

Feb. 7, 1933.

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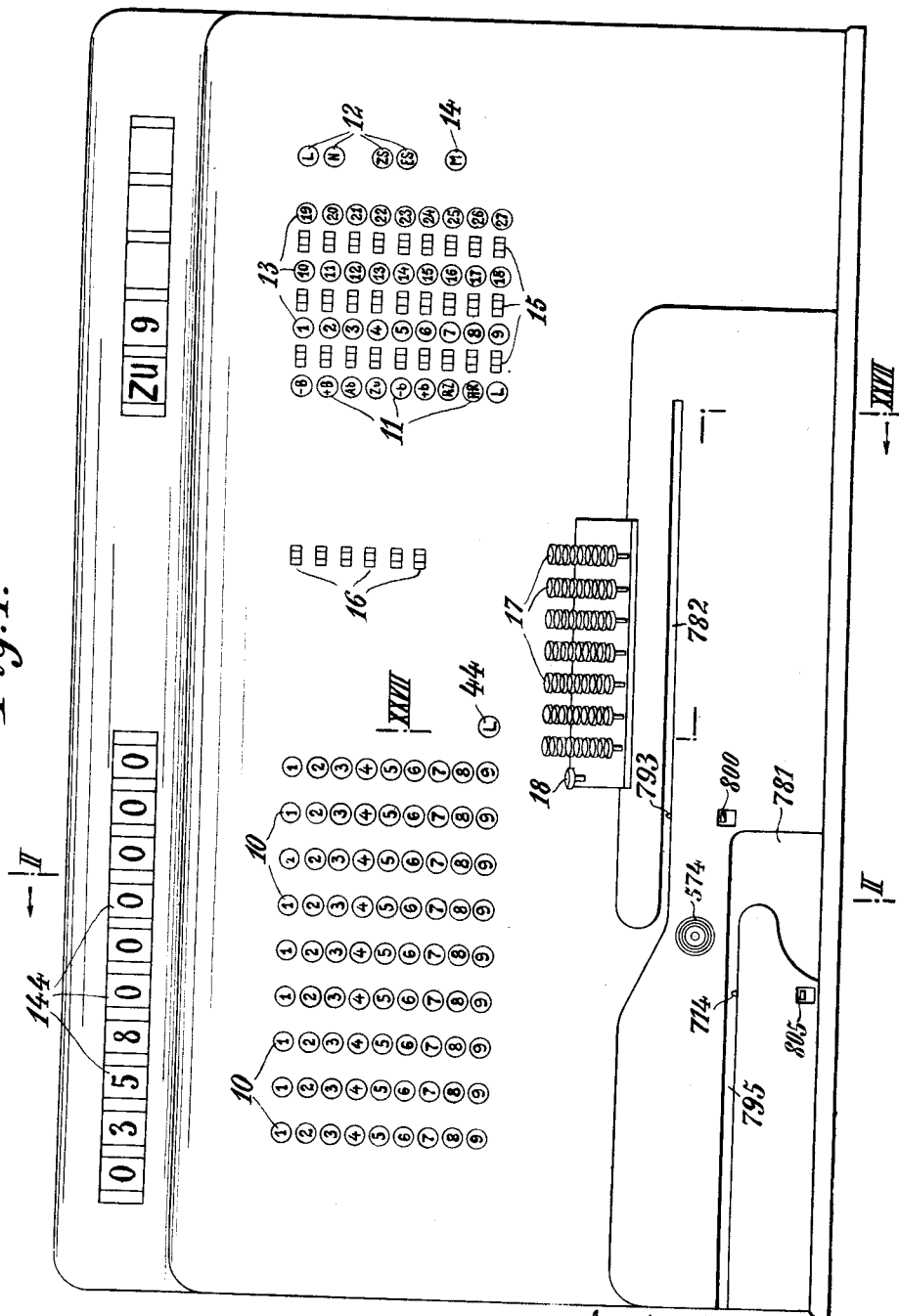
1,896,936

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42 Sheets-Sheet 1

Fig. 1.



Inventors
 Bruno Bornkessel
 Ernst Breithung
 Wilhelm Mauer
 Karl August Lehmann
 By *Kling & Frey* atty.

Feb. 7, 1933.

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