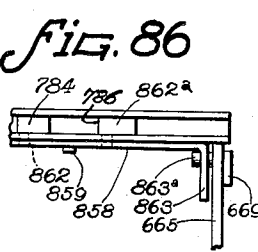


Fig. 87

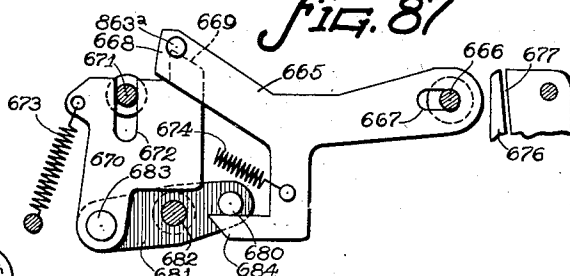


Fig. 88

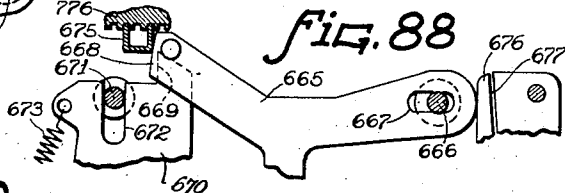
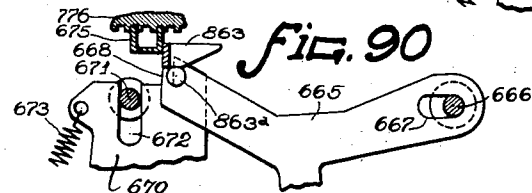


Fig. 90



Inventor
O.J. Sundstrand
By *Chindell Parker Carlson*
Attorneys

March 19, 1940.

O. J. SUNDSTRAND

2,194,270

COMPUTING AND PRINTING MACHINE

Filed Dec. 18, 1931

30 Sheets-Sheet 28

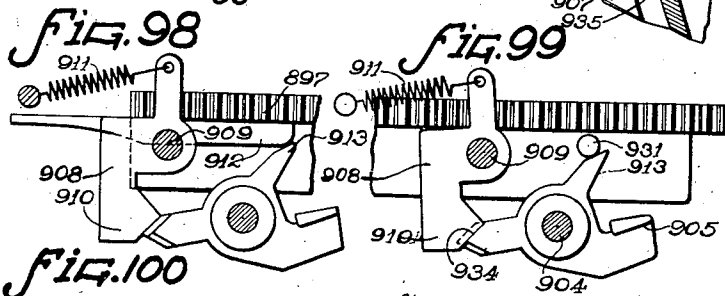
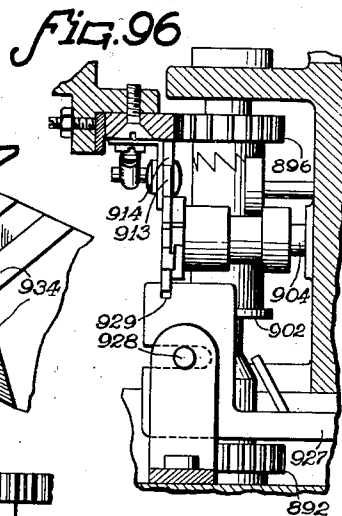
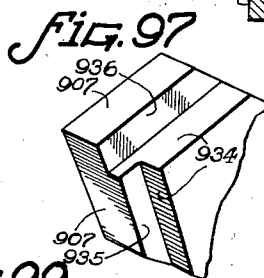
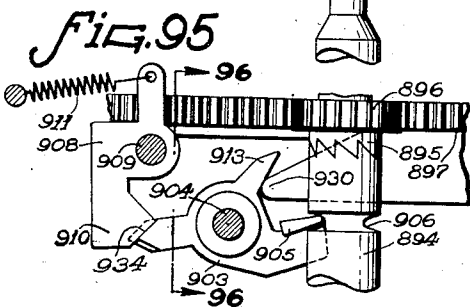
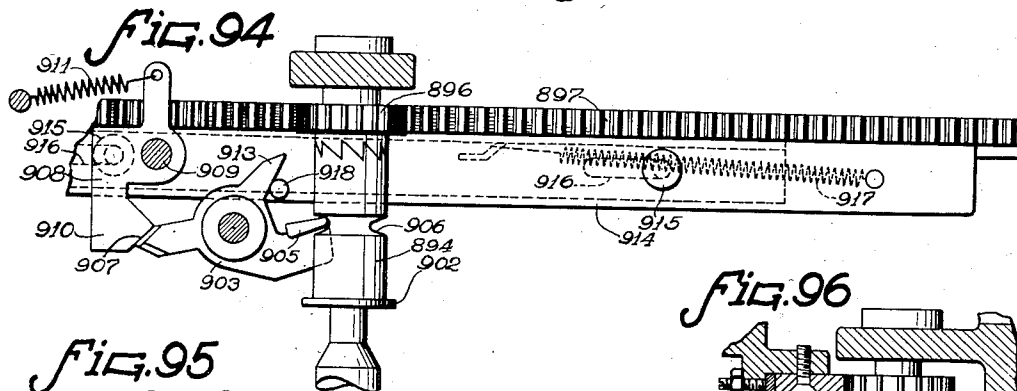
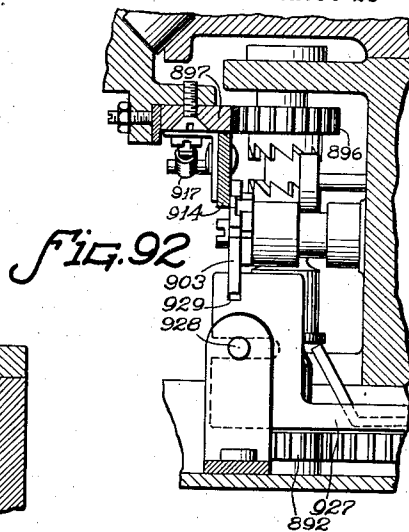
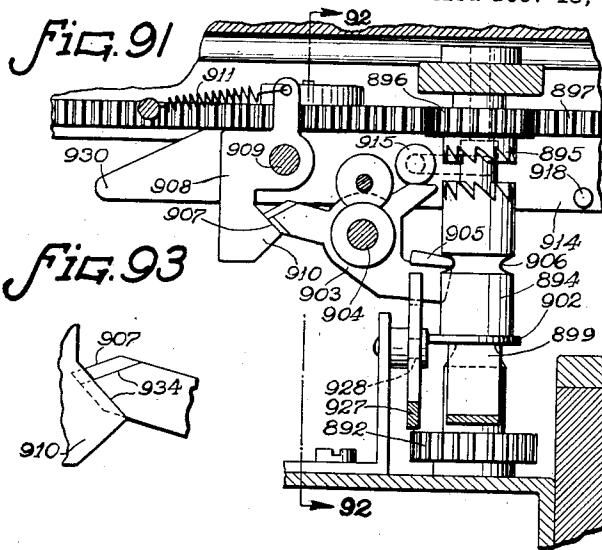
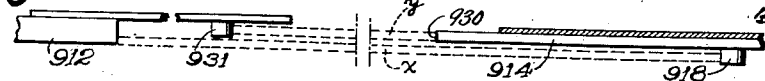


Fig. 99

Fig. 100



Inventor
O.J. Sundstrand
By *Charles R. Parker*
Attorneys

March 19, 1940.

O. J. SUNDSTRAND

2,194,270

COMPUTING AND PRINTING MACHINE

Filed Dec. 18, 1931

30 Sheets-Sheet 29

Fig. 101

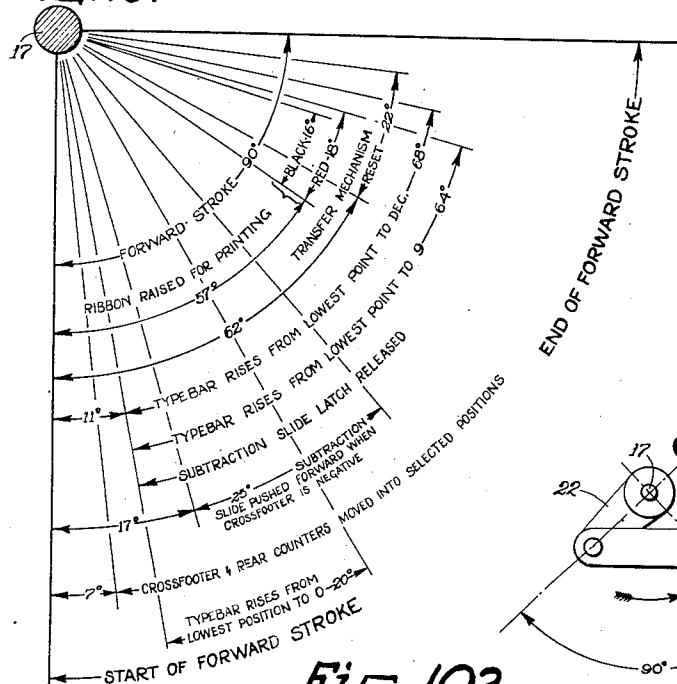


Fig. 103

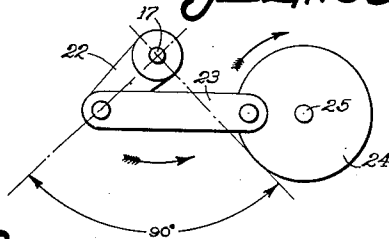


Fig. 102

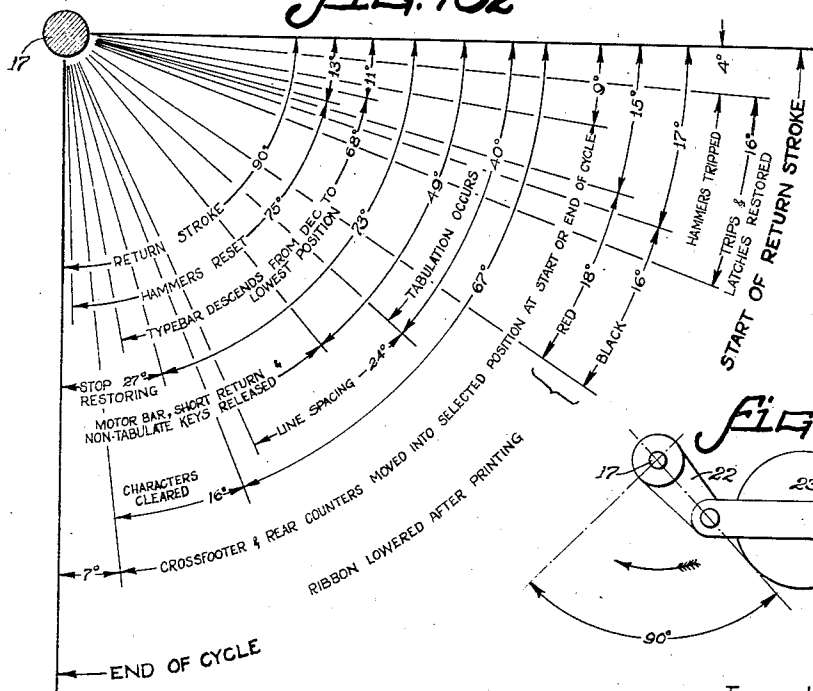
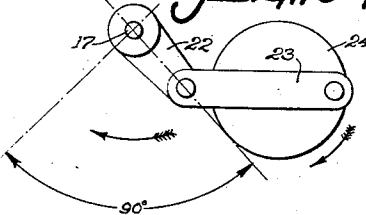


Fig. 104



Inventor
O. J. Sundstrand
By *Chas. H. Raper* *Paulson*
Attorneys

2,194,270

30 Sheets-Sheet 30

Date	Invoice No.	Charges	Credits	Balance	For'd IP	Balance
JUL 7 '31	248	2500		175000		175000
JUL 7 '31	249	3500		20000		20000
JUL 7 '31	758		2500	23500		23500
JUL 8 '31	759		22000	21000		21000
JUL 9 '31	822	1000		1000		1000
				.00		.00

JUL 9 '31	268	2500		18700		18700
JUL 9 '31	469	1050		15050		15050
JUL 9 '31	692		2500	17500		17500
JUL 9 '31	582	1456		18756		18756
JUL 9 '31	822	1000		.00		.00

O.J.S.

17500	5000
23500	2500
21000	22000
1000	1000

DEBITS	A	
	→	6000*
OLD BAL.	B	
	→	17500*
TOTAL IN		
CROSS-FOOTER	→	23500*
NEW BAL.	C	
	→	23500*
	D	
	→	.00*

Fig. 105

Fig. 106

Inventor
O.J. Sundstrand
By *Chimble Parker Carlson*
Attorneys

UNITED STATES PATENT OFFICE

2,194,270

COMPUTING AND PRINTING MACHINE

Oscar J. Sundstrand, Rockford, Ill., assignor, by
mesne assignments, to Underwood Elliott
Fisher Company, New York, N. Y., a corpora-
tion of Delaware

Application December 18, 1931, Serial No. 581,800

41 Claims. (Cl. 235—60)

One of the salient objects of the invention is to provide automatically-actuated mechanisms for performing the various operations involved in the printing of dates, folios, debit items, credit items, old balances, new balances and other classes of amounts upon sheets employed in book-keeping and analogous work, including the computation of the balances, and the printing upon a tape of proof of the correctness of the entries; and to provide for the accumulation or storage of old balances, debit items, credit items, new balances and other classes of amounts, and the printing of the total of each such class of accumulations.

Another object is to provide for convenient manual control and adjustment of the various printing and computing mechanisms.

Another object is to provide, in association with a cross-tabulating paper carriage, readily adjustable devices to enable the carriage to control the performance of printing, computing, cross-tabulating and paper-feeding operations, whereby the machine may be conveniently arranged to operate automatically upon a great variety of printed forms.

Another object is to make possible the use of a much greater number of symbols or "characters" than has heretofore been practicable.

A further object is to provide a basic plan of organization of the various parts of a computing and printing machine which shall be readily adaptable to the construction of numerous models or types of such machines, with resultant economy in manufacture.

Other objects and advantages of the present invention will become apparent in connection with the following detailed description of one form of machine embodying the invention.

In the accompanying drawings,

Figure 1 is a plan view of a bookkeeping machine embodying the features of my invention, the carriage being shown in the sixth columnar position.

Fig. 2 is a right-hand side elevation of the machine with the casing plates removed, the mechanism being shown in the initial position.

Fig. 2^a is a fragmental detail view illustrating a means to prevent more than one of the counter-selecting keys from being used at a time.

Fig. 2^b illustrates a device to prevent the depression of more than one total key at a time.

Fig. 3 is a left-hand side elevation with the casing plates removed and the mechanism in its initial position.

Fig. 3^a is a fragmental left-hand side elevation

illustrating a portion of the mechanism concerned with the resetting of stops.

Fig. 3^b is a fragmental view of a means for closing a switch in the motor circuit.

Fig. 4 is a rear elevation with the left-hand parts broken away approximately as indicated by dotted line 4—4 of Fig. 1.

Fig. 4^a is a fragmental detail view of one of the selectors operated by the carriage.

Fig. 5 is a plan view of the mechanism with the paper carriage and its supports omitted as indicated by dotted line 5—5 of Fig. 2. The mechanism is shown in the initial position.

Fig. 6 is a fragmental plan view of the stops and stop-setting mechanism.

Fig. 7 is a vertical sectional view taken in the plane of line 7—7 of Fig. 6.

Fig. 8 is a fragmental view of the back-space mechanism.

Fig. 9 is a fragmental view of the escapement for the stop-setting mechanism.

Fig. 10 is a fragmental plan view illustrating the repeat mechanism and the means for restoring the stops to their initial position. The parts are shown in their initial position in full lines. The dotted lines indicate the position assumed when a digit is set up in the keyboard.

Fig. 11 is a view similar to that of Fig. 10, but showing in full lines the position assumed when a digit is set up on the keyboard and in dotted lines the position assumed when the repeat key is depressed.

Fig. 12 is a fragmental view looking from the front of the machine as indicated by the line 12—12 in Fig. 10.

Fig. 13 is a fragmental perspective view of the parts shown in Figs. 10, 11 and 12.

Fig. 14 is a fragmental perspective view of the character sections and the means for releasing operated character keys.

Fig. 14^a is a fragmental perspective view illustrating a means for adjusting the character key releasing mechanism.

Fig. 15 is a fragmental elevation of the printing mechanism, the parts being shown in the positions assumed when the main rock shaft is at the end of its forward turning movement, and the type bars being in position to print two naughts as a clear sign. This view also illustrates the mechanism for controlling date and folio printing.

Fig. 16 is a fragmental plan view showing the connections between the type bars and the keyboard.

Fig. 17 is a fragmental perspective view showing

ing two of the stops comprised in one of the character sections.

Fig. 18 is a fragmental elevation looking from the right-hand side of the machine, illustrating the units order of the computing mechanism. The plane in which this view is taken is shown by dotted line 18—18 of Fig. 5.

Fig. 19 is a fragmental view showing the cross-footer pinions engaged with the subtracting racks.

Fig. 20 is a fragmental view looking from the right-hand side of Fig. 19.

Fig. 21 is a right-hand elevation of the means for selectively placing the rear counters in and out of operation, the view being taken approximately in the plane of dotted line 21—21 of Fig. 5.

Fig. 22 is a fragmental view illustrating the means for adjusting the cross-footer for addition or subtraction, the parts being shown adjusted for addition and the main rock shaft being illustrated as having just begun to make its forward stroke.

Fig. 23 is a similar view, but showing the positions assumed at the beginning of the return stroke of the rock shaft.

Fig. 24 illustrates the positions assumed during non-addition, the main rock shaft having just commenced its return stroke.

Fig. 25 illustrates a later stage in the return stroke of the main rock shaft during non-addition.

Fig. 26 is a detail view of the crank arm and pawl carried by the main rock shaft for controlling the cross-footer.

Fig. 27 is a fragmental perspective view illustrating the Non-add, Subtotal and Total mechanism for the front counter or cross-footer, the parts being shown in the position occupied when the main rock shaft is at the end of its forward stroke in the taking of a debit subtotal.

Fig. 28 is a fragmental perspective view illustrating the Subtraction key and the Second Pickup of Credit Balance Key and the connections between said keys and the cross-footer, the parts being shown in the position occupied when the main rock shaft is at the end of its forward stroke in the operation of subtracting an item.

Fig. 29 is a fragmental left-hand elevation illustrating the cross-footer and more particularly the means for introducing the fugitive unit. The fugitive unit has just been accumulated positively on the units pinion.

Fig. 30 is a similar view, but showing the position assumed immediately after the introduction of the fugitive unit subtractively.

Fig. 31 is a fragmental perspective view of the fugitive-unit-introducing mechanism, the parts being shown in the positions occupied just prior to the introduction of the fugitive unit additively into the units pinion.

Fig. 32 is a fragmental detail view of the transfer mechanism.

Fig. 33 is a fragmental perspective view illustrating the subtotal mechanism for the cross-footer, the parts being shown in the position occupied when the main rock shaft is at the beginning of its return stroke in the taking of a credit subtotal.

Fig. 34 is a vertical sectional view looking from the right-hand side of the machine and showing a portion of the mechanism for actuating the hammer mechanism, the alining mechanism and the transfer-restoring mechanism for all of the counters.

Fig. 35 is a vertical sectional view looking from the left-hand side of Fig. 34.

Fig. 36 is a fragmental left-hand view of certain parts shown in Figs. 34 and 35, and showing the position occupied immediately after the hammers have been tripped.

Fig. 37 is a fragmental right-hand elevation showing the ribbon and the means for vibrating, that is to say, lowering and raising, the ribbon.

Fig. 38 is a fragmental plan section taken in the plane of dotted line 38—38 of Fig. 37.

Fig. 39 is a fragmental sectional view of the hammer mechanism, the parts being in the position assumed just prior to the tripping or unlatching of the hammers, the non-print detent being shown in position to prevent effective operation of the hammers.

Fig. 40 is a front view of the hammer latches.

Fig. 41 is a fragmental perspective view of the hammer latches and certain cooperating parts, the latches for the signal hammer, the units hammer and the tens hammer being shown as about to be tripped to effect the printing of a clear signal and two naughts.

Fig. 42 is a detail plan view of the escapement lever of the stop-setting mechanism of the amount keyboard.

Fig. 43 is a fragmental perspective view of a keyboard lock, the parts being shown in the position assumed when the motor bar is depressed.

Fig. 44 shows the main rock shaft as having just started on its return stroke and the mechanism being adjusted so that the cross-footer pinions are about to move into mesh with the subtracting racks.

Fig. 45 shows the cross-footer in the position it occupies at the beginning of a subtracting operation following a subtracting operation, the main rock shaft having just begun its forward stroke, and the pinions being about to move out of mesh with the subtracting racks.

Fig. 46 illustrates the operation of taking a second credit total or subtotal, the main rock shaft having just begun its forward stroke.

Fig. 47 is a fragmental plan view of the second pickup of credit balance mechanism.

Fig. 48 is a fragmental view of a mechanism concerned with the taking of two consecutive credit subtotals.

Fig. 49 is a fragmental elevation of the subtraction mechanism.

Fig. 50 is a fragmental perspective view of the manual means for controlling the operation of the A counter, the main rock shaft having just started upon its return movement and the A counter having been placed in mesh with the racks. The view also shows portions of the carriage-controlled mechanism for selecting any of the rear counters.

Fig. 51 illustrates the A counter and the transfer mechanism for all of the rear counters.

Fig. 52 is a fragmental perspective view of the Non-add, Sub-total, and Total mechanism for the rear counters, the mechanism being shown in the position occupied when the main rock shaft is at the end of its forward stroke.

Fig. 53 is a right-hand elevation of the middle character section, i. e., the section that controls the printing of the numbers of the days of the month.

Fig. 54 illustrates the latch mechanism and stop mechanism for the units keys used in setting up the numbers of the days of the month.

Fig. 55 is a plan section on line 55—55 of Fig. 54.

Fig. 56 shows the latching mechanism and stop mechanism for the tens keys used in setting up the numbers of the days of the month.

Fig. 57 illustrates the latching mechanism and stop mechanism associated with the keys used in setting up various bookkeeping symbols.

Fig. 58 is a plan section on line 58—58 of Fig. 57.

Fig. 59 represents the latching mechanism and the stop mechanism for the two keys used in setting up the numbers denoting two years.

Fig. 60 is a fragmental perspective view of the three left-hand character sections, looking from the rear of the machine.

Fig. 61 is a fragmental perspective view of the stop mechanism comprised in the middle character section.

Fig. 62 is a fragmental phantom view of the four type bars farthest to the left.

Fig. 63 illustrates the signal type bar and the characters printed thereby.

Fig. 64 is a fragmental perspective view looking from the front of the machine and showing the escapement mechanism for the paper carriage. The carriage is assumed to be moving and as about to be stopped in one of its columnar positions. The Credit key 840 is assumed to be in depressed position so as to effect positioning of the stops on the paper carriage for the posting of credit items.

Fig. 64^a is a fragmental perspective view of one of the control elements on the paper carriage.

Fig. 65 is a perspective view of a pivoted unit comprised in the amount keyboard.

Fig. 66 is a detail view of one of the carriage control elements on the machine frame; it may be assumed to be either the subtraction control element or the motor repeat element.

Fig. 67 is a fragmental perspective view of the mechanism for setting the stops.

Fig. 68 illustrates, in perspective, a slide comprised in the stop-setting mechanism of the amount keyboard.

Fig. 69 is a horizontal sectional view of certain parts comprised in the amount keyboard.

Fig. 70 is a fragmental perspective view illustrating the connections between the carriage and the Normalizing key, the Carriage short return key, the Non-tabulating key, the Tabulating key, and the Carriage return key.

Fig. 71 is a vertical sectional view taken in the plane of dotted line 71—71 of Fig. 3.

Fig. 72 is an enlarged detail view of a detent for holding the main clutch disengaged.

Fig. 73 is a section on line 73—73 of Fig. 3.

Fig. 74 is a perspective view of the Carriage short return key and the Non-tabulate key and their connections.

Fig. 75 illustrates a manually-operable means for unlatching either of the last mentioned two keys.

Fig. 76 illustrates a portion of the connection between the Carriage short return key and the clutch-shifting cam.

Fig. 77 is a fragmental perspective view of the line-space mechanism and the mechanism whereby the carriage controls line spacing.

Fig. 78 is a fragmental plan section taken in the plane of line 78—78 of Fig. 2.

Fig. 79 is a fragmental front elevation of the means whereby the carriage controls item repeat and folio repeat, these parts also being shown in the right-hand portion of the plan view, Fig. 10.

Fig. 80 is a perspective view of a portion of the mechanism shown in Fig. 78.

Fig. 81 is a right-hand elevation of the Credit key.

Fig. 82 is a right-hand elevation of a portion of the connections operated by the Credit key.

Fig. 83 is a left-hand elevation of one of the control elements carried by the paper carriage. It is the stop used in the third columnar position in the set-up hereinafter described and is shown in the position occupied during credit posting.

Fig. 84 is a similar view, but showing the control element in the position occupied during debit posting.

Fig. 85 is a plan view of the inner end of the control element shown in Fig. 83, the carriage having been arrested in the third columnar position during credit posting.

Fig. 86 shows this same control element skipping the third columnar position, as illustrated in Fig. 84.

Fig. 87 is a rear elevation of the escapement mechanism in the same position as shown in the perspective view, Fig. 64.

Fig. 88 is a section taken in the plane of line 88—88 of Fig. 83.

Fig. 89 is a view similar to Fig. 88, but showing the position assumed in the cycling of the machine.

Fig. 90 is a section on line 90—90 of Fig. 84, showing the carriage as skipping the third columnar position.

Fig. 91 is a fragmental view looking from the front as indicated by dotted line 91—91 in Fig. 1, and showing a portion of the carriage, the rack and pinion drive therefor, the clutch for communicating power to the pinion, and some of the mechanism for operating the clutch. The carriage is shown as approaching the end of its working stroke.

Fig. 92 is a section in the plane of line 92—92 of Fig. 91.

Fig. 93 is a fragmental view of a detent comprised in the clutch-controlling mechanism.

Fig. 94 is a view similar to Fig. 91, but showing the carriage as having completed its working stroke and as having thrown in the clutch.

Fig. 95 is a similar view, but showing the carriage as about to be returned from an intermediate point.

Fig. 96 is a section in the plane of line 96—96 of Fig. 95.

Fig. 97 is a fragmental perspective view of one of the elements shown in Fig. 93.

Fig. 98 is a fragmental view showing the carriage as having nearly completed its return movement to initial position, and as about to throw out the clutch.

Fig. 99 shows the carriage as having almost completed its return to an intermediate columnar position and as about to throw out the clutch.

Fig. 100 is a plan view illustrating the two paths in which a certain carriage-return element is arranged to lie.

Figs. 101 to 104 are views to illustrate the timing of the mechanisms.

Fig. 105 is a diagrammatic view illustrating a customer's monthly statement, the ledger sheet for the same account, and the proof tape, also showing diagrammatically the control plate on the paper carriage, also a fragmental view of the journal, record or audit sheet produced as a carbon copy of the entries made upon the statements.

Fig. 106 illustrates a fragment of the tape,

showing totals obtained from the several counters.

For the convenience of the reader, the description of the embodiment herein shown of the invention is arranged under the following headings:

1. General organization.
2. Actuators or type bars.
3. Stop mechanism for amount keyboard.
4. Correction key for amount keyboard.
5. Back-space key for amount keyboard.
6. Repeat key for amount keyboard.
7. Cross-footer.
8. Taking totals from cross-footer.
9. Non-addition in cross-footer.
10. Transfer mechanism.
11. Introducing the fugitive unit.
12. Restoring transfer mechanism.
13. Enforcing a blank or spacing cycle.
14. Hammer mechanism for amount type bars.
15. Double naught printing.
16. Aliner.
17. Conditioning cross-footer for subtraction.
18. Taking credit total or credit subtotal.
19. Addition after credit totaling.
20. Rear counters.
21. Selecting the desired rear counter.
22. Taking a total from a rear counter.
23. Conjoint use of counters.
24. Non-addition in rear counter.
25. Interlock between total keys.
26. The folio keyboard.
27. Hammer mechanism for folio type bars.
28. Printing signals.
29. Character keys.
30. Releasing character keys.
31. Hammer mechanism for character type bars.
32. Ribbon mechanism.
33. Timing of mechanisms.
34. Motor drive and manual control thereof.
35. Time switch.
36. Keyboard lock.
37. Paper carriage.
38. Line-space mechanism.
39. Escapement mechanism.
40. Automatic operation of the escapement.
41. Tabulator key 699.
42. Non-tabulate key 699.
43. Carriage control of driving clutch.
44. Carriage control of machine functions.
45. Control plate.
46. Carriage control of line-spacing.
47. Carriage control of subtraction.
48. Carriage control of non-addition in cross-footer.
49. Carriage control of final total from cross-footer.
50. Carriage control of subtotal from cross-footer.
51. Carriage selection of "A" counter.
52. Carriage control of selection of "B" counter.
53. Carriage control of selection of "C" counter.
54. Carriage control of selection of "D" counter.
55. Carriage control of final total from rear counter.
56. Carriage control of subtotal from rear counter.
57. Carriage control of non-addition in rear counter.
58. Carriage control of date, folio and character printing.
59. Carriage control of amount repeat.
60. Carriage control of date, folio and other character repeat.
61. Carriage control of motor repeat.
62. Carriage control of non-print.
63. Changing from debit posting to credit posting, and vice versa.

64. Second pick-up of credit balance key.
65. Normalizer key 870.
66. Carriage return.
67. Carriage return key 898.
68. Disengaging clutch on return to initial position.
69. Automatic engagement of carriage return clutch.
70. Return from one intermediate position to another intermediate position.
71. Tabulation and line-spacing in connection with short return.
72. Latches for the non-tabulate key 699 and the carriage short return key 919.
73. Taking two consecutive credit subtotals.
74. Examples of work.
75. Comparison with prior art.

1. General organization

The particular embodiment of my invention 20 which has been selected for illustration is intended to operate upon a given set of forms or work-pieces used in commercial bookkeeping, but it will be understood that the machine may be readily modified to perform in proper sequence the operations required for other commercial forms and for bank bookkeeping. The machine comprises a front counter or crossfooter and four rear counters, but it will be evident that the number of counters may vary. The cross-footer is adapted to add and subtract and to give the true algebraic sum, whether positive or negative. The rear counters, in this particular embodiment, are not adapted for subtraction.

2. Actuators or type bars

The type for printing items, totals, dates, folios, etc., upon the work-pieces are carried by type bars or actuators of which they may be any desired number. Herein there is a type bar 1 (Fig. 1) for printing symbols or "signals" to denote the character of the amount or to indicate that a particular counter is clear, nine type bars 2 for use in printing amounts and for printing two naughts to signify that a counter was clear, four type bars 3 for printing folios, and four type bars 4 for printing dates and various abbreviations used in bookkeeping.

In this instance, the type bars or actuators 1, 2, 3 and 4 have a rectilinear vertical movement. They are guided by a rod 5 (Fig. 15) fixed in the machine frame and extending through a slot 5^a in each of the type bars, a bar 6 secured in the machine frame, and a plate 7 likewise fixed in the machine frame, said plate having vertical slots through which brackets 8 fixed to the type bars extend. Each type bar has a rearward extension 9 having at its rear end a lug 10 that extends through a vertical guide slot in a plate 11 fixed in the machine frame.

While the means for raising the type bars may partake of various forms, I have herein shown a plurality of levers 12 (Fig. 18), one for each type bar, said levers being pivoted in the machine frame at 13. The forward arm of each lever 12 has a pin-and-slot connection with the bracket 8 on the corresponding type bar. A coiled spring 14 tends to move the lever in the direction to raise the type bar.

The means for restoring the type bars to their initial position comprises two crank arms or cams 15 and 16 (Figs. 2 and 18) fixed upon a main rock shaft 17 and carrying rollers 18 that engage within the forked ends 19 of two levers 20. When the levers 20 are in their lower or initial position,

the surface 19^a is concentric with the shaft 17, hence movement of the shaft does not cause movement of the levers 20 until the roller 18 enters the portion 19^b of the fork. Similarly, the surface 19^c is concentric with the shaft 17 when the levers are in their upper position, the return swing of the shaft being ineffective to move the levers 20 until the roller 18 engages the portion 19^d. These levers 20 are pivoted upon the axis 13 and are rigidly connected by means of a universal bar 21 (Figs. 4 and 18) which overlies the forward arms of the levers 12. The shaft 17 is oscillated by means herein shown as comprising a crank arm 22 (Figs. 3 and 16) fixed upon said shaft, the end of said crank arm being connected by means of a link 23 to a crank disk 24 which is fixed upon a shaft 25. The last-mentioned shaft is driven from an electric motor 26 (Fig. 3) through reduction gearing contained in a housing 27. The means for stopping the shaft 17 at the conclusion of each oscillation (i. e., a forward swing and a return swing) will be hereinafter described. It will be seen that when the rock shaft 17 turns in the forward direction, the universal bar 21 is lifted to allow the springs 14 to raise such of the actuators 1, 2, 3 and 4 as are needed in performing the desired operation, and that when the rock shaft returns to its initial position, the universal bar 21 restores the actuators to their normal lower position.

3. Stop mechanism for amount keyboard

The actuator 2 farthest to the right serves for the printing and registration of units, the next actuator for tens, and so on. The means for determining the extent to which the actuators 2 shall rise comprises, in the present instance, a stationary group of stops 28 (Figs. 6 and 7) which may be of any desired construction, as for example, that shown in the Sundstrand Patent No. 1,198,487. The stops are arranged in as many columns as there are actuators 2, there being ten stops 28 in each column. Pivoted to the lower portion of each actuator 2 is a forwardly extending bar 29 (Fig. 15) the front end of each bar 29 extending slidably into an opening in a vertically extending pin 30. The pins 30 are guided for vertical movement in a slide 31 (Figs. 7 and 68) which is mounted upon a stationary rod 32 for movement transversely of the machine. The slide 31 is arranged to shift the pins 30 from their normal or initial position at the left-hand side of the group of stops 28 (shown in Fig. 6) into the vertical planes of the columns of stops. The rear end of a stop which has been moved rearwardly into set position overhangs the transverse path of movement of the group of pins 30. When an actuator 2 is raised until its pin 30 stops against the lowermost stop in a given column, the actuator is in position to effect printing and/or registration of the digit "0". The second stop from the bottom corresponds to "1" and so on.

The actuators 2 for the numerical orders which are not needed in printing or registering a given amount are prevented from rising above the cipher-printing position by a detent plate 33 (Figs. 6, 7 and 16) located at the left of the group of stops 28 and guided to move horizontally forward and back in the machine. Said plate has an arm 34 which is pivoted at 35 to a lever in the form of a bail 36 (Fig. 27), said bail being pivoted on a rod 37. A spring 38 normally holds the plate 33 in its rearward position, with its rear edge overhanging the pins 30. The forward and

back movements of the detent plate 33 are limited by the engagement of shoulders 39 (Figs. 6, 7 and 16) on the plate with the back wall 40 (Figs. 6 and 7) of the frame in which the stops 28 are mounted.

The means for pushing the stops 28 rearwardly into position to limit the rising movement of the pins 30 comprises a tier of ten push pins 41 (Figs. 6, 7 and 67) the forward portions of which are slidable in openings in a post 42 which is fixed to a bracket 43 that swings upon an axis 44. The slide 31 and the bracket 43 are connected to move in unison by means of a stud 45 (Fig. 7) on the bracket which lies in a fork 46 (Fig. 68) on the slide. By means hereinafter described, the bracket 43 is caused to swing step by step from the initial position shown in Fig. 6 toward the right to position the rear ends of the push pins 41 in register with successive columns of stops 28. The forward ends of the push pins 41 are pivoted to the arms 47 (Figs. 6 and 69) of a series of three-arm levers 48 (Fig. 69). The levers 48 are mounted upon a pivot 49 in the machine frame and are arranged to be swung counter-clockwise, as viewed in Fig. 6, to set the stops, by means of numeral keys 50 (Figs. 5 and 7) having stems 51 which are guided in the framework of the keyboard for vertical movement. The movements of the keys 50 are limited by engagement of lugs 52 on the lower ends of the key stems 51 with a stationary plate 53. Each key stem 51 has a notch 54 (Fig. 7) to receive a lug 55 (Fig. 6) on a rocking element consisting virtually of two bell crank arms 56 and 57 and a shaft portion 58, the shaft portion being pivoted at opposite ends in the framework of the keyboard. To the arm 57 of each rocking element is connected a link 59 which is pivoted to one of the arms 47. It will be apparent from Fig. 67 that depression of a numeral key 50 will cause the corresponding push pin 41 to be pushed rearwardly to set a stop 28. A coiled spring 60 (Fig. 69) connected to the arm 61 of each of the levers 48 restores the lever 48 and the key 50 as soon as the operator releases the key.

The means for impelling the slide 31 and the bracket 43 to move toward the right comprises a link 62 (Fig. 6) pivoted at its right-hand end to the bracket 43 at 63, and pivoted at its left-hand end to an arm 64 (Fig. 13) which is pivoted in the machine frame on the axis 65. Rigid with the arm 64 is an arm 66 to which is connected a resetting lever 67. A spring 68 connected to the lever 67 exerts its force through the connections just described to move the slide 31 and the bracket 43 toward the right as viewed in Fig. 6. Such movement of the slide and the bracket is controlled by means of an escapement consisting, in this instance, of a bar 69 (Fig. 68) fixed to the slide 31 and having two series of teeth 70 and 71. An escapement lever 72 (Figs. 6 and 42) pivoted in the machine frame at 73 has a tooth 74 (Fig. 9) which is arranged to move into the path of successive teeth 70. An escapement tooth 75 is formed upon a pawl 76 which is pivoted to the lever 72 at 77 and is normally held against a stop pin 78 by means of a spring 79. The tooth 75 is arranged to engage successive teeth 71. As shown in Fig. 9, the teeth 74 and 75 are so located as to engage the teeth 70 and 71 alternately as the escapement lever 72 is swung. Said lever is swung by means of a link 80 (Fig. 6), the forward end of which is pivoted to an arm 81. The arm 81 is rigid with a struc-

ture 82 (Fig. 65) which is pivoted in the machine frame on the axis 49. Said structure comprises a universal rod 83 which is held in contact with the arms 84 (Fig. 69) of the three-arm levers 48 by means of a spring 85 (Fig. 65). Whenever one of the numeral keys 50 is depressed, the corresponding arm 84 causes the structure 82 to swing counter-clockwise, as viewed in Fig. 6, thereby operating the escapement lever 72 to withdraw the tooth 75 from the tooth 71 with which it was in engagement, and placing the escapement tooth 74 in position to engage the next tooth 70. When the operator permits the key 50 to rise, the spring 85 turns the structure 82 in the clockwise direction, thereby restoring the escapement lever 72 to normal position, withdrawing the tooth 74 from the tooth 70 with which it was in engagement, and allowing the tooth 75 to move into position to engage the next tooth 71.

As the operator sets up by means of the keyboard an item containing, say, four digits, the slide 31 and the bracket 43 move step by step toward the right. Depression of a digit key in setting up the thousands digit of the item causes the selected stop 28 in the column farthest to the left to be set. The release of the key permits the bracket 43 to move to place the push pins 41 in register with the next column of stops and allows the slide 31 to shift the pins 30 so as to bring the one that is connected with the units actuator 2 into position beneath the stop that has just been set. Setting up of the hundreds digit of the item causes setting of a stop in the second column from the left and advances the group of pins 30 another step. When the tens digit of the item is set up on the keyboard, the corresponding stop is set in the third column from the left and the group of pins 30 is moved another step. The setting up of the units digit of the item causes the setting of the selected stop in the fourth column from the left and advances the group of pins 30 another step. It will be seen that the pin 30 associated with the units actuator 2 is now located beneath the set stop in the fourth column from the left, the pin 30 connected with the tens actuator 2 is located beneath the set stop in the third column from the left, the pin 30 which is connected with the hundreds actuator 2 is below the set stop in the second column from the left, and the pin 30 which is associated with the thousands actuator 2 is located beneath the set stop in the column farthest to the left. Thus the item is set up by the operator in the natural order, and the required number of pins 30 are moved out from under the detent plate 33 and brought into alignment with the proper columns of stops.

Stops that have been pushed rearwardly into set position are restored to initial position by means of a post 86 (Figs. 7 and 68) fixed to the slide 31 and having a beveled face 87 adapted in the leftward movement of the slide 31 to cam the stops 28 back to initial position. The upper end of the post 86 extends through a slot 86^a (Fig. 6) in a stationary plate 86^b, said slot assisting to guide the slide 31.

In the normal cycling of the machine, the stops 28 are reset and the slide 31 and the bracket 43 returned to initial position at the end of the cycle of operations by means of an arm 88 (Figs. 3, 3^a and 10) fixed to the rock shaft 17. Near the end of the return stroke of the rock shaft, the arm 88 engages the end of the

resetting lever 67 and pushes said lever forward to a point slightly beyond its normal position. In order to move the rear end of the resetting lever 67 out of line with the arm 88 so as again to permit the setting up of numbers in the keyboard, I provide a lever 89 (Fig. 13) pivoted at 90 in the machine frame and carrying a stud 91 against which the resetting lever 67 is normally held by the spring 68. As the arm 88 approaches its initial position, it engages a lug 92 (Fig. 13) on the lever 89 and thereby turns said lever counter-clockwise, as viewed in Fig. 13, thus swinging the resetting lever 67 to the right sufficiently to withdraw the rear end of said resetting lever from in front of the arm 88. The forward movement imparted to the resetting lever 67 by the arm 88 is sufficient to cause the beveled face 87 (Fig. 6) to reset the stops in the most leftward column of stops. As soon as the rear end of the resetting lever 67 has been moved out of line with the arm 88, the spring 68 moves said lever 67 toward the rear and the slide 31 toward the right until the foremost tooth 71 stops against the tooth 75, which movement is sufficient to withdraw the cam face 87 from a position directly behind the column of stops 28 farthest to the left, and to place the push pins 41 in register with said column of stops.

At the beginning of the next cycle of operations of the machine, the arm 88 swings away from the lug 92, whereupon a coiled spring 93 (Fig. 13) swings the lever 89 clockwise until said lever stops against a stop pin 94 (Fig. 10), thereby allowing the spring 68 (Fig. 13) to place the resetting lever 67 in the path of the return movement of the arm 88. The spring 93 is anchored at one end to the machine frame at 94^a (Fig. 13) and is attached at its other end to a slide 95 (Fig. 13) which is pivoted to one arm of the lever 89. The slide 95 is similar in form to, and directly below, the slide 492^b shown in Fig. 10. (The slide 95 is further referred to under the heading "59. Carriage control of amount repeat.")

4. Correction key for amount keyboard

A Correction key 96 (Fig. 7) is provided for manually restoring all of the stops 28 in one movement. The stem 97 of said key has a lug 98 that bears against a lug 99 on a bell crank lever 100 pivoted at 101 in the machine frame. A spring 102 normally holds the Correction key elevated, a pin 103 on the stem 97 limiting the action of the spring by engaging the plate 53. On the bell crank 100 is a stud 104 which lies within an elongated opening 105 formed in a link 106. The rear end of the link 106 is connected to an arm 107 (Fig. 6) which is pivoted in the machine frame at 108. In the arm 107 is a slot 109 to receive a pin 110 on the link 62. It will be seen that depression of the Correction key 96 will cause the link 62 to be moved toward the left, as viewed in Fig. 6, to reset the stops 28.

5. Back-space key for amount keyboard

A Back-space key 111 (Fig. 7) provides means for restoring the stops 28 at the rate of one numerical order for each depression of the key. On the stem 112 of the key 111 is a pin 113 that engages a bell crank lever 114 which is pivoted in the machine frame at 115. To the other arm of the bell crank lever 114 is pivoted a link 116, the rear end of which is pivoted to a

bell crank lever 117 pivoted in the machine frame at 118, the bell crank 117 carrying a pivoted dog 119 (Fig. 8) which is adapted to engage with teeth 71. When the Back-space key 111 is released, a spring 120 restores the pawl 119 and the key 111 to their normal position, the action of the spring being limited by a stop pin 121 (Fig. 7) on the key stem 112, said pin stopping against the plate 53.

6. Repeat key for amount keyboard

In order to permit printing or registering the same amount more than once under manual control, I provide a Repeat key 122 (Fig. 7) having a stem 123, the key being normally held in elevated position by means of a spring 124. The normal position of the key is determined by contact of a stop pin 125 on the key stem 123 with the top plate 126 of the keyboard. The lower end of the stem 123 is arranged to engage a cam surface 127 (Fig. 12) formed on a slide 128 which is guided for movement transversely of the machine by means of two guide studs 129 (Figs. 6 and 11) extending through elongated openings 130 in the slide. The left-hand end of the slide is connected to one arm of a lever 131 (Figs. 12 and 13) pivoted at 132 (Fig. 10). The other arm of said lever is arranged to engage a downwardly extending lug 133 (Figs. 12 and 13) on the lever 89. When the Repeat key 122 is depressed, the slide 128 is pushed toward the left, thereby causing the lever 89 to swing in the counter-clockwise direction so as to swing the resetting lever 67 toward the right into the position shown in dotted lines in Fig. 11. The key stem 123 is notched (Fig. 7) to provide a shoulder 134 which is adapted to engage beneath the top plate 126 and thus retain the Repeat key depressed and hold the reset lever 67 in the dotted-line position shown in Fig. 11, whereby to permit the repeated printing or registration of the same amount as many times as desired. When the operator disengages the shoulder 134 from the plate 126, the spring 124 restores the Repeat key to its normal position and permits the spring 93 to swing the lever 89 in the clockwise direction, the spring 68 at the same time swinging the reset lever 67 toward the left into position to be engaged by the arm 50 88 at the conclusion of the cycle of operations.

7. Cross-footer

The cross-footer comprises a series of pinions 135 (Figs. 18 and 22) rotatably mounted upon a transverse shaft 136. The shaft 136 is supported for sliding movement longitudinally of the machine. The set of pinions 135 (of which there is one for each actuator 2) is located between two sets of racks 137 and 138. A rack 137 and a rack 138 are connected to each actuator 2 in the manner to be presently described, and the set of pinions is arranged to be moved into mesh with either set of racks. When the pinions are out of mesh, they are midway between the two sets of racks, and are ready to be moved into mesh with either set without any preliminary or selective movement, such as is required in certain other types of machines.

Addition is accomplished by means of the set of racks 137. When an item is to be added, the pinions are moved forward into neutral position between the two sets of racks before the actuators 2 are raised, and are moved rearwardly into mesh with the racks 137 just before the actuators 2 are moved downwardly. Addition, therefore,

occurs in the down stroke of the racks 137, the extent of rotation of the pinions depending, of course, upon the extent of movement of the racks.

Subtraction is effected by means of the set of racks 138, the pinions being moved into mesh with said racks just before the latter descend. Subtraction thus takes place in the down stroke of the racks.

The upper end of each rack is attached to the rearwardly extending portion 9 of one of the actuators 2 by means of a headed pin or stud 139 (Fig. 18) extending through a vertically elongated opening 140 in the rack. A contractile spring 141 attached at its upper end to the rack and at its lower end to a downwardly extending part of the portion 9 tends to move the rack downwardly with relation to the actuator one tooth space for transfer purposes.

The pinions 135 are moved into and out of mesh with the racks 137 and 138 by means such, for example, as two links 142 (Figs. 18, 20 and 22), one at each side of the machine, the forward ends of which links have bearings to receive the ends of the shaft 136. The rear ends of the links 142 are pivoted at 143 to two arms 144 (Fig. 20), which are rigidly secured to a shaft 145 that is journaled in the framework of the machine.

The means herein shown for swinging the arms 144 to move the pinions into and out of mesh with the racks, comprises an arm 146 (Figs. 19 and 20) which is rigid with the right-hand arm 144 and carries a pin 147 that engages the notched end of an arm 148. The arm 148 is secured upon a short shaft 149 that is journaled in the machine frame. Also fixed to said shaft is an arm 150. The arm 150 is swung by means of a lever 151 (Fig. 22) pivoted at 152, said lever having a cam slot 153 therein to receive a stud 154 on the arm 150. The lower portion of the cam slot 153 imparts the meshing and demeshing movements required in adding and debit-totaling operations, while the upper portion of the cam slot 153 produces the meshing and demeshing movements incident to subtraction and credit totaling operations. The lever 151 is swung by means of a link 155 having notches 156 and 157 in its opposite edges. The notch 156 is adapted to receive a stud 158 on the cam lever 151, the notch 157 being adapted to receive a stud 159 on said lever. The studs 158 and 159 are at opposite sides of the axles 152, and hence it will be seen that when the link 155 is in engagement with the pin 158, vertical movement of the link 155 will cause reciprocation of the lever 151 to cause operation of the lower portion of the cam slot 153 on the stud 154, whereas when the link 155 is in engagement with the pin 159, the lever 151 will be swung to cause operation of the upper portion of the cam slot 153 on the stud 154.

The link 155 is pivoted to one end of a rocker arm 160 which is pivoted in the machine frame at 161. The other end of the rocker arm 160 is pivoted to a link 162 having a notch 163 adapted to receive a pin 164 on a lever 165. The last mentioned lever is pivoted on the axis 166 in the machine frame and has a pin and slot connection with an arm 167 which is pivoted at 168.

The means for swinging the lever 165 comprises an arm 169 (Figs. 16 and 26) fixed upon the main rock shaft 17. On said arm is pivoted at 170 a pawl 171 having two shoulders 172 and 173 and a hook 174. The pawl 171 is influenced by a tension spring 175. On the lever 165 is a pin 176 arranged to be engaged by the shoulder 172. On

the arm 167 is a pin 177 arranged for engagement by the shoulder 173.

178 (Fig. 27) is a detent pivoted in the framework at 178^a. It has two cam notches to receive a pin 178^b carried by the rocker arm 160. A spring 178^c connected to the detent holds the latter in engagement with the pin. This spring-actuated detent helps to move the cam lever 151 suddenly into its counter-meshed or its counter-demeshed position and to hold it in such position.

Referring now to Fig. 22 which shows the parts in initial position, the pinions being in mesh with the adding racks 137: When the main rock shaft 17 begins its forward movement, the arm 169 swings in the direction indicated by the arrow in Fig. 22, whereupon the shoulder 172 engaging the pin 176 (assisted by the spring detent 178) causes the lever 165 to turn counter-clockwise into the position shown in Fig. 23, whereby the link 162 is lifted and the link 155 lowered, thereby swinging the cam lever 151 downwardly and thus promptly placing the pinions 135 in neutral position between the two sets of racks. The pinions are thus moved out of mesh with the racks 137 just before the racks begin rising to the extent corresponding to the item set up on the keyboard. As the arm 169 completes its upward stroke, the surface 179 on the pawl 171 comes into engagement with the pin 177 on the arm 167, causing the pawl 171 to assume the position shown in Fig. 23.

On the return stroke of the rock shaft 17, the shoulder 173 of the pawl 171, operating against the pin 177 (and assisted by the spring detent 178), swings the arm 167 into the position shown in Fig. 22, thereby, through the connections previously described, swinging the cam lever 151 to the position shown in Fig. 22, and thus returning the pinions 135 into mesh with the racks 137. This occurs promptly after the commencement of the return stroke of the arm 169, and in the continuing operation of the machine the racks 137 descend, thereby turning the pinions 135 to accumulate thereon the amount set up in the keyboard.

Any desired means may be used to prevent casual rotation of the pinions while they are out of mesh with the racks, as, for example, that fully disclosed in my application Serial No. 670,665, filed October 25, 1923 (now Patent No. 1,965,611, dated July 10, 1934).

8. Taking totals from cross-footer

When a debit or positive total (whether subtotal or final total) is to be printed, the pinions are retained in mesh with the racks 137 during the upward movement thereof. The means whereby the upward movement of the arm 169 is rendered ineffective to withdraw the pinions from the racks 137 will now be described, reference being made particularly to Fig. 27. The Total key 180 and the Subtotal key 181 are carried by key stems 182 and 183, respectively. The lower ends of these stems are arranged to engage balls 184 and 185, respectively, which are pivoted at 186 in the machine frame. The balls 184 and 185 are arranged to engage lugs 187 and 188 on a total slide 189 and a subtotal slide 190, respectively. Depression of a key 180 or 181 causes forward movement of the corresponding slide 189 or 190. On the total slide 189 is an upstanding portion 191 which is yieldingly connected through a tension spring 192 to an arm 193 pivoted in the machine frame at 194. The spring 192 normally holds a pin 195 on the arm

193 against a lug 196 on the total slide. Rigid with the arm 193 is an arm 197 which is connected by means of a link 198 to the lower end of the link 162. It will be seen that depression of the Total key 180 will cause the arms 193 and 197 to swing forward to withdraw the notch 163 from the pin 164 and to place the edge 199 of the link 162 against a pin 200 on the lever 165, the spring 192 yielding to permit the key 180 to complete its downward movement. In the ensuing cycle of operations of the machine, the arm 169 swings upwardly, swinging the lever 165 counter-clockwise idly without imparting any movement to the link 162, hence the pinions remain in mesh with the racks as the latter rise. As the lever 165 completes its counter-clockwise movement, the pin 200 comes into registry with a notch 201 in the link 162, whereupon the spring 192 moves the notch into engagement with the pin. When the lever 169 starts on its return stroke, the shoulder 173 of the pawl 171 engages the pin 177 and swings the lever 165 clockwise, thereby lifting the link 162 and thus causing the pinions to be withdrawn from the racks 137 before the latter descend, thus leaving the pinions standing at zero or clear. The completion of the debit final total cycle leaves the pinions in neutral.

When a subtotal is to be taken, the Subtotal key 181 is depressed, thereby drawing the subtotal slide 190 forward. On said slide is a post 202 which engages a pin 203 on the total slide and thus causes the link 162 to be disengaged from the pin 164 and engaged with the pin 200, as described in connection with the operation of taking a final total. Since, however, the pinions are not to be cleared, they should remain in mesh with the racks 137 during the descent of the latter. To effect this result, a cam surface 204 is provided on the upper end of the post 202 to engage a stud 205 on an arm 206 pivoted on the axis 207. Rigid with the arm 206 is an arm 208 carrying a stud 209. When the subtotal slide 190 is drawn forward, the cam 204 places the stud 209 in position to depress the pawl 171 when the arm 169 approaches its upper position. Consequently when the arm 169 makes its return stroke, the shoulder 173 of the pawl is unable to engage the pin 177 and therefore the pinions are not withdrawn from the racks 137. Near the end of the downward stroke of the arm 169, the hook 174 engages the pin 176, and as the arm 169 completes its downward movement the hook 174 turns the lever 165 clockwise, thereby lifting the link 162, lowering the link 155, and lowering the cam arm 151, and thus moving the pinions 135 into neutral position, this occurring a moment after the racks have returned to their normal down position.

The Total key and the Subtotal key, together with a number of other operation-controlling keys, are latched in the depressed position during a given cycle of operations of the machine by means of a slide 210 (Fig. 28) which is reciprocable longitudinally of the machine and has a series of lugs 211 thereon. Each lug has a beveled surface 212 and a locking shoulder 213 therebelow. On each of the key stems is a locking stud 214 having a beveled surface to engage the surface 212 when the key is depressed and thus push the slide 210 forward to allow the stud 214 to engage beneath the shoulder 213 when the slide 210 is drawn rearwardly by the spring 215. Near the end of the cycle of operations, the slide 210 is drawn forward to release the key to the

action of the key-restoring means. The latter consists of a bell crank 216 pivoted at 217, one arm of the bell crank engaging the key stem and the other arm being pivoted to the forward end of a slide 218. The rear end of the slide is guided in the framework. An expansive spring 219 normally holds the slide 218 in its forward position, thus holding the key elevated. The slide 210 is drawn forward to release the depressed key by means comprising an elongated plate 220 which is pivoted along its upper edge to the machine frame. The lower edge of the plate at the right-hand side of the machine engages behind a lug 221 on the slide 210. Near the end of the cycle of operations, the plate 220 is swung forward by means including a slide 222 (Figs. 3 and 14) which is guided in the machine frame for movement longitudinally of the machine. A spring 223 normally holds the slide 222 in its rearward position. On the arm 88 is a pin 224 to engage the rear end of the slide 222 and push it forward, thereby tilting the plate 220. On the slide 222 is a cam surface 225 which, when the slide 222 is pushed forward by the pin 224, engages a stationary cam surface 226, whereby the rear end of the slide 222 is caused to move upwardly out of engagement with the pin 224, whereupon the spring 223 returns the slide 222 to its normal rearward position.

When the Total key 180 or the Subtotal key 181 is released in the manner heretofore described, a spring 227 (Fig. 27) restores the total slide 189 or the subtotal slide 190, as the case may be, to its normal rearward position and withdraws the cam 204 from the pin 205, whereupon a spring 228 lifts the stud 209 into its ineffective position.

When a total is to be taken, whether a final total or a subtotal, the detent plate 33 (Fig. 18) must be moved forward to permit the rising movement of the pins 30 connected to those of the actuators 2 which are required in the printing of the total or subtotal. For this purpose each of the slides 189 and 190 (Fig. 27) has a lug 229 which, when the slide is moved forward, engages one arm of a lever 230 pivoted at 231. The other arm of the lever 230 engages an arm 232 which is rigid with the bail 36. Thus it will be seen that when the Total key 180 or the Subtotal key 181 is depressed, the detent plate 33 will be drawn forward out of position to restrain the pins 30.

9. Non-addition in cross-footer

It is sometimes desirable to print an item without introducing it into the cross-footer. This may be accomplished by means of a Non-add key 233 (Fig. 27), the stem 234 of which is arranged to operate a bail 235 which is similar to the bails 184 and 185. The bail 235 is arranged to draw forward a non-add slide 236 which has a post 237. On the upper end of the post 237 is a cam surface 238 arranged to operate upon the stud 205. When the Non-add key 233 is depressed, the stud 209 is lowered into position to prevent the shoulder 173 of the pawl 171 from engaging the pin 171, as shown in Fig. 24. Consequently the pinions 135, which were moved out of mesh with the racks 137 when the arm 169 began to swing upwardly, remain in such withdrawn position as the arm 169 makes its return stroke. As the arm 169 is completing its downward or return movement, the hook 174 engages the pin 176, as shown in Fig. 25, whereby the pinions are moved into mesh with the racks 137 after the lat-

ter have been returned to their normal down position. At the close of the cycle of operations, the Non-add key 233 is released by the plate 220 (Fig. 28), whereupon a spring 238a (Fig. 27) restores the non-add slide 236 to its normal rearward position and the spring 228 lifts the stud 209 into its inoperative position.

10. Transfer mechanism

The transfer mechanism may be of any desired character. Herein I have shown a set of transfer devices for the racks 137 to carry amounts from one numerical order to the next higher order in operations involving addition, and a like set of transfer devices for the racks 138 to carry amounts from one numerical order to the next higher order in subtracting operations. The extent of downward movement of the tens and higher racks is limited (except in transfer operations) by contact of lugs 239 (Fig. 32) on the racks with pawls 240. When an amount is to be transferred from one order to the next higher order, the pawl 240 for the rack belonging to such higher order is withdrawn, thereby allowing that rack to descend under the action of its spring 141 (Fig. 18) until its lug 239 stops against a bar 241. The extent of such further descent of the rack is just sufficient to turn the pinion for that rack through the distance of one tooth. The pawls 240 are pivoted on a rod 242 in the machine frame. To the lower end of each pawl is pivoted a dog 243 having a tooth 244 adapted to engage the edge of the adjacent bar 241. A contractile spring 245 normally holds the tooth 244 in engagement with the bar 241, the pawl 240 being then in position to support the corresponding rack.

The means for disengaging the tooth 244 from the bar 241 consists of two diametrically opposite lugs 246 fixed to one side of each pinion. (Two lugs 246 are provided because each pinion has twenty teeth). When the amount registered by a pinion reaches 9, continued rotation of the pinion as its rack descends brings one of the lugs 246 against the end of the dog 243 associated with the next higher rack, thereby depressing the dog until the tooth 244 thereof is clear of the bar 241, whereupon the spring 245 (assisted by the downward pressure of said next higher rack) pulls the dog and the pawl 240 away from the last mentioned rack, the latter then moving down one tooth space under the influence of its spring 141 until stopped by the bar 241.

When any pinion stands at zero, one of the lugs 246 on said pinion lies directly beneath the end of one of the dogs 243 associated with the set of racks 137, if the amount accumulated to be a debit or positive amount, or directly beneath the end of one of the dogs 243 associated with the group of racks 138, if the amount accumulated be a credit or negative amount. Therefore, when a total is to be printed, those racks which mesh with the pinions standing at zero cannot rise, the remaining racks rising until the rotation of their pinions brings the lugs 246 thereon into contact with the respective dogs. The type bars 2 are then in position to print the total amount accumulated on the pinions.

11. Introducing the fugitive unit

If a debit or positive amount has been accumulated in the cross-footer, and one or more amounts are subtracted so as to leave a credit or negative total in the cross-footer, the true credit or negative total cannot be printed until the

credit or negative total has been increased by one unit. Similarly, if a credit or negative total be converted into a positive or debit total by the addition of amounts, the correct total cannot be printed without first adding a unit to the total. In other words, in order that the true algebraic sum shall be printed, it is necessary to introduce a unit (hereinafter termed the "fugitive unit") into the cross-footer whenever the cross-footer "passes through zero." In order to effect this result automatically, I have provided the means to be now described.

The units rack 137 and the units rack 138 are arranged to be supported in normal position by means of pawls 247 (Figs. 18 and 31) which are pivoted upon the rods 242 and are arranged to support the lugs 239 on said units racks. When the cross-footer is passing through zero, say, from the positive to the negative condition, the fugitive unit is introduced by withdrawing the pawl 247 for the units rack 138, whereupon the spring 141 for said rack moves the rack down one tooth space and thus turns the units pinion the same distance. The means for thus withdrawing the pawl 247 at the time the cross-footer passes through zero comprises two diametrically opposite lugs 248 (Fig. 31) on the pinion of highest order, said lugs being arranged to engage a dog 249 which may be, and preferably is, identical in form with the dogs 243. The dog 249 is pivotally supported upon the lower arm of a lever 250 which is pivoted on the rod 242. The upper arm of the lever 250 is rigidly connected with an arm 251 which is rigid with the pawl 247 by means of a cross-bar or plate 252.

Let it be assumed that the amount "3" has been accumulated or added by operation of the adding racks 137. The units pinion will therefore stand with one of its lugs 246 three spaces below the zero position on the adding side of the cross-footer, the corresponding lugs 246 of the other pinions lying directly beneath the ends of the dogs 243 at the same side of the cross-footer. The diametrically opposite lugs 246 are above the horizontal plane of the ends of the dogs 243 at the subtracting side of the cross-footer. Assuming that 5 is to be subtracted, the pinions are first moved out of mesh with the racks 137, and after the units rack 138 has been raised to the position for registering "5", the pinions are moved into mesh with the racks 138, whereupon the units rack 138 descends, thus turning the units pinion five tooth spaces. In the course of such turning movement, one of the lugs 246 on the units wheel is carried into engagement with the end of the dog 243 associated with the tens rack 138, thereby disengaging said dog from the bar 241 and thus allowing said tens rack to descend one tooth space. Said tens rack being in mesh with the tens pinion, the latter was caused to turn through one tooth space, whereby the lug 246 on said tens wheel tripped the dog 243 for the hundreds rack and so on from pinion to pinion. An impulse was thus transmitted from the units pinion to the pinion of highest order so as to place one of the lugs 246 on all the pinions except the units pinion directly below the normal horizontal plane of the dogs 243 at the subtracting side of the cross-footer. The rotation thus imparted to the wheel of highest order served to disengage the dog 249 from the bar 241, whereupon the corresponding spring 245 swings the lever 250 counter-clockwise as viewed in Fig. 30, the movement of said lever being transmitted through the plate 252 and the arm 251 to the

pawl 247, whereby the units rack 138 was allowed to descend an additional tooth space, thus introducing the fugitive unit.

12. Restoring transfer mechanism

After each transfer operation and each fugitive unit-introducing operation in the cross-footer, the pawl or pawls 240, the dog or dogs 243, or the dog or dogs 249, as the case may be, are restored to normal position by means of a rod 253 (Fig. 29), there being one such restoring rod for each of the sets of transfer mechanism. Each rod 253 is carried by two bell crank levers 254 (Fig. 30) which are pivoted in the machine frame on the axis 242. The bell crank levers at each side of the machine are connected for simultaneous swinging movement by a pin and slot connection, as shown at 255. The restoring rods 253 are simultaneously moved toward and away from each other by means of an arm 256 (Fig. 30) on each of the two forward bell cranks 254, each of said arms having a pin and slot connection with the forward end of a link 257. The rear end of each link 257 has a pin and slot connection with an arm 258 (Fig. 18) which is pivoted in the machine frame at 259. A spring 260 (Figs. 18 and 29) connected to one of the restoring rods 253 normally holds them in their withdrawn position. A spring 261 connected to one of the arms 258 normally holds a lug 262 on each link 257 against a cross-bar 263 carried by a plate-like member in the nature of an arm 264, said member being pivoted on the axis 265. The left-hand end of the cross-bar 263 extends into an elongated opening 266 in the rear end of a link 267, the forward end of which link is pivoted to the upper arm of a lever 268 pivoted in the framework at 269. On the lower arm of the lever 268 is a roller 270 (Fig. 34) which is arranged to be engaged by the left-hand fork 19 in the upward swing of the latter. Thus it will be seen that any transfer pawls and dogs concerned in a transfer operation or a fugitive-unit-introducing operation will be restored to their normal position during the forepart of the succeeding cycle of operations.

When the type bars are raised for a printing operation, the racks do not begin to rise until the studs 139 (Fig. 15) engage the upper ends of the elongated openings 140. Those racks, however, which have descended below the normal position in order to effect a transfer or to introduce the fugitive unit, rise practically simultaneously with the type bars and thus are lifted before the pawls 240, 243 and 249 (Figs. 30 and 32) are restored to normal position by the rod 253. In this way the lugs 239 are raised sufficiently to permit the placing of the pawls 240 thereunder.

13. Enforcing a blank or spacing cycle

It will be seen that the machine should not be put through a total-taking cycle of operations until after the transfer mechanism has been restored to normal position. I therefore provide means to insure that the machine shall be put through a blank cycle before the total-taking cycle is performed, during which blank cycle the transfer mechanism is restored, if it had operated in the last preceding cycle. The means to compel the performance of the blank cycle, in this embodiment of the invention, is made sensitive to the operation of the actuators 2. Thus if one or more actuators 2 are raised to register or print, the next cycle is not permitted to be a total-taking cycle; but after a blank cycle (in

which the actuators 2 are not raised to print) a total-taking cycle may be performed. The means herein shown to enforce the blank or spacing cycle comprises a slide 271 (Fig. 33) mounted for reciprocation longitudinally of the machine alongside the slide 210 (Fig. 28). The slide 271 (Fig. 33) is urged forward by a spring 272. Two lugs 273 and 274 are located on the slide 271 in position to underlie the lugs 214 on the Total key 180 and the Subtotal key 181, respectively, when the slide 271 is in its forward position. Said slide is normally held in its rear position by means including an arm 275 which is pivoted in the framework at 276. On the lower edge of the arm 275 is a cam lug 277 that bears against a pin 278 on the total lock slide 271. The arm 275 is arranged to be raised by means of a crank pin 279 carried by two cams 280 and 281, (Figs. 16 and 33) said cams being fixed upon the rock shaft 17. The rear end of the arm 275 rests upon the crank pin 279. A spring 282 tends to move the arm 275 down. When the rock shaft 17 makes its forward swing, the arm 275 is raised, thereby lifting the cam 277 sufficiently to allow the spring 272 to draw the total lock slide 271 forward far enough to block depression of the Total key 180 and the Subtotal key 181. Thus after a cycle of operations has been started the keys 180 and 181 cannot be depressed.

In the return stroke of the rock shaft 17, the downward movement of the crank pin 279 would permit the spring 282 to lower the arm 275 and thus cam back the total lock slide 271 into ineffective position, were it not for a mechanism comprising an arm 283 pivoted at 284 and having a finger 285 that extends into an opening 286 in the arm 275. The rear portion of the opening 286 is of such height that when the finger 285 is therein, said finger does not prevent the spring 282 from lowering the arm 275 and thus camming back the total lock slide 271. The forward portion of the opening 286, however, is of such reduced height that when the finger 285 is in said portion of the opening, the arm 275 cannot drop down far enough to cam the total lock slide 271 back into ineffective position. 287 is a lug on the lever 275 between the forward and rear portions of the opening 286. A spring 288 tends to swing the arm 283 to place the finger 285 in the rear portion of the opening 286. Rigid with the arm 283 is an arm 289 carrying a stud 290 (Figs. 33 and 39) that underlies several of the latches 291 which control the printing hammers 292. The hammers 292 are pivoted on the axis 293 and are impelled against the type by individual springs 294 that are anchored to a rod 294^a. The latches 291 are arranged to engage the lugs 295 on the hammers. As shown in Fig. 40, the latch 291 for each of the hammers for the type bars 2 (except the highest order latch) has a lug 295^a overlying the latch next to the left, so that the actuation of any latch will actuate all the latches of lower order. On each type bar 2 is a pin 296 (Fig. 33) which overlies the free end of an arm 297, which is pivoted on a rod 298 carried by a plate in the nature of an arm 299 pivoted at 284. A spring 301 (Fig. 39) normally holds the free end of the arm 297 in contact with the pin 296, said spring being connected to the latch 291. When the type bar is raised sufficiently to bring the type for the digit "1" or any higher digit to the printing line, a shoulder 302 (Fig. 39) on the arm 297 is brought in front of a lug 303 on the latch 291.

It will be seen that when one or more of the

type bars are raised into position to print "1" or a higher digit, rearward movement of the corresponding arms 297 will cause the shoulders 302 to engage the lugs 303 and thus disengage the corresponding latches 291 from the hammers required for printing from the raised type bars. Such movement of the latches 291 also serves to depress the stud 290 (Fig. 39) and thus move the finger 285 (Fig. 33) into the forward portion of the opening 286 so that in the continuing return stroke of the rock shaft 17, said finger prevents the arm 275 from descending far enough to cam the total lock slide 271 rearwardly. The lug 287 retains the finger 285 in the forward portion of the opening 286 so that at the end of the cycle in which the printing of the digit "1" or a higher digit occurred, the arm 275 is held up by the finger 285, and the total lock slide 271 remains in its forward position. Thus it is impossible to depress the Total key or the Subtotal key in preparation for the next cycle and hence the next cycle cannot be a total-taking cycle. If the operator wishes to take a total, he must put the machine through a blank cycle of operations, that is to say, a cycle in which no number is set up on the keyboard. In the first half of the blank cycle, the crank pin 279 lifts the arm 275, thus disengaging the lug 287 from the finger 285. Subsequently in the same half of the cycle, a stud 304 (Figs. 16 and 33) on the cam 281 engages the end of a finger 305 on the arm 283 and pushes said arm forward, thereby again placing the finger 285 in the forward portion of the opening 286. In the second half or return stroke of the cycle, the spring 288 causes the finger 305 to follow the stud 304 so that the finger 285 passes into the rear portion of the opening 286 before the crank pin 279 has allowed the arm 275 to drop. In the latter portion of the second half of the cycle, the crank pin 279 allows the arm 275 to descend under the action of its spring 282, whereby the total lock slide 271 is cammed back into ineffective position, thus allowing a total or subtotal to be taken in the next ensuing cycle.

The mechanism just described for enforcing the performance of a blank cycle prior to a totaling or subtotalling operation is not effective when the machine is operating under the control of the carriage. In the latter case the carriage stops are set to provide a blank cycle before each totaling or subtotalling cycle or, if preferred, only when restoration of the transfer mechanism is required.

14. Hammer mechanism for amount typebars

The hammers 292 (Fig. 39) were described in connection with the means to enforce a blank cycle. They are released through rearward swinging movement of the arm 299 that supports the series of arms 297. The means for swinging the arm 299 is shown in Figs. 18 and 34. To the left-hand end of the rod 298 is pivoted a link 306, the rear end of which is connected to the upper arm of a lever 307 pivoted in the machine frame at 308. The lower arm of the lever 307 carries a roller 309 adapted to run on the edge of the cam 16 fixed on the main rock shaft 17. The major portion of the periphery of the cam 16 is concentric with the shaft 17, but in the lower portion of the cam is a notch 310 providing a cam surface 311. A link 312 connects the upper end of the lever 307 to an aliner 313 which is pivoted in the machine frame at 314. A spring 315 connected to the aliner holds the roller 309

in engagement with the cam 16. It will be seen that movement of the roller 309 into the notch 310 would permit the spring 315 to swing the arm 299 rearwardly to disengage the latches 291 from the hammers, but it is desired that the hammers shall not be released until during the beginning of the return stroke, thus giving the actuators time to reach the selected printing and registering position and come to rest. It is also desired that the hammers shall be released suddenly. I therefore provide an arm 316 loosely pivoted on the shaft 17 and normally held against a stop 317 on the cam 16 by gravity. The free end of the arm 316 is curved concentrically with the shaft 17 and projects slightly beyond the concentric or dwell portion of the cam 16. The side of the arm 316 facing the stop 317 has a notch 318 (Fig. 36) to receive a square stud 319 on the lower arm of the lever 307.

In the forward stroke of the rock shaft 17 the cam 16 rises, the projecting end of the arm 316 passing under the square lug 319 before the roller 309 can drop into the notch 311. As the cam 16 completes its upward swing, the stud 319 drops off the end of the arm 316 onto the stop 317. When the cam 16 starts on its return stroke, the projecting end of the arm 316 catches on the lug 319, whereby the arm 316 is caused to lag while the cam 16 continues to swing downwardly, thereby forming a space between the arm 316 and the stop 317 into which the lug 319 drops (see Fig. 36) under the action of the spring 315, thereby quickly unlatching the hammers very soon after the return stroke has commenced. As the cam 16 continues its return movement, the roller 309 rides out on the cam surface 311 until it is again on the concentric or dwell portion of said cam, thus disengaging the square stud 319 from the arm 316, whereupon said arm drops into engagement with the stop 317. A leaf spring 320 on the machine frame is located in position to come into engagement with the arm 316 as the cam 16 is completing its upward stroke, this spring being provided to prevent the arm 316 from continuing to swing up through momentum.

The hammers 292 are reset or cocked by means of a rod 320^a (Fig. 33) carried by the upper ends of two levers 320^b (Figs. 28 and 33) which are pivoted in the machine frame at 320^c. A tension spring 320^d (Fig. 28) tends to move the rod 320^a away from the hammers. The lower arm of the right-hand lever 320^b is arranged to be engaged by a roller 320^e on the arm 169. A roller 320^f (Fig. 16) on the cam 16 is arranged to engage the lower arm of the left-hand lever 320^b.

It will be remembered that the hammers are released at the beginning of the return stroke of the rock shaft 17. At that time the resetting rod 320^a is in its rearward position away from the hammers. Soon after the return stroke has been commenced, and before the type bars start down, the rollers 320^e and 320^f engage the lower arms of the levers 320^b and draw the hammers away from the type. When the hammers 292 are reset by the rod 320^a, the lugs 295 on the hammers slip under the hooked ends of the latches 291 so that said latches shall be able to restrain the hammers during the first half of the next cycle, during which period the resetting rod 320^a is moving away from the hammers.

15. Double naught printing

Means is provided for printing a plurality of naughts (herein two) to indicate that a given counter is clear. This requires tripping of a

hammer latch 291. As before stated, the pins 296 on the actuators 2 are so located as to permit tripping of the hammer latches 291 only when an actuator 2 is lifted high enough to print the digit "1" or a higher digit. Other means must therefore be provided to trip a latch 291 when a naught not preceded by a "1" or higher digit is to be printed.

When the cross-footer is clear, if an attempt be made to take a total therefrom, the type bars rise only to the cipher-printing position. In order to trip the tens latch 291 when the type bars are raised to the cipher-printing position, I provide on the pivot rod 298 (Figs. 39 and 41) a lever 320^g, the rear end of which is arranged to engage the lug 303 on the tens hammer latch 291. (Said lug 303 is widened (as shown in Fig. 40) for engagement by the lever 320^g as well as the tens lever 297.) In the forward arm of the lever 320^g is a cam slot 320^h having dwell portions extending forwardly and rearwardly from the cam portion thereof. In said slot is a pin 320ⁱ on an arm 320^k (Fig. 27) which is fixed to the bail 36. When either of the Total keys 180 and 181 is depressed, the corresponding slide 189 and 190, operating on the lever 230, will cause the pin 320ⁱ to move forwardly, thus swinging the rear arm of the lever 320^g upwardly, as shown in Figs. 15 and 41, so that when the machine is cycled the rearward movement of the pivot rod 298 will trip the tens latch 291 and hence the units latch, thus causing the printing of two naughts. When the slides 189 and 190 are restored to their normal position, the spring 38 (Fig. 27) returns the lever 320^g to its normal position as shown in Fig. 18. The rearwardly extending dwell portion of the slot 320^h accommodates the pin 320ⁱ when the total detent plate 33 is in its rear effective position and the hammers are tripped.

16. Aliner

The aliner 313 (Fig. 34) comprises a blade 321 which is quickly moved into engagement with notches 322 (Fig. 15) in the actuators 1, 2, 3 and 4 at the beginning of the return stroke of the rock shaft 17 to insure correct alinement of the type and correct registration of amounts. Placing the aliner in engagement with the actuators on the return stroke gives the actuators time to complete their movement into the selected positions and come to rest. As the roller 309 rides out on the cam surface 311 in the return stroke of the rock shaft 17, the blade 321 is withdrawn from the notches 322, this action occurring before the roller 318 acting on the fork 19 has caused the type bars to start down.

17. Conditioning cross-footer for subtraction

Reverting now to Fig. 22: When the machine is clear, the link 155 is in engagement with the pin 158, the pinions 125 being then in mesh with the adding racks 137. Reciprocation of the link 155 will therefore shift the pinions into and out of mesh with those racks. When an amount is to be subtracted, the link 155 is shifted out of engagement with the pin 158 and into engagement with the pin 159. The means for thus shifting the link 155 comprises an arm 324 (Fig. 28) pivoted on the axis 325 and having a forked lower end to engage a pin 326 on the link 155. Rigid with the arm 324 is an arm 327 (Fig. 33) the lower end of which is yieldingly connected to a subtraction slide 328 by means of a spring 329 (Figs. 33 and 49) that normally holds a shoulder 330 on the arm 327 against a pin 331 on the slide

328. A spring 332 (Fig. 28) normally holds the subtraction slide 328 in its rear, ineffective position. The slide is pulled forward into effective position by means of a Subtraction key 333 having a stem 334 which is arranged to operate a ball 335 that engages an upstanding lug 336 on the front end of the subtraction slide. When the Subtraction key 333 is depressed, the slide 328 is drawn forward and held forward through the latching of the Subtraction key in depressed position, thereby shifting the link 155 until the edge 337 (Fig. 22) of the link stops against the pin 159, the pin 158 being still within the notch 156. In the ensuing forward stroke of the rock shaft 17, the link 155 is moved downward, thereby swinging the lever 151 into the position shown in Fig. 44, whereby the pinions 135 are moved out of mesh with the adding racks 137. As soon as the pin 159 was raised sufficiently to register with the notch 157, the spring 329 (Fig. 49) moved the link 155 to place said notch in engagement with said pin 159, as shown in Fig. 44. In the return stroke of the rock shaft 17, the link 155 is lifted, as shown in Fig. 45, thereby swinging the lever 151 down so as to cause the upper portion of the cam slot 153 to act upon the roller 154, whereby the pinions 135 are placed in mesh with the subtraction racks 138 before the latter start down.

When there is a credit or negative total or overdraft in the cross-footer and said total or overdraft is to be printed, it is necessary that the pinions 135 be prevented from moving into mesh with the adding racks 137 at the conclusion of the blank or spacing stroke. This result could be effected by holding the Subtraction key depressed during the spacing stroke. Inasmuch, however, as the operator may not know that the total is negative, and for the further reason that the machine is intended for automatic operation under the control of the paper carriage, I provide means for automatically maintaining the cross-footer in condition for the printing of a negative total when it contains such a total. Said means comprises a slide 338 (Fig. 33) guided for horizontal reciprocation longitudinally of the machine, said slide being impelled forward by a spring 339. On the rear end of the slide 338 is a lug 340 which is arranged to engage an upstanding lug 341 on the subtraction slide 328 for the purpose of pushing the subtraction slide forward into effective position. After each operation of the slide 338, it is restored to its normal rear position by means of the cam 280 on the main rock shaft 17, said cam engaging a roller stud 342 on the slide 338 near the end of the return stroke of the rock shaft. The slide 338 is prevented from operating to push the subtraction slide 328 into effective position except when there is a credit balance or overdraft in the machine.

A slide 343 movable transversely of the machine carries a locking stud 344 which is arranged to lie in the path of a shoulder 345 on the slide 338 to prevent said slide from moving an effective distance under the influence of its spring 339. A spring 346 connected to the slide 343 tends to move the latter to the left to place the stud 344 out of the path of the shoulder 345. When there is a debit balance in the machine, the slide 343 is prevented from moving under the influence of its spring 346 to release the slide 338, by means of a stop arm 347 (Figs. 29 and 33) fixed to one arm of a bell crank 348 which is pivoted on the axis 349. The other arm of the bell crank 348 is arranged to be moved by the levers 250. A link 350 has a pin and slot connection with both of the

levers 250 and is pivoted to the bell crank 348, as shown in Fig. 29. When the cross-footer passes from the positive to the negative side of zero, the arm 250 shown at the right-hand side of Fig. 30 pushes the link 350 toward the left as viewed in said figure, thereby rocking the bell crank in the direction to lower the stop arm 347 out of the path of the slide 343; and when the cross-footer passes through zero in the opposite direction, the lever 250 shown at the left in Fig. 29 pushes the link 350 toward the right to place the stop arm 347 in the path of the slide 343. Thus, When there is a positive or debit balance in the machine, the slide 343 is held by the stop 347 in position to prevent the slide 338 from conditioning the cross-footer for a negative operation; and when there is a credit balance in the machine, the slide 343 is permitted to move under the influence of the spring 346 to the left so as to free the slide 338 for operation on the subtraction slide 328. The slide 343 is moved to the right into a position where it can be held by the stop arm 347 by means of an arm 351 (Fig. 33) fixed to the arm 150 and arranged to operate against a cam surface 352 on the slide 343. Whenever addition occurs, the arm 351, acting on the cam surface 352, pushes the slide 343 to the right.

If we assume that there is a credit balance in the machine, the stop arm 347 will be down as in Figs. 30 and 33, and therefore not in position to prevent the slide 338 from conditioning the machine for subtraction. If we assume that it is desired to add an amount, it will be seen that means must be provided to prevent the slide 338 from conditioning the machine for subtraction. This means comprises a stop slide 353 (Figs. 5, 6, and 33) which is urged toward the right by a spring 354 (Fig. 5) into position to place a lug 355 in the path of the forward end of the slide 338. On the left-hand end of the slide 353 is an angular portion 356 (Figs. 6 and 7) which lies at the left-hand side of the stud 63 on the swinging bracket 43. It will be seen that if an amount be set up in the keyboard (as would be required preparatory to adding an amount to a credit balance) the swinging bracket 43 will swing to the right, thereby allowing the spring 354 to place the lug 355 in the path of the slide 338.

18. Taking credit total or credit subtotal

In manually conditioning the cross-footer for the taking of a credit total or a credit subtotal the Total key or the Subtotal key is depressed, just as in taking a debit total or subtotal. If the total be a credit amount the true negative total will be printed.

19. Addition after credit totaling

After taking a credit total, or subtotal, adding can be done immediately and the correct result obtained, because the fugitive unit is introduced in connection with the addition of the first item following the taking of a negative total or subtotal.

20. Rear counters

The present embodiment of the invention comprises four auxiliary registers or counters A, B, C, and D (Fig. 18). Each counter comprises a series of pinions 357 having ten teeth each and adapted to mesh with a set of racks 358. These counters are arranged in a series extending longitudinally of the racks 358. The counter pinions are always in the planes of the racks, ready

to be meshed or demeshed, and require no preliminary or selective movement. The racks 358 are guided in the rear portion of the machine frame for vertical reciprocation and are connected at their lower ends to levers 359 which are pivoted on the axis 13. For each lever 359 there is a tension spring 360 that connects said lever to one of the levers 12. The rear end of the lever 12 is forked to receive a headed stud 361 on the lever 359. Addition occurs in the up stroke of the racks 358. The initial position of said racks is determined by transfer mechanism which, in this instance, comprises a stationary element 362 (Fig. 18) arranged to be engaged by a lug 363 on the units rack, and a series of transfer levers 364 (Fig. 51) pivoted on the axis 259, one arm of each of said levers being arranged to serve as a stop for the lug 363 on the racks of higher order than the units order. Individual springs 365 for the transfer levers 364 tend to swing said levers in the direction to permit a transfer movement of the racks 358. The levers are normally restrained from such movement by means of shoulders 366 formed on transfer slides 367, said slides alternating with the racks 358. The shoulder 366 is engaged by an angular lug 364^a on the transfer lever. Below the shoulder 366 is a cam surface 366^a. Each of the slides 367 serves to control the corresponding pinions of all of the rear counters, and for this purpose is provided with four lugs 368 arranged to be engaged by transfer lugs 369 on the pinions 357. When any one of said pinions passes through the zero position, the transfer lug 369 lifts the adjacent transfer lug 368, as in Fig. 51, thereby lifting the transfer slide 367 sufficiently to remove the locking shoulder 366 from engagement with the transfer lever 364 that has been restraining the rack of next higher order, whereupon the spring 365 for said transfer lever swings the lever in the counter-clockwise direction, the lug 364^a acting on the surface 366^a to cam the transfer slide 367 up until the lever stops against a shoulder 366^b on the transfer slide. This movement of the transfer lever 364 is just sufficient to allow the corresponding rack 358 to move up under the tension of its spring 360 one tooth space, thereby turning the pinion of the next higher order a corresponding distance. Such transfer movement occurs at the close of the cycle of operations, the transfer mechanism being reset to the initial position during the forepart of the next ensuing cycle of operations by means of the arm 264 operating to move the slides 257 forward as previously described. The forward movement of the slides 257 causes the arms 258 to swing forward, thereby causing the cross-bar 370 extending between said arms to swing the transfer levers 364 in the clockwise direction as viewed in Fig. 51, thereby depressing the rack or racks 358 which were concerned in the previous transfer operation. When the transfer levers 364 are thus swung to their initial position, the transfer slides 367 are drawn downwardly by their individual springs 371, whereby the locking shoulders 366 are placed behind the lower ends of the levers 364 to hold them in their initial position. The springs 371 are not as effective as the springs 365 and hence do not prevent the latter from camming up the transfer slides when the shoulders 366 are disengaged from the lugs 364^a.

Since, in the present embodiment of the invention, there is but a single set of transfer members for all four rear counters, it will be seen that only one of said counters may be used at a

time. Each of the rear counters is moved into and out of mesh with the racks 358 by means of two racks 372 (Fig. 50) connected to the counter and supported for horizontal sliding movement longitudinally of the machine. The racks 372 mesh with mutilated pinions 373 which are rigid with a shaft 374. On the right-hand end of the shaft 374 is a crank arm 375 which is connected through a link 376 to a member 377. Said member is supported for reciprocation longitudinally of the machine, being suspended in the machine frame by means of two parallel links 378. The link 376 has a disengageable connection with the member 377 consisting, in this instance, of a notch 379 in the link to receive a pin 380 on the member 377. A tension spring 381 tends to hold the link 376 with the pin 380 in the notch 379. The member 377 is reciprocated to place the selected rear counter in and out of mesh with the racks 358 by means of a lever 382 pivoted at 161 and having in its rear end a cam slot 384 into which extends a stud 385 carried by the member 377. The lever 382 is swung by means including a link 386 which is pivoted to the forward arm of the lever 382. Said link has a notch 387 to receive a pin 388 on a lever 389 which is pivoted in the machine frame at 390. The lever 389 has a pin and slot connection with an arm 391 which is pivoted at 168. The means for swinging the lever 389 comprises the arm 15 30 (Figs. 16 and 50) fixed upon the main rock shaft 17. On said arm is pivoted a pawl 392 which is like the pawl 171. The pawl 392 has two shoulders 393 and 394 and a hook 395. The pawl is acted upon by a tension spring 396. On the lever 35 389 is a pin 397 arranged to be engaged by the shoulder 393. On the arm 391 is a pin 398 for engagement by the shoulder 394.

A detent 399, pivoted in the machine frame at 399^a, has two cam notches therein to receive a pin 399^b fixed to the forward end of the cam lever 382. A spring 399^c attached to the detent holds the latter in engagement with said pin. This spring-actuated detent assists to move the lever 382 suddenly into either of its positions and to hold it in such position.

When the rear counters are out of mesh with the racks 358 they are held against casual rotation through engagement of the pinions with blades 400 (Fig. 18) fixed in the machine frame.

21. Selecting the desired rear counter

In this embodiment of the invention, it is necessary to select the desired rear counter prior to each cycle in which a rear counter is to be used. All of the rear counters, therefore, are normally in their rear or withdrawn position, as will be understood from Fig. 21, except when a rear counter has been used in the last preceding cycle, in which instance that counter is in its forward or engaged position at the beginning of the next cycle. The means for selecting the rear counters comprises four keys 401, 402, 403 and 404 (Figs. 2, 5 and 50), each of which operates upon a bail 405. For the bails 405 there are slides 406, 407, 408 and 409, (Figs. 5 and 50). Each of the slides 406, 407, 408 and 409 has a shoulder 410 (Fig. 50) which bears against a lug 411 on a bail, the bail for the A counter being designated 412 and the remaining bails being numbered 413, 414 and 415 (Figs. 5 and 21). An individual spring 416 tends to swing the bails downwardly and move the connected slide rearwardly. Each bail 412, 413, 414 and 415 is connected to its respective link 376 through a link 417 (Figs. 21 and 50).

there being a pin and slot connection between each link 417 and its respective link 376. It will be seen that depression of a rear counter selecting key will raise the corresponding link 417 so that the pin 417^a is in the lower portion of the slot 417^b.

418 (Fig. 50) are pins fixed in the framework in position to lie directly in front of the links 376 when the counters are in withdrawn position, and thus hold them in such a position.

Assuming that no rear counter has been used in the preceding cycle, and that it is desired to use the A counter for addition in the ensuing cycle, the A counter-selecting key 401 is depressed as shown in Fig. 50, the corresponding link 417 being thus raised until the pin 417^a on the upper link 376 is in the lower portion of the slot 417^b. When the rock shaft 17 begins to make its forward swing, the arm 15, supplemented by the spring-actuated detent 399, moves the lever 389 counter-clockwise, such movement occurring very early in the front stroke. The movement of the lever 389 is transmitted through the pin 388 to the link 386 and thus to the cam lever 382, whereby the rear end of said cam lever 382 is swung downwardly and the member 377 moved rearwardly, bringing the uppermost pin 380 into register with the notch 379. Thereupon the spring 381 raises the link 376 to place the pin and the notch in engagement with each other. On the return stroke of the rock shaft 17, the shoulder 394 operating on the pin 398 and supplemented by the spring-actuated detent 399, causes the lever 389 to swing in the clockwise direction, the movement of said lever being transmitted to the cam lever 382 to raise said lever into the position shown in Fig. 50. The member 377 is thereby moved forward very early in the return stroke, carrying with it the link 376 and thus placing the A counter in mesh with the racks 358 a moment before the latter start rising. The cycle is completed with the A counter still in mesh with the racks, but at the end of the cycle the A counter-selecting key 401 is released by the forward movement of the slide 210 (Fig. 28), whereupon the spring 416 moves the slide 406, the bail 412 and the corresponding link 417 toward their normal positions to the extent permitted by the uppermost pin 418 on which the link 376 is then resting as shown in Fig. 50. If the A counter is not used in the next succeeding cycle, the member 377 is moved rearwardly at the beginning of the front stroke of the rock shaft 17, as previously described, whereby the link 376 is pushed rearwardly to withdraw the A counter before the racks 358 descend. As soon as the front end of the corresponding slide 376 has been moved past the uppermost pin 418, the spring 416 completes the return of the slide 406, the bail 412, the corresponding link 417, and the A counter link 376 to their normal positions, whereby the said link 376 is disengaged from the member 377. The spring 416 is more effective than the spring 381.

Any suitable means may be used to prevent more than one of the counter-selecting keys 401, 402, 403 and 404 from being used at a time. Herein I have shown three similar detents 419 (Figs. 2 and 2^a) pivoted at 420 between the stems of the counter-selecting keys. On each of said stems is a shoulder 421 adapted to engage lugs 422 on the adjacent detents 419. Depression of, say, the B counter-selecting key 402 will swing the detent 419 located immediately in the rear

of the key 402 so as to place the rear lug 422 on said detent in position to block descent of the shoulder 421 on the stem of the A counter-selecting key 401 and at the same time preventing rearward pivotal movement of the other two detents. Thus, depression of the keys 401, 403 and 404 to an effective extent is prevented.

22. Taking a total from a rear counter

Referring now to the matter of taking a subtotal or a final total from a rear counter: As heretofore explained, the conclusion of a cycle of operations in which a rear counter was used finds that rear counter engaged with the racks 358. If a total were to be taken from that particular counter in the next cycle, the counter would be in mesh with the racks, but if a total were to be taken from one of the other rear counters, such counter would not be in mesh with the racks 358 and hence a blank or spacing stroke would have to be taken to place such rear counter in mesh with the racks before the latter start descending. For the sake of uniformity in operation, therefore, means is provided to enforce a blank cycle before the taking of a total from any of the rear counters through depression of one of the Total keys 430 and 431. This means is that which has been already described in connection with the cross-footer. It is illustrated in Fig. 33 where it will be seen that the Total key 430 and the Subtotal key 431 for the rear counters have key stems which are arranged to be blocked by the total lock slide 271 in the manner heretofore described.

Preparatory to taking a total from a rear counter by use of one of the Total keys 430 and 431, the counter-selecting key for that counter is depressed, thereby raising the corresponding link 417. If that particular counter had been in use in the preceding cycle, its link 376 would be still engaged with the corresponding pin 380 on the member 377, and during the blank or spacing cycle the link 376 would be reciprocated to withdraw the counter from the racks 358 and restore the counter to said racks. If, on the other hand, that particular counter had not been in use during the last preceding cycle, it would be placed in mesh with the racks 358 during the last half of the spacing cycle. The total lock slide 271 also is withdrawn into its rear or ineffective position during the last half of the spacing cycle. The desired Total or Subtotal key 430 or 431 may then be depressed. The selected counter being in mesh with the racks 358, it is desired that it remain in mesh with said racks during the downward movement thereof. The means whereby the upward movement of the arm 15 is rendered ineffective to withdraw the counter from the racks comprises a total slide 432 and a subtotal slide 433 (Fig. 52) arranged to be drawn forward by bails 434 operated by the stems of the keys 430 and 431, respectively. On the total slide 432 is a portion 435 which is yieldingly connected through a spring 436 to an arm 437 pivoted in the machine frame at 438. A pin 439 on the arm 437 is normally held against a lug 440 on the total slide by the spring 436. Rigid with the arm 437 is an arm 441 which is connected through a link 442 to the lower end of the link 386. It will be evident that depression of the Total key 430 will cause the arms 437 and 441 to swing forward to withdraw the notch 387 from the pin 388 and to press the edge 443 of the link 386 against a pin 444 on the lever 389, the spring 436 yielding to permit the key 430 to complete its downward movement. In

the ensuing total-taking cycle of operations, the arm 15 swings upwardly, swinging the lever 389 counter-clockwise idly without producing any movement of the link 386; consequently the selected rear counter remains in mesh with the racks as the latter descend. As the lever 389 completes its counter-clockwise movement, the pin 444 comes into registry with a notch 445 in the link 386, whereupon the spring 436 moves the notch into engagement with the pin. When the arm 15 starts on its return stroke, the pawl 392 engages the pin 398 and swings the lever 389 clockwise, thereby lifting the link 386 and causing the counter to be withdrawn from the racks 358 before the latter rise, thus leaving the rear counter standing at zero or clear.

When a subtotal is to be taken, the Subtotal key 431 is depressed, thereby drawing the subtotal slide 433 forward. On said slide is a post 446 which lies behind a pin 447 on the total slide 432, and thus causes the link 386 to be disengaged from the pin 388 and engaged with the pin 444 as described in connection with the matter of taking a final total. Since, however, the counter is not to be cleared, it should remain in mesh with the racks 358 during their upward movement. I therefore provide a cam surface 448 on the upper end of the post 446 to engage a stud 449 on an arm 450 pivoted on the axis 207. Rigid with the arm 450 is an arm 451 carrying a stud 452. When the subtotal slide 433 is drawn forward, the cam 448 places the stud 452 in position to depress the pawl 392 when the arm 15 approaches its upper position. As a result, when the arm 15 makes its return stroke, the shoulder 394 of the pawl is unable to engage the pin 398 and therefore the counter is not withdrawn from the racks 358. Near the end of the return or downward stroke of the arm 15 the hook 395 engages the pin 397, and as the arm 15 completes its return movement said hook turns the lever 389 clockwise, thereby lifting the link 386 and lowering the cam lever 382, and thus withdrawing the counter from the racks immediately after the racks have returned to their normal up position.

As the cycle is being completed, the plate 220 (Fig. 28) draws the slide 210 forward, thereby releasing the Subtotal key 431, whereupon the subtotal slide 433 (Fig. 52) is drawn rearwardly to its initial position by means of a spring 452a (Fig. 52). Such return of the subtotal slide allows a spring 452b (Fig. 52) to lift the non-add and subtotal stud 452 into ineffective position. The return of the subtotal slide 433 to normal position also permits a spring 452c (Fig. 52) to return the total slide 432 to normal position, and to swing the link 386 out of engagement with the pin 444 and placing the edge 452d on said link against the pin 388.

When a total is to be printed, whether a final total or a subtotal, the detent plate 33 (Fig. 16) must be moved forward to allow the rising movement of the pins 30 connected to those of the actuators 2 which are required in the printing of the total or subtotal. For this purpose, the slides 432 and 433 (Fig. 52) are arranged in their forward movement to engage the lever 230, whereby the detent plate 33 is drawn forward out of position to restrain the pins 30, as heretofore described.

When any one of the rear counters is clear, and an attempt is made to take a total therefrom, two naughts will be printed, as heretofore described, by reason of the action of the slides 432 and 433 on the lever 230.

23. Conjoint use of counters

The following combinations of operations may be performed:

(a) Addition may occur simultaneously in the cross-footer and in any selected rear counter.

(b) Subtraction may occur in the cross-footer and addition simultaneously occur in any selected rear counter.

(c) The total may be taken from any rear counter and transferred to (that is to say, added to the total contained in) the cross-footer, leaving said rear counter clear.

(d) The total may be taken from any rear counter and transferred to (that is to say, added to the total contained in) the cross-footer, the total being retained in said rear counter.

(e) The total may be taken from any rear counter and subtractively transferred to (that is to say, subtracted from the total contained in) the cross-footer, leaving said rear counter clear.

(f) The total may be taken from any rear counter and subtractively transferred to (that is to say, subtracted from the total contained in) the cross-footer, the amount being retained in said rear counter.

(g) The total (whether a positive or a negative number) may be taken from the cross-footer and transferred to (that is to say, added into) any selected rear counter, leaving the cross-footer clear.

(h) The total (whether a positive or a negative number) may be taken from the cross-footer and transferred to (that is to say, added into) any selected rear counter, the amount being retained in the cross-footer.

(i) The total may be transferred from any rear counter to the cross-footer, and then transferred to any other rear counter, leaving the first mentioned rear counter clear.

(j) The total may be transferred from any rear counter to the cross-footer, and then transferred to any other rear counter, the total being retained in the first mentioned rear counter.

In performing operation *a*, the item is set up in the keyboard, the counter-selecting key for the desired rear counter depressed, and the motor bar 594 then depressed, whereupon the machine is caused to go through a cycle of operations to add the item into the cross-footer and the selected rear counter.

In performing operation *b*, the same steps are performed as in operation *a* except that the Subtraction key 333 is depressed at the same time that the counter-selecting key is depressed.

In performing operation *c*, the following steps are performed:

1st. The counter selecting key for, say, the A counter is depressed.

2nd. The motor bar 594 is depressed, whereby the machine is cycled to place the A counter in mesh with the racks 358, and to move the total lock slide 271 rearwardly to unlock the Total keys. The cross-footer is not operated in this cycle because the type bars are held down by the detent plate 33.

3rd. The Total key 430 for the rear counter is depressed.

4th. The motor bar is depressed, whereupon the machine is cycled to take a final total from the A counter, a corresponding amount of movement being imparted to the pinions of the cross-footer, whereby the total cleared out of the A counter is added into the cross-footer.

Operation *d* is performed just as in the case

of operation *c* except that in the third step, the Subtotal key 431 for the rear counter is depressed, instead of the Total key 430.

In performing operation *e*, the same steps are performed as in operation *c* with the exception that the Subtraction key 333 is depressed at the same time that the Total key 430 for the rear counter is depressed.

Operation *f* is performed as in the case of operation *d* except that the Subtraction key is depressed at the same time that the Subtotal key 431 for the rear counter is depressed.

In performing operation *g*, the following steps are taken:

1st. The motor bar is depressed to put the machine through a blank cycle to unlock the Total keys.

2nd. The Counter-Selecting key for the desired rear counter is depressed and at the same time the Total key 180 for the cross-footer is depressed.

3rd. The motor bar is depressed, whereupon the machine goes through a cycle of operations to take a final total from the cross-footer and at the same time add the amount into the selected rear counter.

In performing operation *h*, the steps performed are the same as those for operation *g* except that the Subtotal key 181 is depressed in place of the Total key.

In performing operation *i* (assuming the cross-footer to be clear), the following steps are taken:

1st. The Counter-Selecting key for, say, the A counter, is depressed.

2nd. The motor bar is depressed, whereupon the machine cycles to place the A counter in mesh with the racks 358 and to move the total lock slide 271 rearwardly to unlock the Total keys. The cross-footer does not operate in this cycle because the type bars are held down by the detent plate 33.

3rd. The Total key 430 is depressed.

4th. The motor bar is depressed, causing the machine to cycle to take a final total from the A counter, a corresponding amount of movement being imparted to the pinions of the cross-footer whereby the total cleared out of the A counter is added into the cross-footer. The total lock slide 271 returns to its effective position.

5th. The motor bar is depressed to put the machine through a blank cycle for the purpose of moving the total lock slide 271 rearwardly to unlock the Total keys. The cross-footer is not operated in this cycle because the type bars are held down by the detent plate 33.

6th. The Counter-Selecting key for, say, the B counter, and the Total key 180 for the cross-footer are simultaneously depressed.

7th. The motor bar is depressed whereby the machine is cycled. During the first half of the cycle, the cross-footer is turned to zero, the racks 358 being lowered correspondingly. In the second half of the cycle, the cross-footer is moved out of mesh with its racks and the B counter is moved into mesh with its racks, and as the racks 358 rise the amount which was transferred from the A counter to the cross-footer is added into the B counter.

In performing operation *j*, the same steps are taken as in performing operation *i* except that in the third step, the Subtotal key 381 is depressed in place of the Total key 380.

24. Non-addition in rear counter

In the performance of cross-tabulating opera-

tions, it will sometimes happen that the machine is set up to introduce amounts into a certain rear counter in two successive columnar positions, but that it is not desirable to introduce an amount into that counter in the second of such positions. For this reason I provide a Non-add key 453 (Fig. 52), the stem of which is arranged to operate a bail 454 which in turn is arranged to draw forward a non-add slide 455 having a post 456. On the upper end of the post 456 is a cam surface 457 arranged to operate upon the stud 449. Before the carriage moves into the columnar position wherein the operator desires to prevent the introduction of an amount into the rear counter, the operator depresses the Non-add key. The stud 452 thus is lowered into position to prevent the shoulder 394 of the pawl 392 from engaging the pin 398 as shown in Fig. 52. When the carriage reaches such columnar position and the machine begins to cycle, the selected rear counter is withdrawn from the racks 358 at the beginning of the upward movement of the arm 15 through the rearward movement of the member 377 as will best be understood from Fig. 21. In the return or downward movement of the arm 15 the stud 452 disables the pawl 392 and hence the rear counter remains in its withdrawn position until, as the arm 15 is completing its downward or return movement, the hook 395 engages the pin 397, whereby the lever 389 is turned clockwise, pulling the link 386 down, raising the cam lever 382, pushing the member 377 forward, and thus returning the rear counter into mesh with the racks just as though that counter had been used during that particular cycle.

25. Interlock between total keys

Means is provided to prevent the depression of either of the rear counter Total keys 401 and 402, if one of the Total keys 180 and 181 for the cross-footer has been depressed, and vice versa. Said means comprises, in this instance, a locking slide 458 (Figs. 2 and 2b) mounted for reciprocation alongside the stems of the above mentioned Total keys, there being four pins 459, 460, 461 and 462 for the keys 180, 181, 430 and 431, respectively. In the stem of each of said keys is a notch providing a shoulder 463. The pins 459, 460, 461 and 462 are so located on the slide 458 with reference to the key stems that when either of the keys 180 and 181 is depressed, the shoulder 463 on the depressed key stem will move the slide 458 rearwardly to place the pins 461 and 462 so far under the shoulder 463 on the stems of the keys 430 and 431 that said keys cannot be depressed. Similarly, if one of the keys 430 and 431 be depressed, the shoulder 463 on the depressed key stem will move the slide 458 forward to place the pins 459 and 460 into position to block descent of the keys 180 and 181.

26. The folio keyboard

Referring now to the means for printing folios, invoice numbers, car numbers or other numerals which are used merely as designations: As shown in Figs. 6 and 16, each of the folio type bars 3 is provided with a pivoted arm 464 similar to the arms 29 and connected to stop pins 465 which are similar to the stop pins 30. The stop pins 465 are guided in a slide 466 (Fig. 6) which is similar to the slide 33. The upward movement of the type carriers 3 is selectively limited by stops 467 which are similar to the stops 28. The stops 467 are set by means of push pins 468 which are similar to the push pins 41 and are carried by a

swinging bracket 468a similar to the bracket 43. The push pins 468 are operated by means of numeral keys 469 constructed and connected similarly to the keys 50. The type bars 3 for the numerical orders which are not needed in printing a given number are prevented from rising by means of a plate 470 (Fig. 16) which for all practical purposes is a stationary element. The movement of the slide 466 to carry the stop pins 465 successively out from under the plate 470 is produced by means including a link 471 connected at its right-hand end to the bracket 468a and at its left-hand end to an arm 472 (Figs. 10 and 11) which is pivoted in the machine frame on the axis 65. Rigid with the arm 472 is an arm 473 to which is connected a resetting lever 474. A spring 475 connected to the lever 474 tends to move the bracket 468a and the slide 466 toward the right as viewed in Fig. 6. Such movement of the slide and the bracket is controlled by means of an escapement consisting, in this instance, of a toothed bar 476 and an escapement lever 477 essentially similar to the corresponding parts 69 and 72. The escapement lever 477 is operated by means of a link 479 (Figs. 5 and 6) which is connected to a rocking structure 480 which is similar to the rocking structure 82 (Fig. 65). Stops 467 that have been pushed rearwardly into set position are restored to initial position by means of a beveled post 481 (Fig. 6) fixed to the slide 466. In the normal cycling of the machine, the stops 467 are reset and the slide 466 and the bracket 468a returned to initial position at the end of the cycle of operations by means of the arm 88 (Fig. 10) as previously described.

A Correction key 482 (Fig. 5) permits of manually resetting all of the stops 467, in one movement, said key being constructed and connected similarly to the Correction key 97 except that the link 483 (Fig. 6) to which said key is connected is pivoted to an arm 484 (Fig. 10) which is rigid with the arms 473 and 472.

A Back-space key 485 (Fig. 5) similar to the Back-space key 111 constitutes means for resetting the stops 467 at the rate of one numerical order for each depression of the key. The key 485 is connected to a pawl lever 486 (Fig. 6) which is similar to the lever 117.

In order to permit the printing of the same folio or other designating amount more than once under manual control, I provide a Repeat key 487, the stem 488 (Fig. 10) of which is arranged to engage a cam surface 489 (Fig. 12) formed on a slide 490 which is guided for movement transversely of the machine. The left-hand end of the slide is connected to one arm of a lever 491 pivoted on the axis 132. The other arm of said lever is arranged to engage a downwardly extending lug on a lever 492 which is similar to the lever 89 and which serves to control the reset lever 474, as in the case of the reset lever 67. The arm 88 acts upon the reset lever 474 as it does on the reset lever 67. 492^a is a lug on the lever 492 which is engaged by the arm 88 as described in connection with the corresponding lug 92. The lever 492 is swung in the opposite direction by a slide 492^b and a spring 492^c, similarly to the lever 89.

27. Hammer mechanism for folio type bars

493 (Fig. 5) are the hammers for the folio type bars 3. They are constructed, tripped and reset like the hammers for the amount type bars 2.

28. Printing signals

Referring now to the means for printing symbols or "signals" at the right-hand side of amounts: The operation-controlling keys 180, 181, 233, 333, 401, 402, 403, 404, 430, 431 and 453 are arranged in a series extending longitudinally of the machine at the right-hand side of the keyboard. As heretofore described, the operation-controlling keys just enumerated are latched in depressed position by means of the slide 210 (Fig. 28), the depression of any one of said keys causing the slide 210 to move forward so as to release any other of said keys which may have been previously depressed. There is a surface 493^a (Fig. 28) between the beveled surface 212 and the shoulder 213. The surface 493^a is slightly inclined from the vertical. By lightly tapping any one of the operation-controlling keys so as not to depress it fully, the slide 210 may be moved forward to release a depressed key. Two keys, as, for example, a counter-selecting key and a total key, may be simultaneously depressed and latched down, or if one is down, it may be held down while another is depressed.

To each of said operation-controlling keys is connected a slide 218 (Figs. 2 and 28), the rear ends of which are vertically aligned when the keys are in their normal position. One tine of the fork on the rear end of each of the slides 218 constitutes a stop 493^b to limit upward movement of a pin 494 connected to an arm 495 (Fig. 16) which is pivoted to the lower end of the signal type bar 1. The rear end of the slide 210 constitutes a stop 496 (Figs. 2 and 28) which serves to prevent the pin 494 from rising when none of said operation-controlling keys is depressed, the slide 210 being then in its rearward position.

The signal type bar 1 carries eleven type adapted to print symbols as indicated in Fig. 63. When the Subtraction key is depressed, its slide 218 serves to stop the ascent of the signal type bar 1 in position to print a minus sign. The Non-add key 233 controls the position of the signal type bar for the printing of the second symbol from the top as shown in Fig. 63, and so on.

The hammer 497 (Fig. 5) for the signal type bar 1 is constructed and operated similarly to the hammers 292. The latch 291 (Fig. 40) for the hammer 497 has no lug 295^a thereon. The pin on the signal type bar corresponding to the pin 296 on each of the type bars 2 is set at such a height as to cause release of the signal hammer latch when the type bar 1 is in position to present the second type at the printing line, the first type in this embodiment not being used.

It will be seen that the signal type bar is operated only when one of the operation-controlling keys at the right-hand side of the keyboard is depressed. Since it is desirable to be able to print a clear signal when the machine is operating under the control of the carriage (at which time none of such operation-controlling keys is operated), means has been provided for printing two naughts as a clear sign, as hereinbefore described. Thus when a total-taking cycle is performed under manual adjustment and the counter is clear, two naughts and a clear symbol are printed, whereas when such a cycle is performed under control of the carriage only the two naughts are printed.

29. Character keys

At the left of the keyboard are three banks of character keys, each bank being generally sim-

ilar to the bank of operation-controlling keys hereinbefore described.

The bank of twelve keys 498 (Fig. 1) at the extreme left are used in printing the names of the months. The keys in this bank are arranged to be locked by means of a slide 499 (Fig. 3) which is like the slide 210. Each key 498 operates a slide which is similar to the slides 218, one tine of the fork at the rear end of each of said slides serving as a stop 500 (Figs. 3 and 60) to limit the upward movement of a pin 501 connected to an arm 502 which is pivoted to the lower portion of the type bar 4 that is farthest to the left (see Fig. 16). This type bar has twelve type adapted to print abbreviations of the names of the months (see Fig. 62). The rear end 499^a of the slide 499, when in its normal or ineffective position, serves as a stop to keep the pin 501 from rising. When any one of the keys 498 is depressed, the slide 499 is moved and held so far forward that its rear end is out of the path of upward movement of the pin 501.

The keys in the middle bank at the left-hand side of the keyboard are used in printing numerals indicating the days of the month. The printing of the units digits "1" to "9", inclusive, is controlled by means of nine keys 503 (Fig. 53) having key stems 504 which are arranged to be latched in depressed position by means of a slide 505. A spring 505^a normally holds said slide in its rear position. On the rear end of said slide is a stop portion 506 (Figs. 54 and 55) which is located in the path of the upward movement of a pin 507 that is connected to an arm 508 which is hinged to the lower portion of the type bar 4 which is third from the left (Fig. 16). This type bar carries ten numeral type as indicated in Fig. 62. The stop 506 is so located as to limit the rising movement of the type bar to the point where the cipher type is positioned at the printing line.

Connected to each of the keys 503 is a slide 509 having at its rear end a fork, one tine of which constitutes a stop 510 (Fig. 5) to limit the upward movement of the pin 507.

The printing of the tens digit in the number of the day of the month is controlled by three keys 511 (Figs. 5 and 53) having key stems 512. The keys 511 are arranged to be latched in depressed position by means of a slide 513 (Fig. 56), said slide being urged rearwardly by a spring 513^a. The rear end of said slide constitutes a stop 514 for a pin 515 which is connected to an arm 516 pivoted to the type bar 4 which is second from the left-hand end, as viewed in Fig. 16. When the slide 513 is in its normal position, the stop 514 prevents upward movement of said type bar, but when said latch is operating to hold one of the keys 511 depressed, the stop portion 514 is out of the path of upward movement of the pin 515. Said type bar carries three numeral type, as shown in Fig. 62.

Each of the keys 511 is connected to a slide 517 having at its rear end a fork, one tine of which forms a stop 518 for the pin 515.

The third bank from the left controls the printing of the numbers denoting say, two years, also a variety of symbols used in bookkeeping work. Herein I have shown the two upper keys in this bank as arranged for controlling the printing of "30" and "31". These year keys are indicated at 519 (Fig. 1) and have key stems 520 (Fig. 59) which are arranged to be latched in depressed position by means of a slide 521. Said slide is urged rearwardly by a spring 521^a.

The keys 519 are connected to slides 522 (Fig. 17) having at their rear ends forks, one tine of each of which serves as a stop 522^a to limit the rising movement of a pin 523 that is connected to an arm 524 which is hinged to the lower portion of the type bar 4 which is farthest to the right as viewed in Fig. 16.

The remaining keys in this bank are denoted by the number 525 (Fig. 1). They have key stems 526 (Fig. 57) which are arranged to be latched down by means of a slide 527. A spring 527^a tends to move the slide 527 rearwardly. The rear end of said slide forms a stop 528 which, when the slide is in its normal position, serves to prevent the pin 523 from rising. When the slide 527 is acting to hold one of the keys 525 down, the stop portion 528 is out of the path of upward movement of the pin 523.

To each of the key stems 526 is connected a slide having at its rear end a fork. One tine of each fork constitutes a stop 529 (Fig. 60) to limit upward movement of the pin 523.

The beveled lugs 530 (Fig. 57) which are arranged to be engaged by the slide 521 for the purpose of locking either of the two year keys down, are also arranged to operate against beveled surfaces 531 on the slide 527, for the purpose of moving the slide 527 forward far enough to withdraw the stop 528 from the path of the pin 523. Depression of any one of the symbol keys 525 will serve to move the slide 527 forward a further slight extent to permit of latching said symbol keys down.

30. Releasing character keys

The plate 220 (Fig. 14) which serves to release any key or keys which may have been depressed in the bank of operation-controlling keys at the right-hand side of the keyboard, also serves to release depressed keys in the three banks at the left-hand side of the keyboard. As shown in Fig. 14, the key-latching slides 499, 505, 513, 521 and 527 have shoulders or lugs 532 which are engaged by the lower portion of the plate 220 when the latter is swung forward so as to draw said slides forward out of engagement with the beveled lugs on the stems of the keys.

In the present embodiment of the invention, the operation-controlling keys at the right-hand side of the keyboard and the ten symbol keys 525 are automatically released at the conclusion of every cycle of operations of the machine. Means is provided whereby the remaining keys in the three banks of character keys may be released when desired. It will be noted in Fig. 14 that the lower edge of the plate 220 has notches 533, 534 and 535 therein. A manually operable lever 536 (Fig. 14^a) is pivoted in the framework at 537. Fixed to said lever is a pin 538, one end of which lies within a notch 539 in the plate 220. The plate 220 is pivotally supported in such a way as to permit of limited endwise movement. A spring-actuated detent 539^a (Fig. 14^a) yieldingly holds the clearing plate 220 in either of its two positions. It will be seen that when the lever 536 is swung toward the right, the plate 220 will be also slid toward the right so as to bring the notch 533 into register with the slide 499, the notch 534 into register with the slides 505 and 513, and the notch 535 into register with the slide 521. With the plate 220 thus positioned, pivotal movement of said plate will not cause movement of the slides 499, 505, 513 and 521, and consequently the keys which may have been latched down by those slides will not be released.

Manually operable means is provided for releasing the keys in the four banks of keys. This means comprises a clear key 540 (Figs. 5 and 14) the stem of which has a lug 541 arranged to bear against an arm 542 which is fixed to the upper edge of the plate 220. A tension spring 543 normally holds the key 540 elevated. It will be seen that depression of the clear key 540 will release the keys in accordance with the position that may be occupied at the time by the plate 220.

31. Hammer mechanism for character type bars

The hammers for the character type bars are indicated at 543^a (Fig. 5). They are constructed, tripped and reset like the hammers 292, except that the latches 291 for the hammers for the second and fourth type bars from the left have no lug 295^a (see Fig. 40).

32. Ribbon mechanism

In order to permit the printing of items and totals in contrasting colors, a two-color ribbon is provided. The ribbon mechanism may be of any desired character. Herein I have shown the ribbon spools 544 (Figs. 2, 3 and 37) and the ribbon guide 545 as mounted upon a base plate 546 which is supported in the machine frame for vertical movement by means of two slides 547 (Fig. 38). The ribbon unit just described is arranged to be moved up and down to bring either color field of the ribbon into use by means herein shown as an arm 548 which engages forked portions of the slides 547. The arm 548 is fixed on a shaft 549 which is journaled in the machine frame. An arm 550 (Figs. 28 and 38) is mounted on said shaft to turn therewith, but is capable of sliding movement longitudinally of the shaft, as by means of a pin 551 fixed to said arm and extending slidably through an arm 552 secured to the shaft 549, said pin being parallel with the shaft. On the arm 550 is a roller 553 which is arranged to be engaged by either of the cams 280 and 281, depending upon the position of the arm 550 longitudinally of the shaft 549. On each of the cams 280 and 281 is a dwell 553^a (Fig. 28) to allow the ribbon to be stationary while the hammers are driving the type to print. The upper field of the ribbon may be assumed to be black and the lower red. When the arm 550 is in its left-hand position, as in Fig. 38, the roller 553 is in position to be engaged by the cam 281 and hence in every cycle of the machine the ribbon will be raised to bring the black field into use and lowered again to expose the imprint; whereas, when the arm 550 is in its right-hand position, the roller 553 is operated by the cam 280 to reciprocate the ribbon so as to bring the red field into use for printing and to lower the ribbon to render the printing visible. The ribbon thus rises variable distances from an invariable low point.

All debit items, debit totals and debit subtotals are printed in black, and all credit items, credit subtotals and credit totals or overdrafts are printed in red. The means whereby the arm 550 is automatically shifted in accordance with the character of the amount to be printed comprises, in this instance, a lever 554 (Figs. 28 and 38) pivotally and slidably mounted on the axis 555, one arm of said lever engaging slidably in a slot 556 in the free end of the arm 550. The other arm of the lever 554 extends slidably into a notch 557 in the subtraction slide 328. In the end of the lower arm of the lever 554 is an open-

ing 558 into which extends a cam finger 559 which is fixed in the machine frame. By referring to Fig. 28 it will be seen that the forward movement of the subtraction slide 328 due to the depression of the Subtraction key 333, causes the lever 554 to move toward the right on the shaft 555 due to the action of the cam finger 559 on the walls of the opening 558, whereby the roller 553 is placed in position to be engaged by the red-printing cam 280. Upon release of the subtraction slide 328, rearward movement of said slide will cause the lever 554 to slide toward the left on its pivot 555, thus placing the roller 553 in position to be engaged by the black-printing cam 281.

Referring now to Fig. 33, it will be remembered that the slide 338, acting on the lug 341 on the rear end of the subtraction slide 328, tends through the force of the spring 339, to move the subtraction slide 328 forward so as to condition the cross-footer for the taking of a credit balance and to condition the ribbon mechanism for the printing of that balance in red. When there is a credit balance in the cross-footer, the stop arm 347 (Fig. 30) permits such operation of the slide 338. When, however, a total is to be taken from one of the rear counters and there is a credit balance in the cross-footer, means must be provided to prevent the slide 338 from operating, as it is not desired to print in red a total taken from one of the rear counters. The means herein shown for this purpose comprises a latch 560 (Fig. 52) pivoted in the machine frame at 561 and having a locking shoulder 562 arranged to lie in the path of the front end of the slide 338 and thus restrain said slide from moving forward to condition the ribbon mechanism for printing in red. A spring 563 tends to move the latch 560 into effective position. On the free end of the latch 560 is a lug 564 which bears against the rear bail 434. When either of the keys 430 and 431 is depressed to take a total or a subtotal from one of the rear counters, the latch 560 is permitted to swing downwardly under the action of its spring 563 so as to prevent the ribbon mechanism from being conditioned for printing in red. The latch 560 under such circumstances also prevents the cross-footer from being automatically conditioned for subtraction, the cross-footer being, however, free to be manually controlled for addition or subtraction.

33. Timing of mechanisms

Figs. 101 and 102 are diagrams representing the time relations of the operations of the mechanisms of the machine. Fig. 101 illustrates the timing of the operations that occur during the forward stroke of the rock shaft 17, while Fig. 102 shows the operations that take place in the return stroke. Figs. 103 and 104 indicate the positions of the crank disk 24 at the beginning and the end of the forward stroke, respectively.

34. Motor drive and manual control thereof

Referring to Fig. 71: On the armature shaft 565 of the motor 26 is a worm 566 that meshes with a worm wheel 567. The worm wheel 567 is rigid with a tubular shaft or hub 568. On the left-hand end of said hub is a clutch face 569 adapted for engagement by a similar clutch face 570 on a clutch sleeve 571. The clutch sleeve 571 is slidably upon the shaft 25, the latter being journaled in the hub or tubular shaft 568. The shaft 25 is caused to rotate with the clutch sleeve 571 by means of a cross-pin or key 572

secured to the end of said shaft and lying within diametrically opposite notches 573 in the clutch sleeve. When the clutch sleeve 571 is in engagement with the clutch face 569, the shaft 25 will be driven by the motor.

The means for controlling engagement of the clutch sleeve 571 with the clutch face 569 comprises a spring 574 (Fig. 73) connected to a fork 575 which is mounted to slide parallel with the clutch sleeve 571 and which slidably engages such sleeve as shown in Fig. 73. A dog 576 is pivoted on a stud 577. Said dog has a shoulder 578 (Fig. 72) adapted to engage a shoulder 579 on the periphery of the clutch sleeve 571. For the purpose of throwing out the clutch faces 569 and 570, the end of the dog 576 is provided with a cam surface 580 which is adapted to be engaged by the beveled end 580^a of the shoulder 579 on the clutch sleeve as said clutch sleeve is completing a revolution, whereby the clutch sleeve is slid toward the left out of engagement with the clutch face 569. The dog 576 and an arm 581 (Fig. 70) are rigidly united by means of a sleeve 582. A spring 583 (Fig. 3) connected to the arm 581 normally holds the dog 576 in contact with the clutch sleeve 571. The arm 581 carries a stud 584 (Fig. 70) which has a pin and slot connection with the rear end of a link 585. The forward end of the link 585 is connected to a crank arm 586 which is fixed on a rock shaft 587. On the right-hand end of the rock shaft 587 is secured an arm 588 to which is pivoted the forward end of a link 589. On the rear portion of the link 589 is a pin 590 which is adapted to be engaged by a shoulder 591 on a link 592, the forward end of which is connected to one arm of a bell-crank 593. To the other arm of said bell-crank is connected the stem of the motor bar 594. A spring 594^a connected to the link 592 tends to draw said link rearwardly and thus serves normally to hold the motor bar elevated. Assuming that the pin 590 is in the path of the shoulder 591, it will be seen that depression of the motor bar 594 will swing the dog 576 away from the clutch sleeve 571, thereby allowing the spring 574 to throw in the clutch, whereupon the shaft 25 and the crank disk 24 are revolved. Immediately after disengagement of the dog 576 from the clutch sleeve, it is returned into engagement with the sleeve by the spring 583 so that as the clutch sleeve completes one revolution, the cam surface 580 serves to disengage the clutch, and the sleeve 571 comes to rest with the shoulder 579 bearing against the shoulder 578.

During the first half of the cycle, the link 592 is lifted so that the shoulder 591 is above the pin 590 by means of a pin 595 on the right-hand lever 320^b, said pin underlying the end of the link 592. As soon as the shoulder 591 is free of the pin 590, the spring 583 swings the dog 576 against the periphery of the clutch sleeve 571, as previously described, in readiness to throw out said clutch sleeve and stop it at the end of a single revolution. Thus, it will be seen that even if the operator were to continue holding the motor bar 594 depressed, the machine would perform but a single cycle of operations.

35. Time switch

In the circuit of the motor 26 is a switch (not shown) which is arranged to be manually operated by means of a lever 596 (Fig. 3). Means is also provided for automatically opening the motor circuit after the lapse of a brief period, say,

one or two minutes, following the last cycle of operations of the machine, so that in the event that the operator fails to open the switch by means of the lever 596, the motor will be automatically stopped. This means comprises a switch (in series with the first mentioned switch) consisting of contacts 597 and 598 (Fig. 5). The contact 598 is arranged to be withdrawn from the contact 597 by means of a lever 599 pivoted at 600. Pivoted to the lever 599 is a link 601. 602 is a cam fixed to a gear wheel 603 that meshes with a pinion 604. Fixed to the pinion 604 is a ratchet wheel 605 which is arranged to be turned by means of a dog 606. A spring 607 tends to move the dog 606 in the direction to turn the ratchet wheel 605. The dog is moved in the opposite direction by means of a link 608 (Fig. 3) which connects said dog to the upper arm of a lever 609. The lever 609 is pivoted on the axis 610. The lower arm of the lever 609 is arranged to be engaged by a pin 611 carried by a gear wheel 612 which is rigid with the hub or tubular shaft 568 (Figs. 71 and 73). The gear wheel 612 is driven continuously during the operation of the motor. It will be seen that the pin 611 will oscillate the lever 609 and thus, in conjunction with the spring 607, cause the dog 606 to turn the ratchet wheel 605, thereby turning the cam 602. A spring 613 connected to the link 601 tends to move said link in the direction to close the contacts 597 and 598, and also holds the link 601 in position for actuation by the cam 602. 614 is a stop pin for the link 601. On the lower side of the link 601 is a stud 615 arranged at times to bear against the periphery of the cam and at other times to rest on the upper side of the cam. On the upper side of the cam is a pin 616 adapted to engage the edge 617 of the link 601. The end of the link 601 is arranged to be engaged by a pin 618 on the ratchet wheel 605. 619 is an anti-return dog for the ratchet wheel 605.

The link 601 is arranged to be lifted until the stud 615 is above the horizontal plane of the top of the cam 602, to allow the spring 613 to move the link against the stop 614, and place the stud 615 on top of the cam. The means for lifting the link 601 comprises a slide 620 (Fig. 3) the rear end of which extends through an opening 621 (Fig. 3^b) in a plate 622 in the machine frame. The rear end of the slide underlies the link 601. On the rear end of the slide 620 is an inclined surface 623 that bears against the rear end wall of the opening 621. The front end of the slide 620 is pivoted at 624 to the lever 581. When the motor bar is depressed, the lever 581 swings counter-clockwise as viewed in Fig. 3, thereby pushing the slide 620 rearwardly and thus raising the link 601 so as to permit the spring 613 to place the link 601 against the stop pin 614. The stud 615 then supports the link on top of the cam. The pin 616 is not of sufficient height to engage the link when the latter is thus supported. When the shoulder 625 of the cam revolves out from under the stud 615, the link 601 drops until it rests on top of the cam, the stud 615 being then alongside the low part of the periphery of the cam, and the free end of the link being at the right of the orbit of the pin 618 on the ratchet wheel. As the cam continues to revolve, the pin 616 engages the edge 617 of the link 601 and swings said link to the left, thus placing the free end of the link in the path of the pin 618. When the pin 618 engages the link 601, the latter is pushed rearwardly

to move the contact 598 away from the contact 597, and thus open the motor circuit.

The length of time that the motor will run after the last cycle of operations of the machine depends upon the position of the cam 602 at the end of the last cycle. When cycles are following one another in the usual quick succession, the stud 615 supports the link 601 on the cam 602 during the major part of the revolution of the cam 602. If during a cycle of operations the shoulder 625 passes out from under the stud 615, and another cycle is initiated before the point 626 (which is where the low portion of the cam merges into the concentric portion of the cam) has reached the stud 615, the link 601 will be lifted and will immediately drop again.

36. Keyboard lock

Means is provided to lock the keyboard so as to prevent the setting up of an item or a folio until the item last set up has been eliminated by the operation of the stop-resetting post 86. The means herein provided for this purpose comprises a plate 627 (Figs. 5 and 43) in the nature of a lever pivoted in the machine frame on the axis 628. At the right-hand side of the plate 627 is a lug 629 to which a spring 630 (Fig. 70) is connected. This spring serves to hold the plate 627 normally elevated. On the under side of the plate 627 are mounted two detents 631 and 632, which are urged forward by springs 633. On the forward end of the detent 631 is a down-turned lug 634 which, when the plate 627 is depressed, is arranged to lie directly behind the edge 635 of the pivoted structure 82 (Fig. 65), and thereby prevents the depression of any of the amount keys 50 unless sufficient pressure is applied to overcome the force of the spring 633. (In the "touch system" which is the method commonly employed, only light pressure is applied to the keys. The detents 631 and 632 are yieldingly mounted to prevent damage in case the operator, on meeting with resistance, should strike the keys with excessive force.) There is a similar lug 634 on the front end of the detent 632 which serves to lock the pivoted structure 480 (Fig. 5) when the plate 627 is in its lowered position, thereby preventing use of the folio keys 469 unless enough pressure is applied to overcome the spring 633 for the detent 632. An arm 636 pivoted on the axis 49 is in contact with the post 42 (Fig. 6) when the latter is in its initial position, a spring 637 holding the arm in contact with said post. On the arm 636 is a headed stud 638. The setting up of one digit by means of one of the amount keys 50 will allow the spring 637 to move the arm 636 so that the head of the stud 638 lies in contact with the edge 639 of the plate 627. Depression of the motor bar 594 will depress the plate 627 so as to allow the spring 637 to move the arm 636 farther to the right so as to cause the head 638 to overlie the edge of the plate 627, thus latching said plate down and thereby maintaining the lugs 634 in position to block movement of the pivoted structures 82 and 480. When the stop or stops 28 are reset by the post 86, the arm 636 is swung to the left to its normal position, thereby disengaging the headed stud 638 from the plate 627 whereupon the spring 630 lifts the plate 627 to its normal position and thus releases the keys 50 and 469 to operation.

It will be seen that when the Repeat key 122 is in its depressed or set position, another number cannot be set up on the amount keyboard

or the folio keyboard until after the Repeat key has been released and the stops 28 reset.

The mechanism just described also serves to prevent the operator from beginning to set up an item until the last preceding item has been completely eliminated through the operation of the stop-resetting post 86.

37. Paper carriage

The machine which has been selected to exemplify the invention is provided with a cylindrical platen 640 (Fig. 1), but it will be understood that other forms of platens may be employed. In this instance, the platen is supported in a travelling carriage 641, but it will be evident that in many respects it is immaterial whether the platen or the printing mechanism is the travelling element. Any preferred construction may be used to support the carriage on the machine frame. Herein I have shown a track member 642 stationarily supported in the machine frame and extending transversely thereof, anti-friction bearings being interposed between the carriage and the track member.

38. Line-space mechanism

The means herein shown for rotating the platen step by step comprises a ratchet wheel 643 (Fig. 2) on the right-hand end of the platen, said wheel being arranged to be engaged by a spring-influenced dog 644. The latter is pivoted at 645 on a plate 646 which forms the right-hand end of a rigid frame that is pivoted in the carriage on the axis 647 (see Fig. 77). A spring 647^a tends to swing said frame rearwardly to retract the dog. The upper bar 648 of said frame is long enough to be engaged by an actuator in any position of the carriage. Said actuator consists of a roller stud 649 carried by an arm 650 which is rigid with a lever 651 that is pivoted in the machine frame at 265. The lever 651 is connected to the left-hand lever 20 (Fig. 34) by a link 652. In the second half of each cycle, the stud 649 is swung forward to impart a feeding movement to the dog 644, if said dog is retracted during the first half of the cycle by the spring 647^a.

When cross-tabulated work is being performed, the line-space mechanism is normally disabled except at the end of the working stroke of the carriage. The means whereby this result is effected comprises a stop arm 653 fixed on a rock shaft 653^a that is mounted on the track member 642 (Fig. 2). A link 653^b is pivoted to a crank 653^c on the rock shaft 653^a and is acted upon by a spring 653^d which normally holds the stop arm directly behind the bar 648, and thus holds said bar in its forward position, thereby preventing the reciprocation of the roller stud 649 from effecting reciprocation of the dog 644.

Three means are provided to lift the stop arm 653 and thus render the line-space mechanism operative, namely, the carriage-controlled means described under heading 46 and shown in Fig. 77, the non-tabulate key 699 described under heading 42 and illustrated in Fig. 74, and the carriage short return key 919 as explained under heading 71.

39. Escapement mechanism

The machine herein shown is arranged to operate at the rate of 125 cycles per minute. It is, of course, desirable that the paper carriage shall move from column to column as rapidly as possible in order that the maximum number of

cycles may be performed per minute. It is therefore desirable that the means for driving the carriage from column to column shall be sufficiently powerful to move the carriage rapidly.

5 The paper carriage is necessarily of considerable weight, which also makes desirable a powerful drive for the carriage. The carriage is arranged to operate a considerable number of mechanisms by which the functions of the machine are controlled, which places a load on the drive for the carriage and constitutes a further reason for the employment of a powerful drive. By reason of the weight of the carriage and the speed with which it moves from column to column, it is necessary that the escapement mechanism shall be very rugged and shall operate with great rapidity to release the carriage from one columnar position and arrest it in the next columnar position.

10 The means herein shown for imparting the leftward or working stroke to the carriage comprises a spring drum 654 (Fig. 4) which is connected to the carriage by a tape 655. Within said drum is a spiral spring (not shown) tending to revolve the drum in the direction to move the carriage toward the left of the operator (toward the right in Fig. 4). If desired, a governor of any preferred type may be employed to prevent the carriage from attaining an excessive velocity on long jumps. Herein is shown a governor 655^a driven from the spring drum 654 through a gear train 655^b.

15 The means for controlling the operation of the spring drum to position the carriage for the performance of cycles of operations in desired columnar positions of the carriage comprises escapement elements which are yieldably supported in the machine frame by means of a plate 656 (Fig. 64). The plate 656 is supported in the machine frame for movement parallel with the carriage travel by means of screws 657 extending through elongated openings 658 in the plate. The means herein shown for moving the plate 656 toward the right comprises a spring 659 connected to the upper arm of a lever 660 which is pivoted at 661. The upper arm of said lever carries a stud 662 that lies within a fork 663 on the plate 656. The lower arm of the lever 660 is connected to a dash-pot 64 (Fig. 4) of any desired construction. When the carriage is released from the escapement elements on the plate 656, the spring 659 moves said plate to its right-hand position wherein the left-hand end walls of the slots 658 are in engagement with the screws 657.

20 On the plate 656 is mounted a lever 665 (Fig. 64) which is pivoted on a stud 666, the opening 667 (Fig. 87) in the lever 665 through which the pivot 666 extends being slightly elongated. The right-hand end of the lever 665 (Fig. 64) constitutes an escapement tooth 668. A coacting escapement tooth 669 is formed upon a slide 670 which is mounted on the plate 656 for vertical movement by means of a screw 671 extending through a vertically-elongated opening 672 in the slide 670. A spring 673 normally holds the tooth 669 down in ineffective position, as in Fig. 64. A spring 674 normally holds the lever 665 up and to the right, with the tooth 668 projecting above and slightly to the right of the tooth 669. The carriage is provided with a plurality of stops 675 (one for each columnar position) to coact with the escapement teeth 668 and 669. When the carriage is moved by the spring drum to bring a stop 675 against the escapement tooth 668, the latter is pushed to the left against the tension of the spring 674 until the left end of the lever

665 (Fig. 64) strikes against an abutment 676, as shown in Fig. 88. The abutment 676 is preferably of such character as to reduce noise and shock. Herein it is shown as composed of a plate having a slit 677 therein, whereby the portion of the plate which is struck by the lever 665 is made very slightly yielding.

When the paper carriage is to be released from a columnar position for movement to the next columnar position, the tooth 669 is raised and the tooth 668 is lowered below the horizontal plane of the stop 675 a moment after the tooth 669 has been raised high enough to be engaged by the stop 675, as in Fig. 89. The carriage then moves under the influence of the spring drum until the stop 675 stands against the tooth 669, the tooth 668 being then below the stop 675. When the carriage is to be released, the tooth 669 is drawn down clear of the stop 675, whereupon the carriage moves to the left, the tooth 668 rising as the stop 675 passes away from it in time to arrest the next succeeding stop 675.

40. Automatic operation of the escapement

25 The means for thus reciprocating the escapement elements 668 and 669 is arranged to be automatically actuated in the cycling of the machine. The means herein shown for this purpose comprises a lever 678 (Fig. 64) pivoted on a stud 679, the right-hand end of said lever being forked to engage a pin 680 carried by a lever 681 which is pivoted to the plate 656 at 682. The lever 681 is pivoted to the slide 670 at 683. The pin 680 overlies an angular lug 684 on the lever 665. The left-hand end of the lever 678 overlies a slide 685 (Fig. 64) which is arranged to be reciprocated by means of a lever 686 pivoted at 687. The lever 686 is connected to one arm of the lever 651. In the first half of the cycle, the lever 20 (Fig. 34) is raised, thereby raising the slide 685, thus raising the tooth 669 and lowering the tooth 668. In the second half of the cycle and soon after the hammers have been unlatched and then withdrawn, the slide 685 is lowered to lower the escapement tooth 669, thus allowing the carriage to travel until the next stop 675 collides with the tooth 668.

41. Tabulator key 688

30 Means is provided for manually operating the escapement to permit the carriage to move from one column to the next. In the present embodiment, this means comprises a Tabulator key 688 (Fig. 70) carried by a lever 689 which is pivoted at 265. On the rear end of the lever 689 are two lugs 690 and 691. The lug 690 underlies the left arm of the lever 678. Depression of the Tabulator key 688 will raise the left arm of the lever 678, thereby raising the escapement tooth 669 (Fig. 64) and lowering the escapement tooth 668. When the operator releases the Tabulator key 688 (Fig. 70), a spring 692 restores the key to its normal position, the spring 673 lowers the escapement tooth 669, and the spring 674 raises the escapement tooth 668, whereby the carriage is released, and the tooth 668 placed in a position to intercept the next stop 675 on the carriage.

35 The lug 691 (Fig. 64) underlies the left arm of a lever 693 which is pivoted on the screw 666. The right-hand arm of said lever has an angular lug 694 (Fig. 64) that overlies the lever 665. Depression of the Tabulator key 688 thus lowers the escapement tooth 668, so that if the left end of the lever 678 is moved rearwardly of the machine by depression of a Normalizer key as will

later appear, to such an extent that it no longer lies above the lug 690, it will still be possible to tabulate the carriage by depression of the Tabulator key. It will be noted, however, that in such instance, although the tooth 668 is lowered from the path of the stop 675, the escapement tooth 669 is not raised as when these parts are operated by movement of the lever 678. This is due to the fact that the lug 684 on the lever 665 lies under the pin 680 but does not embrace it as does the right-hand end of the lever 678. This makes it possible to allow the carriage to travel continuously through its entire distance to the left should the Tabulator key be held depressed. This differs from the usual tabulating action in which the Tabulator key must be depressed and released once for each tabular step of the carriage.

Depression of the Tabulator key 688 also closes the switch 597—598. A lever 695 (Fig. 3) pivoted at 696 has an angular forward end 697 (Fig. 70) that underlies the forward arm of the Tabulator key lever 689. The rear arm of the lever 695 has an angular lug 698 (Fig. 3) that underlies the lever 620. Depression of the Tabulator key 688 will therefore lift the link 601 (Fig. 5), whereupon the spring 613 will close the switch. A spring 698^a (Fig. 3) normally holds the lever 695 in ineffective position. This closing of the switch initiates operation of the carriage return mechanism in case the carriage is manually tabulated through the last columnar position at a time when the switch is open.

42. Non-tabulate key 699

It is sometimes desirable to suspend the tabulating movements of the carriage in order to permit of listing amounts in a given column. To effect this result, I provide a Non-tabulate key 699 (Figs. 5 and 70) which is carried by a lever arm 700 pivoted on an axis 701. A web 702 unites the arm 700 to a downwardly extending arm 703 to which is pivoted a slide 704, the rear portion of which is slidably supported upon a pin 705 set in the machine frame. The rear end of the Non-tabulate slide 704 is arranged to bear against the left arm of the lever 678 (Fig. 64). Depression of the Non-tabulate key 699 will cause the slide 704 to move rearwardly to push the left arm of the lever 678 rearwardly out of the path of movement of the slide 685 and the lug 690, thereby preventing the carriage from being tabulated in the automatic cycling of the machine, and also depriving the Tabulator key 688 of control of the escapement element 669. The pivotal mounting of the lever 678 is sufficiently loose to allow it to have the necessary swinging movement in a horizontal plane. A leaf spring 706 normally holds the lever 678 within the range of action of the slide 685 and the lug 690.

The Non-tabulate key 699 is also arranged to throw in the clutch 569—570. As shown in Figs. 70 and 74, there is an arm 707 which is pivoted on the axis 701 and carries a pin 708. One end of said pin lies in position to be engaged by the Non-tabulate key lever 700, whereas the other end of said pin lies in front of the upper arm of a lever 709 which is pivoted at 710 in the machine frame. The lower arm of the lever 709 lies behind a lug 711 on the link 592. It will be seen that depression of the Non-tabulate key 699 will push the link 592 forward and that (if said link is in its lower position) the shoulder 591, acting upon the pin 590, will cause the dog 576 to be withdrawn

from the clutch sleeve 571, whereupon the spring 574 will throw in the clutch.

Depression of the Non-tabulate key 699 also throws in the line space mechanism. This is effected by the means shown in Figs. 74 and 77, wherein it will be seen that the lever 700 is arranged to engage the forward arm of a lever 712 that is pivoted in the machine frame on the axis 713. The rear end of the lever 712 underlies the stop arm 653. Depression of the Non-tabulate key 699 will therefore raise the stop arm 653 so as to permit the spring 647^a and the roller stud 649 to reciprocate the line-space dog 644.

Means is provided to lock the Non-tabulate key 699 in depressed position. This means comprises an arm 714 (Fig. 74) pivoted on the axis 701, and forked to receive a pin 715 set in the key lever 700. A latch arm 716 pivoted in the machine frame is normally pressed against the arm 714 by a spring 717. When the key 699 is depressed, the arm 714 is swung below the free end of the latch 716, whereupon said latch springs rearwardly into position above the arm 714, thus holding the key depressed.

The Non-tabulate key is automatically unlatched in the last half of the cycle. A member 718 (Fig. 74) is pivoted at 719 to a link 720 which is pivoted in the machine frame on the axis 721. The member 718 rests slidably on the rod 294^a. In the member 718 is a notch 722. On the link 720 is an angular lug 723 that lies behind the latch arm 716. As the hammer reset rod 320^a is returning to its normal forward position, it engages the rear end of the member 718, thereby swinging the link 720 forward and thus disengaging the latch arm 716 from the arm 714, whereupon the spring 717 lifts the key lever 700 to its normal position. As the rod 320^a is completing its forward movement, it passes into the notch 722.

Means is also provided for manually unlatching the Non-tabulate key 699. This means comprises a bell-crank lever 724 (Fig. 75) pivoted in the machine frame on the axis 725. The upwardly extending arm of the bell crank 724 lies directly behind the lug 723. Manual depression of the forwardly extending arm of the bell crank 724 will cause the link 720 and the latch lever 716 to swing forward, thereby releasing the key lever 700.

If it becomes desirable to enter two or more items in a given column, the operator, after setting up the first item for that column, depresses the Non-tabulate key 699, whereby the automatic slide 685 is deprived of effect upon the escapement element 669, the clutch 569—570 is thrown in and the line-space mechanism is released to action. Thus the machine is caused to cycle to print and register the item, and the paper is fed up one line space. As the cycle is completed, the rod 320^a releases the Non-tabulate key. The operator then sets up the second item and, if desired, again depresses the Non-tabulate key to cause another cycling of the machine without tabulation of the carriage.

43. Carriage control of driving clutch

Means is provided to prevent the operator from throwing in the clutch 569—570 unless the carriage is in one of its columnar positions. This means comprises a bell crank lever 726 (Fig. 70) pivoted at 727 in the machine frame, one arm of said lever bearing against a pin 728 on the plate 656 and the other arm of said lever underlying the rear end of a lever 729. The last mentioned

lever is pivoted on the axis 325. The forward end of the lever 729 carries a pin 730 that underlies the rear end of the link 592. A spring 731 holds the bell crank lever 726 in contact with the pin 728 and tends to raise the link 592 so that the shoulder 591 thereon cannot engage the pin 596.

When the carriage has completed a movement into a given columnar position, a stop 675 (Fig. 64) on the carriage bears against the escapement tooth 668 and thereby holds the plate 656 in its left-hand position, whereby the bell crank 726 holds the forward arm of the lever 729 depressed so that the shoulder 591 may engage the pin 590. Depression of the motor bar 594 or of the Non-tabulate key 699 will then be effective to throw in the clutch 569—570. As soon as the carriage starts traveling to the next columnar position, the spring 659 moves the plate 656 into its right-hand position whereby the pin 730 is raised to lift the link 592, thus depriving the motor bar 594 and the Non-tabulate key 699 of control of the clutch.

44. Carriage control of machine functions

The machine comprises means arranged to be actuated by the paper carriage for controlling the counters and certain other mechanisms of the machine in order automatically to determine the character of any given cycle and thus the nature and the sequence of the cycles performed during the working stroke. The carriage exerts such control through pivoted elements which we may term "selectors" and which in this instance are in the form of levers pivoted on the axis 732 (Fig. 4). The selectors are compactly grouped at the rear end of the machine and below the path of travel of a control plate attached to the carriage.

Referring now to Figs. 2 and 5: In the present embodiment of the machine there are seventeen selectors. The one nearest to the front of the machine is numbered 733; it enables the line-spacing mechanism. The second one (734) conditions the machine to effect subtraction in the cross-footer. The third (735) conditions the machine to effect non-addition in the cross-footer. The fourth (736) conditions the machine for the taking of a final total from the cross-footer. The fifth (737) conditions the machine for the taking of a subtotal from the cross-footer. The sixth (738) conditions the machine for the taking of a final total from whichever rear counter is in use. The seventh (739) conditions the machine for the taking of a subtotal from whichever rear counter is in use. The eighth (740) conditions the machine to effect non-addition in whichever rear counter is in use. The ninth (741) conditions the machine to place the D counter in use. The tenth (742) conditions the machine to place the C counter in use. The eleventh (743) conditions the machine to place the B counter in use. The twelfth (744) conditions the machine to place the A counter in use. The thirteenth (745) controls the printing of the date and the folio. The fourteenth (746) controls the repetition of printing of an amount. The fifteenth (747) controls the repeated printing of the folio. The sixteenth (748) causes the driving clutch to be thrown in; and the seventeenth (749) conditions the machine to effect nonprinting of the amount. (The drawings show another selector (750) which, in this embodiment of the invention, has no function.)

The selectors are guided to swing in vertical planes by means which includes slots 751 into which the free ends of the selectors extend. Each

selector carries a member to be engaged and depressed by a coacting element or stop on the control plate forming part of the carriage. In the case of all of the selectors except the subtraction selector and the motor repeat selector, said member consists of a roller 752 (Figs. 4 and 4^a) which is yieldably supported upon the selector by means herein shown as a bell crank 753 pivoted at 754 and held in normal relation to the selector by means of a spring 755, said spring holding a pin 756 on the bell crank against a stop 757 on the selector.

In the case of the subtraction selector and the motor repeat selector, the part that is engaged by the carriage consists of a member 758 (Fig. 66) pivoted at 759 on a bell crank 760 which is pivoted on the selector at 761. A spring 762 holds the bell crank in normal position, the action of the spring being limited by engagement of the pin 763 on the bell crank with a shoulder 764 on the selector. The member 758 has an inclined or cam surface 765 and a square shoulder 766. Said member is held in normal position by a spring 767, the action of the spring being limited by contact of the lug 768 on said member with a pin 769 on the bell crank 760. In the working stroke of the carriage the appropriate carriage stops engage and depress the members 758, thus depressing the selectors 734 and 748, but in the return stroke of the carriage the carriage stops engage the square shoulders 766 and tilt the members 758, thereby passing said members without depressing those selectors.

45. Control plate

Rigid with the paper carriage is a control plate 770 (Fig. 1) extending longitudinally of the carriage and occupying a horizontal plane. The plate 770 is adapted to support a series of control elements 771 (Fig. 64). In the construction herein shown, each control element is in the form of an elongated holder for stops and is made of sheet metal bent to provide two vertical walls 772 and a bottom connecting wall 773. The control elements 771 are supported upon the carriage to extend transversely of the direction of carriage travel. The forward or inner end of each control element constitutes the stop 675 hereinbefore referred to. The control element is adjustably secured to the control plate 770 by means herein shown as comprising a series of notches 774 (Fig. 1) formed in the rear edge of the control plate 770 to receive the forward edges of the upwardly extending portions 775 (Fig. 83) of the side walls 772. Fixed to the lower side of the control plate 770 near the forward or inner edge of the same, is a bar 776, the rear and lower sides of which are grooved to receive the front edges of the side walls 772 and the upper edges of the U-shaped stop 675. The control element is clamped to the control plate 770 by means consisting, in this instance, of an arm 777 pivoted to the portion 775 at 778 and adapted to be clamped against the top of the control plate by means of a nut 779 turned on a screw 780 which is rigid with an arm 781 formed integral with the arm 777. The nut 779 is arranged to exert its pressure against the rear end of the control element and thus force the arm 777 down against the control plate. On the upper surface of the control plate is fixed a plate that provides a shoulder 782 which is engaged by a locking shoulder 783 on the arm 777.

The control element is adapted to contain one or more stops arranged at desired points along

the length of the control element. In the present instance, each stop consists of a block 784 adapted to fit within the control element, and a stop lug 785 adapted to project through any one of a series of openings 788 (Fig. 85) in the bottom wall of the control element.

It will be seen that the stop lugs 785 of the various control elements are arranged on the control plate 770 to move with the carriage in a plurality of parallel paths, which paths are in the respective vertical planes of the selectors on the machine frame. The upper portions of the peripheries of the rollers 752 and the inclined surfaces 765 of the members 758 project into the paths of the stop lugs 785. Hence it will be seen that contact of the stop lugs with said rollers 752 and members 758 will cause depression of the selectors, such movement of the selectors being utilized to effect the before-mentioned control of machine functions.

46. Carriage control of line-spacing

Referring to Fig. 77, the member 653^b is arranged to be lifted to place the stop arm 653 in ineffective position by means of a bell crank 787 pivoted on the axis 788. The rearwardly extending arm of the bell crank 787 supports a pin 789 which is guided in the machine frame for vertical movement. The upper end of the pin 789 underlies the selector 733. At a point or points on the stop plate 770 corresponding to the columnar positions where line-spacing should occur, there is a stop lug 785 which in the travel of the paper carriage engages the roller 752 on the selector 733, and thereby depresses the selector and the pin 789, thereby enabling the line-space mechanism. In the set-up illustrated in Fig. 105 of the present drawings, there is but one such stop lug 785, it being located in position to cause line-spacing after an imprint has been made in the last columnar position.

47. Carriage control of subtraction

It will be remembered that the machine is conditioned to perform subtraction in the cross-footer by moving the slide 328 (Fig. 28) forward. 790 is a bell crank pivoted on the axis 788, one arm of said bell crank being arranged to engage the slide 328 to advance the same, and the other arm supporting a pin 791 that underlies the selector 734. For every columnar position where subtraction is to occur, a stop lug 785 is provided on the carriage to cause depression of the selector 734. During the return stroke of the carriage, it is undesirable to shift the link 155 out of engagement with whichever pin 158 or 159 it may be engaging, hence, the member 758 (Fig. 66) is mounted to yield upon contact therewith of a lug 785 in the return movement of the carriage.

The carriage is obliged to exert considerable force in conditioning the machine for subtraction. In order to reduce shock and to cause a more uniform application of power, the active side of the member 758 is beveled, as shown in Fig. 66.

48. Carriage control of non-addition in the cross-footer

Non-addition in the cross-footer is effected by placing the stud 209 (Fig. 27) in position to render the pawl 171 ineffective at the beginning of the return stroke of the rock shaft. The stud 209 is placed in this position by means of the cam 238 on the non-addition slide 236. The

slide 236 is arranged to be moved forward into effective position by one arm of a bell crank 792 pivoted on the axis 788, the other arm of which bell crank supports a pin 793 which is arranged to be depressed by the selector 735. For each of the columnar positions where non-addition in the cross-footer should take place, the carriage is provided with a stop lug 785 to depress the selector 735.

49. Carriage control of final total from the cross-footer

To condition the cross-footer for the taking of a final total therefrom, the total slide 189 (Fig. 27) is moved forward. The carriage is arranged to effect such forward movement by means of a bell crank 794, pivoted on the axis 788, and interposed between the total slide 189 and a pin 795. The pin 795 is arranged to be depressed by the selector 736. One or more stop lugs 785 on the paper carriage effect depression of the selector 736 in those columnar positions where a final total is to be taken from the cross-footer.

50. Carriage control of subtotal from the cross-footer

To move the subtotal slide 190 (Fig. 27) forward into effective position, I provide a bell crank 796 pivoted on the axis 788, a pin 797 transmitting power from the selector 737 to the bell crank 796. On the paper carriage are located one or more stop lugs 785 in positions corresponding to the columns where subtotals from the cross-footer should be printed, these stop lugs acting upon the selector 737.

In the embodiment herein shown of the invention, the total slide 189 must be moved forward whenever the subtotal slide 190 is advanced. In order to lighten the load on the spring 755 (Figs. 4^a and 27) of the subtotal selector 737, the total selector 736 is also depressed whenever a subtotal is to be taken from the cross-footer, the necessary stop 785 being provided on the control plate 770. Fig. 27 shows both selectors 736 and 737 depressed.

51. Carriage selection of A counter

The A counter is selected by moving the slide 406 (Fig. 50) forward. The carriage is arranged to produce such movement through the medium of a bell crank 798, pivoted at 788, and receiving power from the selector 744 through a pin 799. When an item is to be entered into the rear counter A, and when a total is to be transferred from the cross-footer to the counter A, the counter is selected just preceding the cycle in which it is to be used. Hence, for each columnar position in which an item or a total is to be added into the A counter, the carriage is provided with a stop lug 785 to operate upon the selector 744. When, however, a total is to be taken from A counter, a blank cycle must intervene between the selection of the A counter and the total-taking cycle. Consequently the stop lug 785 is positioned on the paper carriage at a point corresponding to such a blank cycle. Totals may be taken from two or more of the rear registers in succession under the control of the paper carriage without necessity for any blank cycles after the first blank cycle.

52. Carriage control of selection of B counter

This mechanism is similar to that described under the last preceding heading, and comprises a bell crank 800 (Fig. 50) arranged to push the

slide 407 forward, said bell crank being actuated by a pin 801 which receives power from the selector 743. Said selector is depressed by one or more stop lugs 785 located on the control plate, as described in connection with the selection of the A counter.

53. Carriage control of selection of C counter

A bell crank 802 operates to push the slide 408 forward, power being transmitted from the selector 742 to the bell crank 802 through a pin 803. The selector 742 is depressed at the proper point or points in the working stroke of the carriage by one or more stop lugs 785.

54. Carriage control of selection of D counter

This is effected by means of a bell crank 804 operating on the slide 409, and actuated by a pin 805 which underlies the selector 741, the latter being depressed at proper times by means of one or more stop lugs 785 on the paper carriage. For a reason which will appear later herein, an elongated lug 785^A (Fig. 4) may advantageously be used in certain sequences of operations.

55. Carriage control of final total from the rear counter

The selected rear counter is conditioned for the taking of a final total therefrom, by forward movement of the total slide 432 (Fig. 52). The carriage is arranged to effect such movement of the total slide by means of a bell crank 806 pivoted at 788 and actuated by a pin 807 which is depressed by the selector 738. For each columnar position in which a final total is to be taken from a selected rear counter, there is a stop lug 785 on the carriage to operate the selector 738.

56. Carriage control of subtotal from the rear counter

This mechanism is similar to that last described and comprises a bell crank 808, pivoted at 788, and operated by the selector 739 through a pin 809. A stop lug 785 located on the paper carriage in a position corresponding to each column in which a subtotal from a selected rear counter is to be printed, depresses the selector 739 at the proper time.

Since, in this embodiment of the invention, the total slide 432 is necessarily moved forward when the subtotal slide 433 is advanced, it is advantageous to supplement the power derived from the subtotal selector 739 by also depressing the total selector 738. As shown in Fig. 52 both selectors 738 and 739 are depressed whenever a subtotal is to be taken from a rear counter.

57. Carriage control of non-addition in rear counter

Non-addition in the selected rear counter is attained by pushing forward the non-add slide 455 (Fig. 52) by means of a bell crank 809^a that receives power from the selector 740 through a pin 809^b.

58. Carriage control of date, folio, and character printing

Means is provided which normally prevents the operation of all of the type bars 3 and 4. In certain columnar positions, the carriage disables said preventing means. Referring to Figs. 5 and 15, 810 is a plate pivoted on the axis 265, the lower edge of said plate being arranged to overlie the lugs 10 on the rear extensions of the

type bars 3 and 4. A spring 811 normally holds the plate 810 forward in effective position. In those columnar positions where the date, the folio, and other characters should be printed, the plate 810 is withdrawn from effective position by means of a bell crank 812 pivoted at 813, the forward arm of said bell crank engaging a pin 814 on the plate 810, and the other arm of the bell crank being engaged by one arm of a bell crank 815, pivoted on the axis 788. The other arm of the bell crank 815 supports a pin 816 which underlies the selector 745 (Fig. 3). The selector 745 is depressed at proper times by a stop lug 785 on the paper carriage.

59. Carriage control of amount repeat

When an amount is to be printed or registered more than once, the means for resetting the stops 28 is disabled. This is effected by imparting a counterclockwise movement to the lever 89 (Fig. 13), thus removing the rear end of the reset lever 67 from the range of action of the arm 88. The lever 89 is given such counterclockwise movement by means including the slide 95, the latter being pivoted to a lever 817 which is pivoted at 818. A bell crank 819 (Fig. 79) pivoted at 788 is actuated by means of a pin 820 which is arranged to be forced downward by the selector 746, the latter in turn being depressed at the desired time or times by one or more stop lugs 785 on the paper carriage.

The paper carriage begins to tabulate or move toward its next columnar position before the cycle of operations of the machine has been completed. In such tabulating movement, the stop lug 785 on the paper carriage would move away from the selector 746, thereby allowing the spring 93 (Fig. 13) to restore the reset lever 67 into the path of the arm 88 were not means provided to hold the reset lever 67 out of the way of the arm 88 until after said arm has returned to its initial position. The means provided for this purpose comprises a latch 820^a (Fig. 14) which is pivoted at 820^b. The lower end of said latch is adapted to lie immediately at the left of the stud 91 and thus prevent the lever 89 from turning clockwise into its initial position. A spring 820^c tends to move the latch 820^a into such position, but the spring is normally restrained by reason of the fact that an angular lug 820^d on the latch overlies the slide 222. When the slide is in its normal upper position, as shown in Fig. 3, the latch 820^a is held in its retracted or ineffective position, but when the arm 88 swings up, as it does in the front stroke of the main rock shaft 17, the withdrawal of the pin 224 permits the slide 222 to descend, thus allowing the spring 820^c to place the latch 820^a in effective position, as shown in Fig. 3^a.

60. Carriage control of date, folio, and other character repeat

The operation of the post 481 for resetting the stops 467 is prevented at desired times by imparting a counterclockwise movement to the lever 492, said lever serving to withdraw the reset lever 474 from the range of operation of the arm 88. The lever 492 is given a counterclockwise movement by means of the slide 492^b, said slide being pivoted to a lever 821 pivoted at 818, and arranged to be moved by means of a bell crank 822 (Fig. 79) which in turn is operated by a pin 823 underlying the selector 747. The carriage is provided with one or more stop lugs 785,

located in position to operate the selector 747 at the desired time or times.

A latch 823^a (Fig. 14) operates similarly to the latch 820^a to keep the reset lever 474 out of the range of the arm 88 until after said arm has returned to its initial position.

61. Carriage control of motor repeat

The carriage is arranged to cause the machine to cycle in the desired columnar positions. This is effected by means of the selector 748, depression of which causes downward movement of a pin 824 (Fig. 78). Said pin is supported by the rearwardly extending arm of a bell crank 825 (Fig. 70) which is pivoted at 788. The downwardly extending arm of said bell crank is arranged to push forward a link 826 which has a pin and slot connection with an arm 827. The latter is pivoted on the axis 549 and is connected to an arm 828 by means of a transverse web 829. The arm 828 is pivoted to the rear end of the link 589. 830 is a spring tending to move the link 826 rearwardly. At points on the control plate 770 corresponding to columnar positions in which the machine is to be cycled, there are stop lugs 785 which serve to depress the selector 748 and thus swing the arm 828 forward, whereby the detent arm 576 is withdrawn from the clutch sleeve 571, whereupon the spring 574 throws in the clutch 569—570.

It may be here noted that means sensitive to the position of the paper feed rolls on the paper carriage is provided to prevent the clutch from being thrown in unless the paper feed rolls are in effective position. This means includes a hook 831 (Fig. 70) on the arm 828, said hook being arranged to be engaged by a lever 832, the position of which is controlled by the position of the paper feed rolls. Inasmuch as this feature will be claimed in a separate application, no further disclosure thereof is required at this time.

In order that the machine shall not be caused to cycle before the selectors that control the various functions of the machine have had time to become effective, the motor repeat selector 748 is provided with a lug having its active surface beveled as shown in Fig. 66, and the motor repeat lug 785 is also beveled, thus delaying contact of the motor repeat lug 785 with the motor repeat selector until after the other lugs 785 have depressed the other selectors required for that columnar position.

62. Carriage control of non-print

In the present embodiment of the invention, the printing mechanism is disabled by preventing the hammers from striking the type when released. In this instance, this result is effected by means of a detent 833 (Fig. 39) fixed on a pivot shaft 834, said plate having at its rear edge a downturned flange 835 adapted, when the detent is swung downwardly, to lie in the path of the hammers for the signal type bar 1 and the amount type bars 2, and thus prevent said hammers from delivering a blow to the type. It will be understood that the flange 835 may be made of any desired length so as to block the operation of any desired hammers. Secured to the right-hand end of the pivot shaft 834 is an arm 836 to which is pivoted a link 837 (Fig. 2). A spring 837^a normally holds the detent 833 elevated. The rear end of the link 837 is arranged to be engaged by one arm of a bell crank 838. The other arm of said bell crank supports a pin 839 which is arranged to be depressed by the

selector 749. Stop lugs 785 are provided on the control plate 770 at a point or points appropriate to effect actuation of the selector 749 in the desired columnar position or positions.

63. Changing from debit posting to credit posting, and vice versa

The stop lugs 785 may be positioned on the control plate 770 so as to cause the machine to perform cycles of the desired nature in the desired sequence, and thus permit of the performance of bookkeeping work in any desired order. If we assume that all debits are to be posted at one time to the customers' ledger accounts, and then all of the credits, the stops on the control plate require adjustment from a set-up appropriate to debit posting to the set-up required for credit posting. Such adjustment of the stops may be effected in various ways. Herein I have shown a key 840 (Figs. 1 and 81) which may be termed the Credit key. The stem 841 of said key is guided for vertical movement. The lower end of the key stem bears against a pin 842 on an arm 843, which is pivoted in the machine frame on the axis 844. The arm 843 is connected to a lever 845 by means of a web 845^a. To the lever 845 is pivoted the forward end of a link 846. Said link extends rearwardly and is connected at the rear of the machine to a ball 847 which is pivoted at 848. Fixed to said ball is a pin 849 (Fig. 3) that engages a fork 850 on the lower end of a slide 851 which is mounted in the machine frame for vertical movement. On the upper end of the slide 851 is a cam 852 (Figs. 2, 3, 5, 83 and 84) which is located in the vertical plane of the axis of the rollers on the selectors, as shown in Fig. 5. The cam 852 is in its elevated or effective position during debit posting, as shown in Fig. 84. Any suitable means may be provided to hold the key 840 and the cam 852 in their different positions. Herein I have shown a spring 853 (Fig. 2) which tends to raise the cam 852 into effective position. This spring also tends to raise the Credit key 840 into its elevated position. Independent means comprising a spring 854 (Fig. 81) and an arm 855 bearing against a pin 855^a on the stem of the Credit key also is provided to raise the key. The upper position of said key is determined by contact of a pin 855^b on the stem of the key with the plate 856. To latch the Credit key in depressed position, a shoulder 857 is formed on the key stem 841, said shoulder being arranged to engage the plate 856 when the key is depressed and pushed rearward slightly.

The cam 852, when in its elevated position, is arranged to withdraw certain stop lugs 785 from effective position. For this purpose means is provided upon certain of the control elements 771 for moving the stop lugs 785 vertically. While any preferred means may be employed for this purpose, I have herein shown a slide 858 (Fig. 83) mounted on one side of the control element for reciprocation longitudinally of the control element. The slide is mounted on the control element by means of headed studs 859 extending through elongated openings 859^a in the slide. A spring 860 normally holds the slide in its rearward position. In the slide are formed one or more cam openings 861 into which extend studs 862 fixed to blocks 862^a carrying stop lugs 785. Where two adjacent stop lugs 785 are to be simultaneously withdrawn, they may be formed upon a single block. The cam 852 is arranged to engage a lug 858^a on the slide 858 to

push said slide forward and hold it in such position, thus raising the associated stop lugs 785 and holding them up out of position to engage the selectors, as shown in Fig. 84.

It will be noted that the Credit key 840 and cam 852 determine whether the cross-footer shall add or subtract in particular columns.

The cam 852 is also arranged to withdraw the escapement tooth 668 so that the carriage shall skip the columnar position or positions at which said cam operates. This result is effected by providing on the inner end of the slide 858 a cam 863 (Figs. 85, 86 and 90) adapted, when the slide is in its forward position, to engage a pin 863^a on the lever 665 and thus depress the tooth 668 below the path of the stop 675.

As shown in the diagram (Fig. 105) there are stops in the second and sixth columnar positions which are needed in the posting of credits. In order that these stops shall not function during the posting of debits, they are arranged to be lifted out of position to engage the selectors during debit posting. The control elements located in the second and sixth columnar positions have upon one side a slide 858^x which is similar to the slide 858 except that it has no skip cam 863. (See Fig. 64^a.)

As shown in Fig. 105, in debit posting, the cam 852, which is then in its elevated position, disables the stops *a* and *b* in the second columnar position, the carriage escapement and all stops in the third columnar position, the stops *c*, *d* and *e* in the sixth columnar position, and the carriage escapement and all stops in the seventh columnar position.

64. Second pickup of credit balance key

In order to prove the correctness of machine posting it is customary, after entering the debits or credits, to "pick up" (that is to say, set up on the keyboard) the old balance again and then operate the machine to subtract the old balance from the new balance. If the old balance was set up correctly in both instances (being added the first time and subtracted the second time) the remainder will be the same as the total of the debits or credits posted, thus proving the accuracy of the picking up of the old balance. Since the balance of the customer's account will ordinarily be a debit, it is customary to arrange the carriage-actuated controls on the machine so that in the columnar position where the second pick-up of the old balance is registered in the cross-footer it will be subtracted as just explained.

If, however, the old balance is an overdraft, it is subtracted when picked up the first time, and consequently it is necessary to add the old balance when it is picked up the second time, in order to prove the accuracy of the posting; and inasmuch as the machine is normally arranged to subtract the second pick-up, it is necessary to provide means whereby, when the old balance was an overdraft, the second pick-up will be added. Such means will now be described.

864 is a key which we may term the Second pick-up of Credit balance key (Figs. 1, 2 and 28). The stem of this key overlies a bail 865 having an arm 866 fixed thereto. Said arm is connected through a spring 867 to one arm of a lever 868, which is pivoted at 869. The other arm of the lever 868 lies in front of the subtraction slide 328 (Fig. 47). The effective strength of the spring 867 is greater than that of the spring 762 (Fig. 66). Hence, it will be seen that when the

Second pick-up of Credit balance key is depressed and latched down by the slide 210, the lever 868 will prevent the selector 734 from moving the subtraction slide 328 forward as it otherwise would do when there is a stop 785 to operate the subtraction selector 734.

A spring 869^a returns the bail 865 to normal position when the key 864 is released from its depressed position.

It will be seen that the key 864 determines whether the cross-footer shall add or subtract.

65. Normalizer key 870

In order to permit of printing items and totals one below the other in a single column, I provide means to deprive the carriage of control of the various machine functions, means to prevent automatic operation of the carriage escapement, and means to enable the line-space mechanism. These various devices are controlled by a Normalizer key 870 (Figs. 1 and 70), the stem 871 of which is guided for vertical movement in the machine frame. A spring 872 normally holds the key 870 elevated. It may be latched in a depressed position in any preferred way, as, for example, by providing a shoulder 873 to be engaged by the guide pin 874 by tilting the key stem slightly forward, the spring 872 serving to hold the shoulder 873 in engagement with the pin 874. On the key stem 871 is a pin 875 that overlies the forward end of a lever 876 which is pivoted at 877. The rear end of the lever 876 engages a pin 878 on a slide 879. The slide 879 is guided for vertical movement in the machine frame. On the slide is a cam surface 880 arranged to engage one end of a lever 881, which is pivoted at 882 in the machine frame. The other end of the lever 881 is arranged to engage the left-hand arm of the lever 678 for the purpose of pushing said lever rearwardly out of reach of the automatic slide 685 and the lug 690 on the tabulator key lever 689. It will be seen that depression of the Normalizer key 870 will disable the escapement dog 669 and result in said dog remaining in its lower inoperative position, through the action of the spring 673. The carriage will then be held through engagement of a stop 675 with the escapement tooth 668. If it be desired to shift the carriage to the left into another columnar position, this may be effected by depressing the Tabulator key 688 and holding it depressed until the carriage nears the desired position whereupon the Tabulator key would be released so as to cause the carriage to stop in the desired position. As shown in Fig. 64 the lug 691 on the rear end of the Tabulator key lever 689 underlies the left hand end of the lever 693 so that depression of the Tabulator key 688 will cause the lever 665 to be depressed, thus disengaging the escapement tooth 668 from the stop 675 and holding said tooth 668 down so long as the Tabulator key 688 is held depressed, thereby permitting the carriage to travel continuously toward the left into any desired columnar position, as just described.

As shown in Fig. 2, the slide 879 is located in a plane extending transversely of the planes of the selectors 733 to 750 inclusive, and beneath the free ends of said selectors. The length of the upper edge of the slide 879 equals or exceeds the width of the series of selectors. When the universal member or slide 879 is raised through depression of the normalizer key, the upper edge of said slide engages the lower sides of the free ends of the selectors and holds them against a

stop bar 883 (Fig. 5), thereby preventing the selectors from being depressed by stop lugs on the control plate 770. When the selectors are thus held against downward movement, the rollers 752 and the pivoted members 758 yield to the pressure of the stop lugs 785.

Depression of the normalizer key also enables the line-space mechanism. The rear arm of the lever 876 (Fig. 70) underlies a pin 884 on the link 653^b. Hence, depression of the totalizer key will lift the stop arm 653 into ineffective position, whereby the line-space mechanism is permitted to operate in each cycle of the machine.

It may be here noted that the force of the springs which normally hold the slides 189, 190, 236, 328, 406, 407, 408, 409, 432, 433 and 455 in their rear positions is not transmitted through the bell cranks and pins to the selectors to press the latter against the stop bar 883, the action of said springs being limited by a fixed stop bar 884^a (Figs. 78 and 80) which is engaged by shoulders on said slides.

66. Carriage return

Means is provided for returning the carriage by power. In the present embodiment of the invention the mechanism for returning the carriage is driven from the same motor that cycles the machine. The spur gear wheel 812 (Figs. 3 and 73), which is driven continuously during the operation of the electric motor, meshes with a spur gear wheel 885 having upon one side bevel gear teeth 886 (Fig. 71) that mesh with a bevel gear pinion 887, said pinion being fixed upon a vertical shaft 888. A train of gears 889, 890, 891, and 892 (Fig. 5) transmits power from the shaft 888 to a vertical shaft 893. A clutch collar 894 (Figs. 91, 92, 94 and 95) is slidable and non-rotatably mounted upon the shaft 893 and is adapted to engage a clutch face 895 which is rigid with a pinion 896. Said pinion is loose on the shaft 893 and meshes with a rack bar 897 attached to the carriage.

It is desirable that there be provision for slippage at some point between the motor and the carriage. Herein such slippage is arranged for by making the gear 899 (Fig. 3) of two-part construction, the upper half meshing with the pinion 889 and the lower half meshing with the gear 891 (Fig. 5), the two halves being frictionally connected by any preferred means. When the carriage return is thrown in, slippage occurs between the two parts of the gear 899 until the inertia of the carriage is sufficiently overcome.

67. Carriage return key 898

The carriage return clutch may be thrown in at any time to effect return of the carriage to its initial position. The means herein shown for this purpose comprises a key 898 (Fig. 70) carried by a lever 899 which is pivoted in the machine frame at 900. A spring 901 normally holds the key 898 elevated. The extent of downward and upward movement of said key is limited by engagement of lugs on said key lever 899 with the pivot shaft 701. The rear end of the lever 899 is arranged to lift the clutch collar 894, a washer 902 being interposed between the lever and the clutch collar. The clutch collar 894 is held in engaged position by means herein shown as comprising a lever 903 (Fig. 91) which is pivoted on a stud 904. One arm of the lever 903 has a lug 905 that lies within a peripheral groove 906 in the clutch collar. The opposite end of the lever 903 is made of wedge form as shown at

907. A detent 908 is pivoted in the machine frame at 909 and has a wedge-shaped tooth 910 adapted to engage the wedge surfaces 907. A spring 911 acting on the detent 908 serves to hold the clutch collar in either of its two positions and insures quick engagement and disengagement of the clutch surfaces.

As shown in Figs. 3 and 70, the angular forward end 697 of the lever 695 underlies the Carriage return key lever 899; consequently the switch 597—598 (Fig. 5) will be closed to effect actuation of the carriage return mechanism, as described under heading 41, in case the switch is open when the Carriage return key 898 is depressed.

68. Disengaging clutch on return to initial position

In the return movement of the paper carriage, the lugs 676 (Fig. 64) successively pass over the upwardly-extending arm of the lever 605 and thus depress the escapement tooth 608.

As shown in Figs. 1 and 98, the carriage is provided with a cam bar 912 which, when the carriage is approaching its initial position, engages an arm 913 which is rigid with the lever 903 and thus tilts said lever against the influence of the detent 908 to withdraw the clutch collar 894 from the clutch face 895. After the clutch is thus disengaged, the spring drum 643 moves the carriage to the left a short distance until the stop 676 in the first columnar position stops against the escapement tooth 608.

69. Automatic engagement of carriage return clutch

A bar 914 (Fig. 94) is mounted on the paper carriage to extend longitudinally thereof. The bar is attached to the carriage by means of headed studs 915 fixed to the bar and extending through elongated openings 916 in a member fixed to the carriage. A spring 917 attached to the bar 914 normally holds the studs 915 against the left-hand end walls of the openings 916, as shown in Fig. 91. On the bar 914 is a pin 918 which is arranged to engage the arm 913 as the carriage is completing its working stroke, and thus cause the carriage-return clutch to be thrown in. The yieldable mounting of the bar 914 cushions the shock of the engagement of the pin 918 with the arm 913.

70. Return from one intermediate position to another intermediate position

A carriage short return key 919 (Fig. 74) is carried by a lever 920 which is fixed on one end of the rock shaft 701. To the opposite end of the shaft 701 is secured an arm 921 (Fig. 76). A spring 922 (Fig. 74) normally holds the key 919 elevated, 923 being a stop on the machine frame to limit the action of the spring. Said spring normally holds the arm 921 against a pin 924 (Fig. 76) on a lever 925. The lever 925 is loosely mounted on the pivot shaft 894. A spring 926 tends to swing the lever 925 rearwardly, but is normally restrained by the arm 921. The lower end of the lever 925 has a pin and slot connection with a slide 927, the rear end of which is supported upon a guide pin 928 (Figs. 91 and 92). In the rear end of the slide 927 is a vertical slot 929 in which lies one arm of the lever 903. Said lever is slidable on its pivot 904 transversely of the direction of travel of the carriage, and it will be seen that depression of the key 919 will allow the spring 926 to slide the lever 903 from the normal forward position shown in Figs. 91, 75

92, 93, and 94 to the rear position illustrated in Figs. 95, 96, and 99. Such shifting of the lever 903 withdraws the arm 913 from the path x (Fig. 100) within which the clutch-engaging pin 918 and the clutch-disengaging cam 912 travel, and places said arm 913 in the path y . When in the path y the arm 913 will be engaged by the left-hand end 930 of the bar 914, whereby the clutch will be thrown in to effect return of the carriage.

On the carriage is a pin 931 which engages the arm 913 in the return travel of the carriage to disengage the clutch.

While the parts 930 and 931 may be located at any desired points along the carriage, they are herein shown as so located as to initiate return movement when the carriage is between the eighth and ninth columnar positions and to terminate the return movement when the carriage is between the first and second columnar positions, the spring drum thereupon placing the carriage in the last mentioned columnar position. It will be understood that in both positions of the lever 903, the part 905 (Fig. 91) lies in the peripheral groove 906 of the clutch collar 894.

71. *Tabulation and line-spacing in connection with short return*

At the time the Short return key 919 is utilized the carriage is standing in a certain columnar position. The machine, therefore, must be cycled to effect tabulation of the carriage to cause the carriage to throw in the carriage return clutch, in other words, to allow the part 930 to engage the arm 913. Such cycling also is necessary in order to effect line spacing. As shown in Fig. 74, the pin 708 carried by the arm 707 is arranged to be engaged by the lever 920. The pin 708 operates the lever 709 (Fig. 70) to throw out the detent 576 and thus throw in the main clutch 569—570.

In the ensuing cycling of the machine, the escapement is automatically operated through the left-hand arm 20 (Fig. 34), the link 652, the levers 651 and 686, the slide 685 (Fig. 64), and the levers 678 and 681. Rearward movement of the arm 707 (Fig. 74) also operates the lever 712 to withdraw the detent 653 (Fig. 77), thus permitting operation of the line-space mechanism so as to present the next line on the paper for use in the second columnar position.

72. *Latches for the non-tabulate key 699 and carriage short return key 919*

Referring to Fig. 74, it will be seen that the key lever 920 carries a pin 932 which engages the forked end of an arm 933 that is loosely pivoted on the shaft 701. The latch arm 716 is broad enough to engage both of the arms 714 and 933 and is normally pressed against said arms by the spring 717. When the carriage short return key 919 is depressed, the arm 933 is swung below the free end of the latch arm 716, whereupon said latch springs rearwardly into position above the arm 933, thus holding the key depressed. In the last half of the cycle, the carriage short return key 919 is automatically unlatched in the following manner: As the hammer reset rod 320^a is returning to its normal forward position, it engages the rear end of the member 718, thereby swinging the link 720 forward and thus disengaging the latch arm 716 from the arm 933, whereupon the spring 922 lifts the key lever 920 to its normal position.

Such unlatching of the Carriage short return key occurs before the pin 931 (Fig. 99) has

reached the arm 913 and therefore means must be provided to retain the arm 913 in the path y until the pin 931 can reach and actuate said arm. As shown in Figs. 93 and 97, the arm of the lever 903 that is engaged by the detent 908 is rabbetted to provide two wedging surfaces 934, thus producing locking shoulders 935 and 936. When the lever 903 is shifted to its rear position, the detent 908 springs into engagement with the lower surface 934 (as shown in Fig. 93), whereby the wedge-shaped end of the detent is placed in front of the locking shoulder 935, thereby holding the lever 903 in its rear position after the Carriage short return key 919 has been released by the latch 716, against the tendency of a spring 937 (Fig. 76) to pull the lever 903 forward. The shoulder 935 thus retains the arm 913 in the path y long enough for the part 930 (Fig. 95) to reach and operate the arm 913 to throw in the carriage return clutch. The tilting of the lever 903 as the clutch is thrown in places the locking shoulder 936 behind the detent 910, whereby the arm 913 is retained in the path y until the pin 931 can reach and operate the arm 913 to disengage the clutch (see Fig. 99).

As shown in Fig. 97 the shoulder 936 is a little distance behind the shoulder 935. When the clutch is thrown in, and the shoulder 936 is placed behind the detent 910, the spring 937 pulls the lever 903 forward until the shoulder 936 bears against the detent 910, this movement of the lever 903 being insufficient to withdraw the arm 913 from the path y . When the clutch is disengaged by the pin 931 the detent 910 is forced from the upper surface 934 to the lower surface 907, as will be understood from Fig. 97, thereby permitting the spring 937 to shift the lever 903 into its normal forward position.

The Carriage short return key 919 may be manually unlatched by means of the lever 724 (Fig. 75).

73. *Taking two consecutive credit subtotals*

It is frequently desired to print a balance from the cross-footer on one work-piece and print the balance again on another work-piece in the next ensuing cycle of operations. This involves no difficulty when the balance is a debit amount, as the cross-footer pinions tend to go into mesh with the adding racks, but since the balance may happen to be a credit amount, it is necessary to provide means which shall automatically cause the cross-footer pinions to go into mesh again with the subtracting racks, if the balance be of a credit nature.

As previously explained, at the completion of a subtotalling operation, the cross-footer pinions move out of mesh with the racks a moment after the latter have returned to their down position. If the subtotal was a credit balance, the subtraction slide 328 (Fig. 33) returns to its normal rear position under the influence of its spring 332 as soon as the cam 280 operating on the roller 342 pushes the slide 338 rearwardly. The spring 332 also tends to swing the adding-subtracting link 155 over to the adding side, i. e., into engagement with the pin 158. If now, the credit subtotal is to be again printed, it will be seen that a cycle of operations would be necessary in order to condition the cross-footer therefor. To avoid such necessity, means is provided to prevent the spring 332 from withdrawing the link 155 from engagement with the

subtraction pin 159. This means comprises a latch 941 (Figs. 33 and 48) pivoted in the machine frame at 942 and arranged to engage a pin 943 on the subtraction slide 328. A spring 944 normally holds the latch in contact with the pin. On the forward end of the latch 941 is pivoted a dog 945 which is normally held against a stop pin 946 on the latch by means of a spring 947. On the arm 15 is a pin 948 to engage the dog 945.

Assuming that in a given columnar position a subtotal is to be taken, a blank cycle is performed in the next preceding columnar position. If the cross-footer contains a credit balance, the subtraction slide 328 is moved forward by the slide 338 during such blank cycle, the subtraction slide 328 being latched in such forward position by the latch 941. In the ensuing subtotal cycle, the pin 948 disengages the latch 941 from the subtraction slide 328, but this is immaterial as the subtraction slide has already functioned for that cycle. After a few degrees of further movement of the rock shaft 17 in that cycle, the spring 339 is allowed by the cam 239 to move the slide 338 forward, thus again placing the subtraction slide 328 under the control of the latch 941, where it stays during the remainder of that cycle and long enough in the second subtotal cycle to perform its function. Thereby the link 155 is kept in engagement with the pin 159, as shown in Fig. 46.

74. Examples of work

In order to illustrate the capabilities of the machine, I have shown in the drawings in a diagrammatic fashion one of many possible practical applications. Referring first to the application illustrated in Fig. 105, the upper portion of the diagram indicates the arrangement of stops 705 on the control plate 770 required to produce the operations indicated upon the work pieces A, B and C. The work piece A is a customer's monthly statement. The work piece B is the ledger sheet for that customer, and the work piece C is a proof tape. Ordinarily, a journal or audit sheet D also would be produced as a carbon copy of the entries on the statement and/or the ledger sheet.

The operator is usually provided with a tray containing ledger sheets and statement forms, the ledger sheet and the statement form for a given customer being arranged in association. Preliminary to the preparation of statements, each statement is headed with the customer's name and address on an addressograph or a typewriter, and the balance from the previous month is entered on the statement by means of a typewriter or by means of the machine herein disclosed, the carriage having been normalized for this purpose. On the statement A is shown an old balance of 175.00 in the balance column. The ledger sheets would be similarly headed and the old balance entered as indicated on the ledger sheet B.

Ordinarily the operator would enter on a given day all of the debits for that day and then all of the credits. The debit posting media would ordinarily consist of a pile of carbon copies of invoices arranged in the same order as the statements and ledger sheets are arranged in the aforementioned tray, i. e., either numerically or alphabetically.

Since the date is to be printed repeatedly the lever 536 (Fig. 14^a) is placed in its right-hand position, and the proper keys are depressed in the

three left-hand character sections to set up the month, day and year.

The journal sheet D and a carbon sheet having been inserted into the machine, the operator inserts the statement and the ledger sheet for the customer indicated on the first invoice to be posted. The carriage being in its first columnar position, the operator "picks up" the old balance of 175.00 by setting up this amount on the amount keyboard and depressing the motor bar. In the cycling of the machine the old balance of 175.00 is accumulated additively in the cross-footer. It is not printed, however, as there is a stop 785 on the control plate 770 in the first columnar position to operate upon the non-print selector 749. During the latter part of the cycle, the escapement tooth 569 is withdrawn to allow the carriage to tabulate to the second columnar position. (Before the carriage reaches this position the stops 785 at the points *a* and *b* are lifted by the cam 352, as they are not used in debit postings.)

The operator now sets up on the folio keyboard the number (248) of the invoice, and sets up on the amount keyboard the amount of the invoice (25.00), the motor bar being then operated to cause the machine to cycle. Since it is desired to print the date in the second columnar position, a stop 785 is provided on the control plate 770 in that columnar position, in position to depress the date selector 745. It is also desired to print the invoice number on the ledger sheet, hence a stop 785 is provided on the control plate at the second columnar position in position to operate upon the folio repeat selector 747.

It is desired to print the amount of the invoice, (25.00) on the ledger sheet. This cannot be accomplished by providing a stop 785 in item repeat position at the second columnar position, because the new balance is to be printed on the statement, and of course such balance or total cannot be printed while an amount remains set up on the stops 23. Therefore one of the rear counters (herein, the D counter) is utilized to preserve the amount of the invoice until it is to be printed on the ledger sheet. For this purpose, a stop 785 is provided in the second columnar position, in position to operate upon the D counter selector 741.

Depression of the motor bar with the carriage in the second columnar position, therefore, causes the printing of the date, the invoice number and the amount of the invoice, and the accumulation of the amount of the invoice in the cross-footer and in the D counter, whereupon the carriage tabulates to the third columnar position.

The cam 352 (Fig. 84) being in its upper position, the slide 358 on the control element at the third columnar position on the control plate 770 is moved forward as the carriage approaches the third columnar position, thereby raising all of the stops 785 on that control element and placing the cam 363 (Figs. 84 and 90) in position to engage the pin 362^a, hence the carriage passes the third columnar position without stopping and without causing depression of any of the selectors, the carriage continuing on to the fourth columnar position, where it is arrested by the escapement tooth 568.

In the fourth columnar position, a blank cycle is performed to condition the machine for the taking of a subtotal from the cross-footer in the fifth columnar position. To effect such blank cycling and to preserve the folio and date set-up, the carriage is provided at the fourth columnar

position with a stop 785 in position to operate upon the motor repeat selector 748 and a stop 785 in position to operate upon the folio repeat selector 747. The machine is thus caused to cycle, whereby the transfer mechanism of the cross-footer (which operated in the addition of 25.00 to 175.00) is restored to normal position. At the conclusion of the blank cycle, the carriage tabulates to the fifth columnar position.

In the fifth columnar position, stops 785 are provided to effect the conditioning of the machine for the taking of a subtotal from the cross-footer and for the preservation of the folio and date set-up, and to produce cycling of the machine; hence after arrival of the carriage in the fifth columnar position the machine is cycled to print the new balance (200.00) on the statement as a subtotal from the cross-footer.

In the sixth columnar position, it is desired to print the charge (25.00) as a total from the D counter. The D counter must therefore be selected in the fifth columnar position; hence a stop 785 is provided to effect selection of the D counter in that columnar position. However, in the last-mentioned columnar position, a subtotal was taken from the cross-footer, and if the D counter is to be selected in that columnar position it is necessary to prevent the subtotal (200.00) contained in the cross-footer from being transferred to the D counter, hence there is provided in the fifth columnar position a stop 785 to effect non-addition in the rear counter. Consequently at the beginning of the return stroke of the cycle performed in the fifth columnar position the pawl 392 (Fig. 52) is disabled by the pin 452, thereby preventing the D counter from being placed in mesh with the racks 358 at that time, and consequently preventing the subtotal in the cross-footer from being transferred to the D counter. If the D counter link 376 (Fig. 50) would remain up in position to be engaged by the D counter pin 380 when the hook 395 on the pawl 392 engages the pin 397 near the end of the return stroke, the D counter would be selected or thrown in mesh with the racks 358 in the fifth columnar position, which is the desired result; but when tabulation from the fifth to the sixth columnar position begins the link 376 would drop, due to the rising of the selector 741, and this would occur before the hook 395 could act; hence it is necessary to prolong the time during which the selector 741 is effective. To attain this result, the stop 785A is employed, said stop being elongated so as to hold the selector 741 depressed until the hook 395 can place the D counter in mesh with the racks 358 at the end of the cycle performed in the fifth columnar position.

In the sixth columnar position, stops 785 are provided to operate the selector 745 which determines date and folio printing, the selector 738 which determines the taking of a final total from the D counter, the selector 735 which effects non-addition in the cross-footer and thus prevents the total in the D counter from being transferred to the cross-footer, and the selector 748 which effects automatic cycling of the machine. (The stops 785 at the locations marked c, d and e are lifted into inoperative position by the cam 852.) Consequently in the sixth columnar position the date and the invoice number are printed and the charge of 25.00 is printed as a final total from the D counter. There is no stop 785 in the sixth columnar position to operate upon the folio and date repeat selector

747. The plate 220 (Fig. 14) is operated to release the depressed keys corresponding to the invoice number (248), but inasmuch as the lever 536 (Fig. 14^a) is in its right-hand position, the keys corresponding to the month, day and year are not released.

The cam 852 being in its upper position, the slide 858 on the control element at the seventh columnar position on the control plate 770 is moved forward as the carriage approaches that position, thereby raising all of the stops 785 on that control element and placing the cam 863 in position to engage the pin 863^a. Consequently the carriage passes the seventh columnar position without stopping and without causing depression of any of the selectors, the carriage continuing on to the eighth columnar position.

Observing that there is another invoice for the same customer, the operator depresses the Carriage Short Return key 920, whereby the arm 913 is placed in the path "y" and the machine is caused to cycle. The line-space mechanism also operates and the carriage tabulates until the portion 930 (Fig. 95) engages the arm 913, whereupon the carriage return clutch is thrown in. The carriage then returns to the right until the pin 931 (Fig. 99) engages the arm 913, when the carriage return clutch is thrown out, the carriage then moving under the influence of the spring drum 643 until the tooth 675 at the second columnar position stops against the escapement tooth 668. The operator now sets up on the folio keyboard the number (249) of the invoice and sets up on the amount keyboard the amount of the invoice (35.00), the motor bar being then operated to cause the machine to cycle. The operations previously described as occurring automatically in the second to the seventh columns, inclusive, in connection with the posting of Invoice No. 248 then occur, the carriage stopping in the eighth columnar position. It will be observed that all operations after the operator depressed the motor bar with the carriage in the second columnar position have been performed automatically up to and including those occurring in the seventh columnar position. When the carriage stops in the eighth columnar position, the operator depresses the motor bar, whereupon the machine performs a blank cycle of operations and the carriage tabulates to the ninth columnar position.

In the ninth columnar position it is desired to print the new balance 235.00 as a subtotal from the cross-footer and to transfer that amount into the C counter where new balances are to be stored. Stops 785 are therefore provided on the control plate 770 in the ninth columnar position to actuate the subtotal selector 737, the C counter selector 742, and the motor repeat selector 748. Consequently after the carriage arrives at the ninth columnar position, the new balance of 235.00 is printed as a subtotal from the cross-footer, and the C counter is engaged with the racks 358 at the beginning of the return stroke so that the new balance of 235.00 is accumulated in the C counter. Thereupon, the carriage tabulates to the tenth columnar position.

With the carriage in the tenth columnar position, wherein the proof tape is presented to the printing mechanism, the operator sets up the old balance (175.00) on the amount keyboard. This amount is to be subtracted from the new balance of 235.00 in order to prove the correctness of the posting of the charges of 25.00 and

35.00. Consequently, the old balance of 175.00 is to be subtracted from the new balance of 235.00 contained in the cross-footer. Hence, a stop 785 is provided on the carriage to operate the subtraction selector 734. It is also desired to store the old balances, and the B counter has been assigned to this function. Consequently, a stop 785 is provided to operate the B counter selector 743. After having set up the old balance of 175.00 on the amount keyboard, the operator depresses the motor bar, whereupon the machine cycles to print the old balance of 175.00 in red on the proof tape, to subtract 175.00 from the amount in the cross-footer, and to add it into the B counter. The carriage then tabulates to the eleventh columnar position.

In the eleventh columnar position a blank cycle is performed to restore the transfer mechanism of the cross-footer preparatory to taking a total in the twelfth columnar position. Such a blank cycle is performed automatically, a stop 785 being provided in position to operate upon the motor repeat selector 748. After the blank cycle the carriage tabulates to the twelfth columnar position.

In the twelfth columnar position, stops 785 are provided in position to operate upon the line space selector 733, the total selector 736, the A counter selector 744, and the motor repeat selector 748. Consequently, upon arrival of the carriage in the twelfth columnar position, the machine is automatically cycled to print the charges (60.00) in black upon the proof tape as a final total from the cross-footer, the charges (60.00) being accumulated in the A counter, and the line space mechanism being actuated to line space all of the work pieces. Thereupon the carriage tabulates a short distance beyond the twelfth columnar position until the pin 918 (Fig. 94) on the carriage engages the arm 913, whereby the carriage return clutch is thrown in, thus initiating return of the carriage toward its initial position. After the carriage has passed a slight distance beyond the first columnar position, the cam 912 (Fig. 98) engages the arm 913 and causes the carriage return clutch to be thrown out, whereupon the spring drum moves the carriage to the left until the stop 675 (Fig. 64) for the first columnar position is arrested by the escapement tooth 668. A complete sequence of operations involved in the posting of Invoices Nos. 248 and 249 has now been completed and the cross-footer cleared preparatory to the posting of the next invoice. The total of the invoices (60.00) has been stored in the A counter, the old balance (175.00) has been stored in the B counter, and the new balance of 235.00 has been stored in the C counter. The operator then removes the statement and the ledger sheet and inserts a statement and a ledger sheet for the customer named in the next invoice to be posted.

After thus posting all of the invoices or other debit media, the operator will usually wish to determine the correctness of the posting by adding the grand total of the debits stored in the A counter to the grand total of the old balances stored in the B counter and then comparing the sum of these two grand totals with the grand total of the new balances stored in the C counter. Preparatory to obtaining such proof, the operator normalizes the carriage in the twelfth columnar position and then proceeds to transfer the totals contained in the A and B counters to the cross-footer in the manner hereinbefore explained. The result of these operations, for the

particular example shown in Fig. 105, is illustrated on the fragment of tape represented in Fig. 106 where it will be seen that the totals transferred to the cross-footer from the A and B counters equal the total of the new balances contained in the C counter, thus proving the correctness of the posting of debits.

The operator then proceeds to post the credits, first depressing the Credit key 840, which lowers the cam 852 to the position shown in Fig. 83. The operator inserts the statement and the ledger sheet for the customer named in the first credit to be posted. We will assume that he is the same customer whose statement and ledger sheet are shown in Fig. 105.

The carriage being in its first columnar position, the operator picks up the old balance of 235.00 by setting up this amount on the amount keyboard and depressing the motor bar. In the cycling of the machine, the old balance of 235.00 is accumulated additively in the cross-footer, but is not printed, after which the carriage tabulates to the second columnar position.

The operator now sets up on the folio keyboard the number (758) of the credit and sets up on the amount keyboard the amount of the credit (25.00), the motor bar being then operated to cause the machine to cycle. Since it is desired to subtract the amount of the credit from the old balance in the cross-footer, a stop 785 is provided on the control plate 770 in position to operate the subtraction selector 734. It is also desired that the credits shall not be printed in the second columnar position. Consequently, a stop 785 is provided at the second columnar position to operate upon the amount non-print selector 749. Since the amount of the credit is to be printed in the seventh column a rear counter, say, the D counter, is used to preserve said amount until after the new balance has been printed in the fifth columnar position. In the second columnar position, therefore, a stop 785 is provided to operate upon the D counter selector 741. Depression of the motor bar with the carriage in the second columnar position therefore causes the printing of the date and the number of the credit, the subtraction of the credit from the old balance in the cross-footer, and the accumulation of the amount of the credit in the D counter. The carriage then tabulates to the third columnar position. At this columnar position of the paper carriage, there is provided a stop 785 to operate upon the subtraction selector 734 (in order that printing shall be done in red), a stop 785 to actuate the rear counter subtotal selector 739, and a stop 785 to operate upon the non-add selector 735 to prevent transfer of the amount of the credit from the D counter to the cross-footer. A stop 785 also is employed to preserve the folio and date set-up, and a stop is provided to actuate the motor repeat selector 748. Consequently when the carriage reaches the third columnar position, the machine is automatically cycled to cause the printing of the amount of the credit (25.00) in red as a subtotal from the D counter, whereupon the carriage tabulates to the fourth columnar position. Upon reaching the fourth columnar position, the machine is automatically cycled to restore the transfer mechanism of the cross-footer, after which the carriage tabulates to the fifth columnar position.

In the fifth columnar position, a stop 785 is provided to effect printing of a subtotal from the cross-footer, the stop 785A effects selection of the

D counter, and a stop 785 prevents a transfer from the cross-footer to the D counter; consequently, upon arrival of the carriage in the fifth columnar position, the machine is cycled to print the new balance (210.00) as a subtotal from the cross-footer, after which the carriage tabulates to the sixth columnar position.

In the sixth columnar position it is desired to print the date and the credit number in red, hence a stop 785 is provided to operate upon the subtraction selector 734. There are stops 785 in position to select and to take a final total from the D counter in the sixth columnar position in debit posting, but inasmuch as it is not desired to take either a final total or a subtotal from the D counter in the sixth columnar position in credit posting, the presence of the stop 785 for the rear counter total selector 738 is nullified by providing a stop 785 for the rear counter subtotal selector 739 and a stop 785 for the non-print selector 749. To prevent transfer of the amount in the D counter to the cross-footer, a cross-footer non-add stop 785 is provided. Consequently, when the machine is automatically cycled in the sixth columnar position, the date and the credit number are printed in red and the D counter goes through a subtotal operation without printing the subtotal, after which the carriage tabulates to the seventh columnar position.

In the seventh columnar position, it is desired to print the amount of the credit (25.00) in red as a final total from the D counter, and to prevent the amount of the credit from being transferred from the D counter to the cross-footer. Hence, there are provided stops 785 to operate the subtraction selector 735, the cross-footer non-add selector 735, the rear counter total selector 738, and the motor repeat selector 748. A stop 785 is also provided in a position to operate upon the D counter selector 741 in order to effect engagement of the D counter with the racks 358 at the beginning of the cycle. Thus in the seventh columnar position the amount of the credit (25.00) is printed in red as a final total from the D counter, whereupon the carriage tabulates to the eighth columnar position.

Upon arrival of the carriage in the eighth columnar position, the operator depresses the motor bar, whereupon the machine performs a blank cycle of operations and the carriage tabulates to the ninth columnar position.

In the ninth columnar position the new balance of 210.00 is printed as a subtotal from the cross-footer, the operations that occur in the ninth, tenth, eleventh and twelfth columns in credit posting, in the particular example in hand, being the same as previously described in the example of debit posting. The carriage returns automatically to the first columnar position.

As pointed out in the foregoing description of a particular application, and as shown in Fig. 105, the columnar positions used in debit posting are Nos. 1, 2, 4, 5, 6, 8, 9, 10, 11 and 12, the cam 852 serving to disable stops *a* and *b* at Columnar position No. 2, stops *c*, *d* and *e* at Columnar position No. 6, and all of the stops at Columnar positions Nos. 3 and 7. At positions Nos. 3 and 7 the tabulating stops also are disabled. All of the columnar positions are used in credit posting.

After finishing the posting of credits on July 7th, the operator verifies the correctness of his work. For the example of credit posting illustrated in Fig. 105, the proof would consist of transferring the total (25.00) from the A counter subtractively to the cross-footer, transferring the

total (235.00) from the B counter additively to the cross-footer, then printing the balance (210.00) from the cross-footer, and then printing the amount (210.00) contained in the C counter. The amounts thus printed from the cross-footer and the C counter being equal, the correctness of the work is proved. The dotted lines on the proof tape in Fig. 105 are intended to indicate that in practice the imprints shown would appear upon separate lengths of tape.

It will of course be understood that the machine may be utilized to prove the accuracy of the work in various ways, according to the preference of the operator or the necessities of the work.

The journal or audit sheet D may be preserved as a record of the posting operations or transmitted to another department for auditing, as desired.

In the example illustrated in Fig. 105, it is assumed that on the following day a credit of 220.00 is to be posted, which results in a credit balance of 10.00 as shown in the fifth and ninth columns. Upon completion of the posting of the credit of 220.00, the carriage returns automatically to the first columnar position.

The example in Fig. 105 shows a debit posting under date of July 9, 1931. After picking up the old credit balance of 10.00 and before depressing the motor bar with the carriage in the first columnar position, the operator depresses the Subtraction key 333. Consequently, the old credit balance is accumulated subtractively in the cross-footer. The posting of Invoice No. 822 amounting to 10.00 balances the account. Consequently, in the fifth and ninth columns two naughts are printed to indicate that the counter (the D counter) from which the balance was sought to be taken was clear.

Upon arrival of the carriage in the tenth columnar position, since the old balance was a credit and was subtracted in the cross-footer in the first columnar position, it should now be added in the cross-footer; therefore, the operator depresses the Second Pick-Up of Credit Balance key 864, as a result of which, when the machine is cycled in the tenth columnar position, the old balance is added into the cross-footer. Thereafter the carriage tabulates to the eleventh columnar position, where a blank stroke is automatically taken, the carriage then tabulating automatically to the twelfth columnar position where the final total of 10.00 is printed from the cross-footer as proof that Invoice No. 822 was correctly posted.

The last line of printing on the audit sheet D was produced as a carbon copy of the last posting on John Smith's statement. The other lines of printing on the audit sheet were produced in making entries on the statements of other customers.

It will be understood that the machine is capable of operating upon so-called fold-over forms, wherein the statement or the ledger is printed, one as a carbon copy of the other, a journal or proof sheet being also produced as a second carbon copy in some instances.

The machine can be arranged to accumulate simultaneously the same amount in two rear counters, but this would be practicable, in the present embodiment, only when no carrying operation would be required, and hence such simultaneous accumulation could occur only in one columnar position and only when such rear counters are clear.

While I have described the operations incident to the system of posting known as horizontal

posting, it should be understood that the machine may also be used for vertical posting, wherein the debits, credits and balances are printed in a single column. In performing such posting, the carriage is normalized and the manually operable keys utilized to select desired counters and determine the character of the operation, whether addition, non-addition, subtraction, subtotalling and/or clearing. If the ledger sheet be made wide enough for a plurality of columns, the carriage may be tabulated, upon the completion of one column, to the next.

The machine is not limited to ledger-posting operations, but may be used in performing various sorts of record-keeping, as, for example, to print different classes of items in different columns on a wide sheet carried by a cross-tabulating carriage, each class of items being accumulated in an individual counter, and all of the items being accumulated, if desired, in the cross-footer. In doing such record-keeping, the totals of the different classes of items may be printed from the various counters as footings below the several columns, and a grand total of all of the items printed from the cross-footer; or all of the totals may be printed in a single column.

75. Comparison with prior art

Comparing the present invention with the prior art, it will be noted that the improvements reside principally in the keyboard, the computing mechanisms and the controls exercised by the paper carriage. Considering first the keyboard, it will be seen that I have arranged two so-called ten-key keyboards close together, each of which controls a printing mechanism, and that both printing mechanisms are arranged to print against one and the same platen. One of these ten-key keyboards is used for setting up amounts (i. e. debits, credits and balances), while the other ten-key keyboard is used for setting up designating numerals such as folios, etc. In a certain prior type of bookkeeping machine employing a single ten-key keyboard, the operator, after setting up the folio, must cycle the machine to print the folio and tabulate the carriage to the amount column, then set up the amount, and then cycle the machine to print and register such amount, thus requiring two cyclings and an intermediate tabulation, whereas with the present machine the folio and the amount are posted with one cycling of the machine.

In the present machine each of the ten-key keyboards is provided with its own repeat mechanism; hence it is practicable to print the folio or other designating number on both the statement and the ledger sheet with one setting of the folio, whereas in the prior machine alluded to it is impossible to print the folio on both the statement and the ledger sheet without setting up the folio twice. It will be seen that the advantage in not being obliged to set up the folio or the amount twice is not merely in the saving of time and effort, but in avoiding the possibility of mistake.

One advantage in the use of two ten-key keyboards, as in the present machine, resides in the fact that after setting up and printing the folio and the amount, the total or new balance may be printed on the statement, and it is still possible to print the invoice number on the ledger sheet.

Considering now the computing mechanism,

we find that all of the counters or totalizers occupy a fixed relation to the racks, requiring only a meshing and demeshing movement, whereas in certain prior machines the counters must be given a movement of translation (in addition to the meshing and demeshing movement) in order to bring them into operative relation with the racks. Furthermore, in certain prior machines the counters are arranged in a series extending longitudinally of the paper carriage, the selection of the counters being more or less dependent upon the position of the carriage, whereas in my machine the counters are arranged in a series extending transversely of the direction of travel of the carriage and may be selected for use in any columnar position. As a consequence, the totals accumulated in the counters of the present machine may be printed in a column, and the column may be printed anywhere on the audit sheet, whereas in the prior machines referred to the totals must be printed in different columnar positions and thus are distributed across the audit sheet instead of being compactly grouped on a convenient portion thereof.

One advantage resulting from the possibility of simultaneously accumulating in a rear counter and the cross-footer (as is done in connection with Invoice No. 248 in Fig. 105) is that the charge set up can be preserved in the rear counter, thus permitting the total or new balance to be printed on the statement from the cross-footer, and later printing the charge on the ledger sheet as a total from the rear counter without again setting up the charge on the amount keyboard. While the amount stops are restored, the amount itself is preserved in the rear counter.

Adverting now to the carriage-actuated controls it may be noted that the number of such controls has been greatly increased as compared with any prior machine, thus attaining a greater degree of automaticity and variability of action than has heretofore been possible. Moreover, such automatic action has been obtained without depriving the operator of manual control of the machine. For example, the carriage may be normalized and computations performed in any of the counters in any desired order and subtotals or final totals taken from the counters in any desired order. In prior machines having a much more limited control through the carriage, there has been little or no manual control of certain counters.

I believe the machine herein disclosed is the only bookkeeping machine of the adding machine type wherein items can be accumulated in any one of the multiple registers from any position of the paper carriage; the only bookkeeping machine of the adding machine type wherein any number of items from various positions of the carriage can be accumulated in any register; and the only bookkeeping machine wherein a total may be taken from any counter in any position of the carriage.

The plan of organization of this machine may be economically used in the manufacture of various models or kinds of computing and/or printing machines. Thus the front portion of the machine is large enough so that a multiple-bank type of stop-setting mechanism may be substituted for the ten-key or single-bank type herein disclosed; the keyboard herein used for setting up folios and other designating numbers may be omitted; three sets of key mechanism similar to

those herein used for dates and symbols may be placed in the space between the motor bar and the row of operation-controlling keys, for the purpose of setting up farthings, pence and shillings; the number of numerical orders in the cross-footer, the rear counters, and the printing mechanism may be increased or diminished; and various other reconstructions may be made without affecting other mechanisms and without departing from the basic dimensions of the machine and with a minimum of expense for dies and jigs.

I claim as my invention:

1. A bookkeeping machine having, in combination, a keyboard, a group of stops controlled by said keyboard, a set of type bars controlled by said group of stops, a laterally shiftable carriage having a platen against which the type bars are arranged to print, said platen being arranged to support two work-pieces side by side, there being a new balance column at the right-hand portion of the left-hand work-piece, and an amount column on the right-hand work-piece, a cross-footing totalizer adapted to add and subtract, an auxiliary totalizer, both totalizers being controlled by the stops and being arranged to control the type bars in total-taking, said totalizers being simultaneously operable under the control of the carriage to accumulate amounts, means under the control of the carriage for operating the cross-footing totalizer in the printing of a total therefrom in the new balance column, means for automatically selecting the auxiliary totalizer when the machine is cycled in the new balance column and for preventing operation of the auxiliary totalizer in the new balance columnar position, and means under the control of the carriage for operating the other totalizer in the printing of a total therefrom in said amount column.

2. A bookkeeping machine having, in combination, a keyboard, a group of stops controlled by said keyboard, a set of type bars controlled by said group of stops, a laterally shiftable platen against which the type bars are arranged to print, a cross-footing totalizer adapted to add and subtract, an auxiliary totalizer, both totalizers being controlled by the stops and being arranged to control the type bars in total-taking, said totalizers being simultaneously operable to accumulate amounts, means for operating the totalizers in the printing of totals in different columnar positions of the platen and means for automatically selecting and non-adding the auxiliary totalizer when the other totalizer is operated to print a total.

3. In a computing machine, the combination of a set of reciprocatory racks, a plurality of totalizers arranged to mesh with said racks, the axes of said totalizers being parallel to each other and said totalizers being arranged in a series extending longitudinally of the direction of movement of the rack bars and being always in position to move directly into mesh with the racks, and mechanism for selectively moving a single totalizer into mesh with the racks, said mechanism including a member having a plurality of pins, one for each totalizer, a link connected to each totalizer, each link having a notch to receive one of said pins, a spring tending to move the link in a certain direction to place the notch in engagement with the pin, a plurality of totalizer-selecting keys, each key being connected to one of said links, and spring means acting through said connections to move said links in the opposite direction.

4. In a computing machine, the combination of a plurality of totalizers, and mechanism for selectively placing a single totalizer in use, said mechanism including a member having a plurality of pins, one for each totalizer, a link connected to each totalizer, each link having a notch to receive one of said pins, a spring tending to move the link in a certain direction to place the notch in engagement with the pin, and a plurality of totalizer selecting keys, each key being connected to one of said links, and spring means acting through said connections to move said links in the opposite direction.

5. In a computing machine, the combination of a plurality of totalizers, and mechanism for selectively placing a single totalizer in use, said mechanism including a reciprocatory member, a link connected to each totalizer, each link being arranged for detachable connection to said member, a spring tending to move the link into such engagement, a plurality of totalizer selecting keys, each key being connected to one of said links, and spring means acting through said connections and tending to move said links out of such engagement.

6. In a computing machine, the combination of computing mechanism comprising pinions and means for rotating the same, and means for conditioning the computing mechanism for a negative operation comprising a slide, a spring tending to move the slide into effective position, a transversely movable second slide arranged to hold said slide in its ineffective position, a spring tending to move the second slide into ineffective position, and a stop arm the position of which depends upon the character of the total in the computing mechanism, said stop arm being arranged to hold the second slide in effective position.

7. In a computing machine, the combination of computing mechanism comprising pinions and means for rotating the same, and means for conditioning the computing mechanism for a negative operation comprising a spring tending to so condition the mechanism, a slide arranged to restrain said spring, a spring tending to move the slide into ineffective position, and a stop arm the position of which depends upon the character of the total in the computing mechanism, said stop arm being arranged to hold the slide in effective position.

8. In a bookkeeping machine, the combination of a laterally movable carriage, a platen on the carriage, line-space mechanism for rotating the platen comprising a bar extending longitudinally of the carriage, a spring tending to move the bar in one direction, means operating in each cycle of the machine which tends to move the bar in the opposite direction, said means being arranged to engage said bar in any position of the carriage, a detent to prevent the bar from moving under the influence of said spring, and means actuated by the paper carriage for withdrawing the detent from effective position.

9. The combination of a laterally movable paper carriage, a horizontal plate extending longitudinally of and rigidly secured to the paper carriage, a plurality of control elements, said elements and said plate being adapted for the detachable mounting of the control elements on the lower side of the plate at various points along the length of the latter, said elements extending transversely of the plate, a plurality of downwardly extending stop lugs carried by each of said control elements, said stop lugs being located

at intervals along the length of the control element, the intervals differing in the respective control elements, the inner end of each control element constituting an escapement stop and means actuated in the travel of the paper carriage for moving one of said stop lugs with relation to the control element that carries it, into ineffective position.

10. The combination of a laterally movable paper carriage, a plate extending longitudinally of the paper carriage, a control element, said element and said plate being adapted for the detachable mounting of the control element on the plate at various points along the length of the latter, said element extending transversely of the plate, a plurality of stop lugs carried by said control element, said stop lugs being located at intervals along the length of the control element, a slide mounted on and extending longitudinally of said control element and connected to one of said stop lugs to raise and lower the same, and means for operating said slide.

11. The combination of a machine frame, a laterally movable paper carriage on the machine frame, a plate extending longitudinally of the paper carriage, a control element, said element and said plate being adapted for the detachable mounting of the control element on the plate at various points along the length of the latter, said element extending transversely of the plate, a plurality of stop lugs carried by said control element, said stop lugs being located at intervals along the length of the control element, the inner end of said control element constituting an escapement stop, a coacting escapement stop on the machine frame, a slide mounted on and extending longitudinally of said control element and connected to one of said stop lugs to raise and lower the same, a cam on said slide arranged to disable the escapement stop on the machine frame, and means for operating said slide.

12. A paper carriage having a plate attached thereto, the rear edge of said plate having a series of notches therein, a part on and extending longitudinally of the lower side of the plate near the forward edge thereof, said part having a series of notches therein, a plurality of dissimilar control elements adapted to engage said notches and extend transversely of the plate, and a clamp lever on each control element arranged to bear against the upper side of the plate whereby the control elements may be attached to the plate at variable intervals.

13. The combination of a machine frame, a laterally movable paper carriage on the machine frame, a control element connected to the carriage, a stop lug carried by said control element, the inner end of said element constituting an escapement stop, a coacting escapement stop on the machine frame, a slide mounted on said control element and connected to said stop lug to raise and lower the same, means on said slide arranged to disable the escapement stop on the machine frame, and means actuated through the lateral movement of the carriage for operating said slide.

14. The combination of a machine frame, a laterally movable paper carriage on the machine frame, a control element connected to the carriage, a stop lug carried by said control element, the inner end of said element constituting an escapement stop, a coacting escapement stop on the machine frame, a slide mounted on said control element and connected to said stop lug to raise and lower the same, means on said slide

arranged to disable the escapement stop on the machine frame, and means for operating said slide.

15. The combination, with a mechanism of a bookkeeping machine, of a lever arranged to control said mechanism, a member yieldably mounted on said lever, a laterally movable paper carriage carrying a part arranged to engage said member in the travel of the carriage and thereby operate said lever, and a normalizing key and connections for preventing depression of said lever upon engagement of said part with said member.

16. In a printing and computing machine, the combination of computing mechanism; type; actuators for the computing mechanism and the type; hammers for driving the type to print; a rock shaft and connections for operating the actuators; a cam fixed to said rock shaft and having a concentric surface, a notch and a stop; a member pivoted on the axis of said shaft adjacent to said cam and projecting beyond said dwell, said member having a notch in its side adjacent to said stop; and a hammer-operating lever arranged to bear against said cam, said lever also having a stud arranged to slide on the end of said member and to drop into the notch in said member at the beginning of the return stroke of said cam.

17. In a printing and/or computing machine, the combination of a mechanism to be controlled; a main rock shaft; a cam fixed to said rock shaft and having a concentric surface, a notch and a stop; a member pivoted on the axis of said shaft adjacent to said cam and projecting beyond said dwell, said member being arranged to bear against said stop and having a notch in its side adjacent said stop; and a lever to operate said mechanism, said lever having a roller arranged to bear against said cam, said lever also having a stud arranged to slide on the end of said member and to drop into the notch in said member at the beginning of the return stroke of said cam.

18. In a printing and computing machine, the combination of an aliner; a main rock shaft; a cam fixed to said rock shaft and having a concentric surface, a notch and a stop; a member pivoted on the axis of said shaft adjacent to said cam and projecting beyond said dwell, said member being arranged to bear against said stop and having a notch in its side adjacent to said stop; and an aliner-operating lever arranged to bear against said cam, said lever also having a stud arranged to slide on the end of said member and to drop into the notch in said member at the beginning of the return stroke of said cam.

19. A bookkeeping machine having in combination two totalizers, mechanisms for operating the totalizers in the taking of a total from one totalizer in one columnar position and from the other totalizer in a subsequent columnar position, and means for automatically selecting and non-adding the last-mentioned totalizer when the other totalizer is operated in the taking of the total therefrom.

20. A bookkeeping machine having in combination a series of levers mounted at the rear of the machine on an axis extending longitudinally of the machine, a series of bell cranks mounted at one side of the machine on an axis extending transversely of the machine, individual means for transmitting force from the levers to the corresponding bell cranks, a series of parallel slides extending forwardly along said side of the machine, and each operable by one of the bell

cranks, devices operable by the respective slides, and a transversely movable paper carriage arranged to operate the first mentioned levers.

21. A control element for a computing-printing machine, comprising a holder made of sheet metal bent to provide two vertical walls and a bottom connecting wall, means on the holder for attaching it to the carriage of such a machine, said bottom wall having a series of openings therethrough, and a block in said holder having a stop lug adapted to project through any of said openings.

22. A control element for a computing-printing machine, comprising a holder having two vertical walls and a bottom connecting wall, means on the holder for attaching it to the carriage of such a machine, said bottom wall having an opening therethrough, and a block in said holder having a stop lug adapted to project through said opening.

23. A control element for a computing-printing machine, comprising a holder, means on the holder for attaching it to the carriage of such a machine, said holder having an opening therethrough, a block in said holder having a stop lug adapted to project through said opening, and a slide mounted on the side of the holder and having a cam connection with said block for moving the block to withdraw and project said lug.

24. A control element for a computing-printing machine, comprising a holder having two vertical walls and a bottom connecting wall, means on the holder for attaching it to the carriage of such a machine, said bottom wall having an opening therethrough, a block in said holder having a stop lug adapted to project through said opening, and a slide mounted on the side of the holder and having a cam connection with said block for moving the block to withdraw and project said lug.

25. In a control element for a computing-printing machine, a holder, means on the holder for attaching it to the carriage of such a machine, a block in said holder having a stop lug, and a slide mounted on the side of the holder and connected to said block for moving the block to withdraw and project said lug.

26. In a control element for a computing-printing machine, a holder, means on the holder for attaching it to the carriage of such a machine, the inner end of said holder constituting an escapement stop, a block in said holder having a stop lug, and a slide mounted on the side of the holder and connected to said block for moving the block to withdraw and project said lug, said slide having an escapement-disabling device which is in effective position when said lug is in ineffective position.

27. In a control element for a computing-printing machine, a structure having an escapement stop, a stop member in said structure and a slide mounted on the structure and connected to move the stop member into and out of effective position, said slide having an escapement-disabling device which is in effective position when the stop member is out of effective position.

28. In a control element for a computing-printing machine, a structure one end of which constitutes an escapement stop, a slide mounted on said structure, the corresponding end of the slide constituting an escapement-disabling device, and a spring acting on the slide to hold the escapement-disabling device normally in ineffective position.

29. In a bookkeeping machine, a cross-tabu-

lating carriage for a work sheet, a control plate rigidly attached to the carriage, a series of dissimilar control elements each adjustably secured to the lower side of the plate and each extending transversely of the path of movement of the carriage, and each comprising a carriage-tabulating stop at its inner end and a machine-controlling stop, a member movably mounted on one of said elements for disabling said machine-controlling stop and preventing the tabulating stop from acting, and means actuated through the movement of the carriage for operating said member.

30. In a bookkeeping machine, in combination, a main frame, a laterally movable paper carriage mounted on the main frame and arranged to be tabulated to carry a work sheet past a series of columnar positions, coacting escapement stops on the main frame and the carriage to define such positions, a series of dissimilar machine-controlling elements located on the carriage at points corresponding with said columnar positions, and manually-operable means on the main frame effective in the travel of the paper carriage simultaneously to disable one of said elements and prevent effective action of the escapement stops at the position corresponding to such element.

31. In a bookkeeping machine, in combination, a main frame, a laterally movable paper carriage mounted on said frame and arranged to be tabulated to carry a work sheet past a series of columnar positions, coacting escapement stops on the main frame and the carriage to define such columnar positions, a series of stops located on the carriage in positions corresponding to the columnar positions, a plurality of different mechanisms on the main frame, each of said mechanisms being arranged to be controlled by one of said carriage stops, and a cam on the main frame along the path of lateral travel of said carriage stops, said cam being manually adjustable into and out of position to disable the carriage stop at one of the columnar positions as the carriage approaches such position and to prevent coaction of the escapement stops at such position.

32. In a bookkeeping machine, in combination, a main frame, a laterally movable paper carriage mounted on said frame and arranged to be tabulated to carry a work sheet past a series of columnar positions, a series of stops located on the carriage in positions corresponding to the columnar positions, a plurality of different mechanisms on the main frame, each of said mechanisms being arranged to be controlled by one of said carriage stops, and a cam on the main frame along the path of lateral travel of said carriage stops, one of said carriage stops being arranged for disablement by said cam as said stop approaches the cam and another of said carriage stops being not arranged for such disablement, said cam being manually adjustable into and out of position to disable the before-mentioned carriage stop at one of the columnar positions.

33. In a bookkeeping machine, in combination, a main frame, a laterally movable paper carriage mounted on said frame and arranged to be tabulated to carry a work sheet past a series of columnar positions, a series of stops located on the carriage in positions corresponding to the columnar positions, a plurality of different mechanisms on the main frame, each of said mechanisms being arranged to be controlled by one of said carriage stops, and disabling means on

the main frame along the path of lateral travel of said carriage stops, one of said carriage stops being arranged for disablement by said disabling means as said stop approaches the disabling means and another of said carriage stops being not arranged for such disablement.

34. In a bookkeeping machine, in combination, a main frame, a laterally movable paper carriage mounted on said frame and arranged to be tabulated to carry a work sheet past a series of columnar positions, a plurality of different control elements which may be mounted in any desired sequence on the carriage, a plurality of different mechanisms on the main frame, said mechanisms being arranged to be controlled by said elements, and a single cam on the main frame along the path of lateral travel of all of said elements, said cam being manually adjustable into and out of position to disable one of the elements as the latter approaches said cam.

35. In a bookkeeping machine, in combination, a main frame, a laterally movable paper carriage mounted on said frame and arranged to be tabulated to carry a work sheet past a series of columnar positions, a plurality of stops on the carriage, one of said stops being used in credit posting and not used in debit posting, and means including a cam on the main frame along the path of lateral travel of said stops, said cam being manually adjustable into and out of position to disable the stop which is not used in credit posting as said stop approaches the cam.

36. A computing and printing machine having, in combination, a set of vertically reciprocable type bars, racks attached thereto, a totalizer arranged to be actuated by said racks, levers pivoted intermediate their ends, said levers being connected at one end to the lower ends of the type bars, racks connected at their lower ends to the other end of said levers for vertical movement in a direction opposite to that of the type bars, a totalizer arranged to be actuated by the last-mentioned racks, and means acting on said levers for pivotally moving said levers to reciprocate the type bars and last-mentioned racks in opposite directions.

37. A bookkeeping machine having, in combination, a cross-tabulating paper carriage pro-

vided with a plurality of control stops arranged in a row extending transversely of the direction of travel of the carriage, and means for adjusting one of said stops relative to another of said stops during the cross-tabulation of the carriage.

38. A bookkeeping machine having, in combination, a cross-tabulating paper carriage, a control plate rigidly attached to the carriage, a plurality of control stops arranged on the lower side of said plate in a row extending transversely of the direction of travel of the carriage, and means for adjusting one of said stops during the cross-tabulation of the carriage.

39. A bookkeeping machine having, in combination, a machine frame, a paper carriage mounted on said machine frame for cross-tabulation, control stops on said carriage arranged to travel in different paths as the carriage is cross-tabulated, selectors corresponding in number to the number of said paths and mounted on the machine frame, each selector carrying a part for engagement by the corresponding stop, said parts being located in a vertical plane extending transversely of said paths, and a cam for adjusting certain of said stops as such stops approach said cam during the cross-tabulation of the carriage, said cam being located on the machine frame in said vertical plane.

40. A bookkeeping machine having, in combination, a cross-tabulating paper carriage, stops on said carriage arranged to travel in different paths as the carriage is cross-tabulated, levers corresponding in number to said paths and compactly grouped and pivoted on a common axis, each lever carrying a yieldable part for engagement by the corresponding stop, and a universal member movable into engagement with said levers to prevent pivotal movement thereof.

41. In a bookkeeping machine having a cross-tabulating paper carriage, a selector in the form of a lever pivoted at one end, a member mounted on said lever intermediate its ends for engagement by the carriage, and means to hold said lever against pivotal movement by the carriage, said member being mounted to yield when the lever is so held.

OSCAR J. SUNDSTRAND.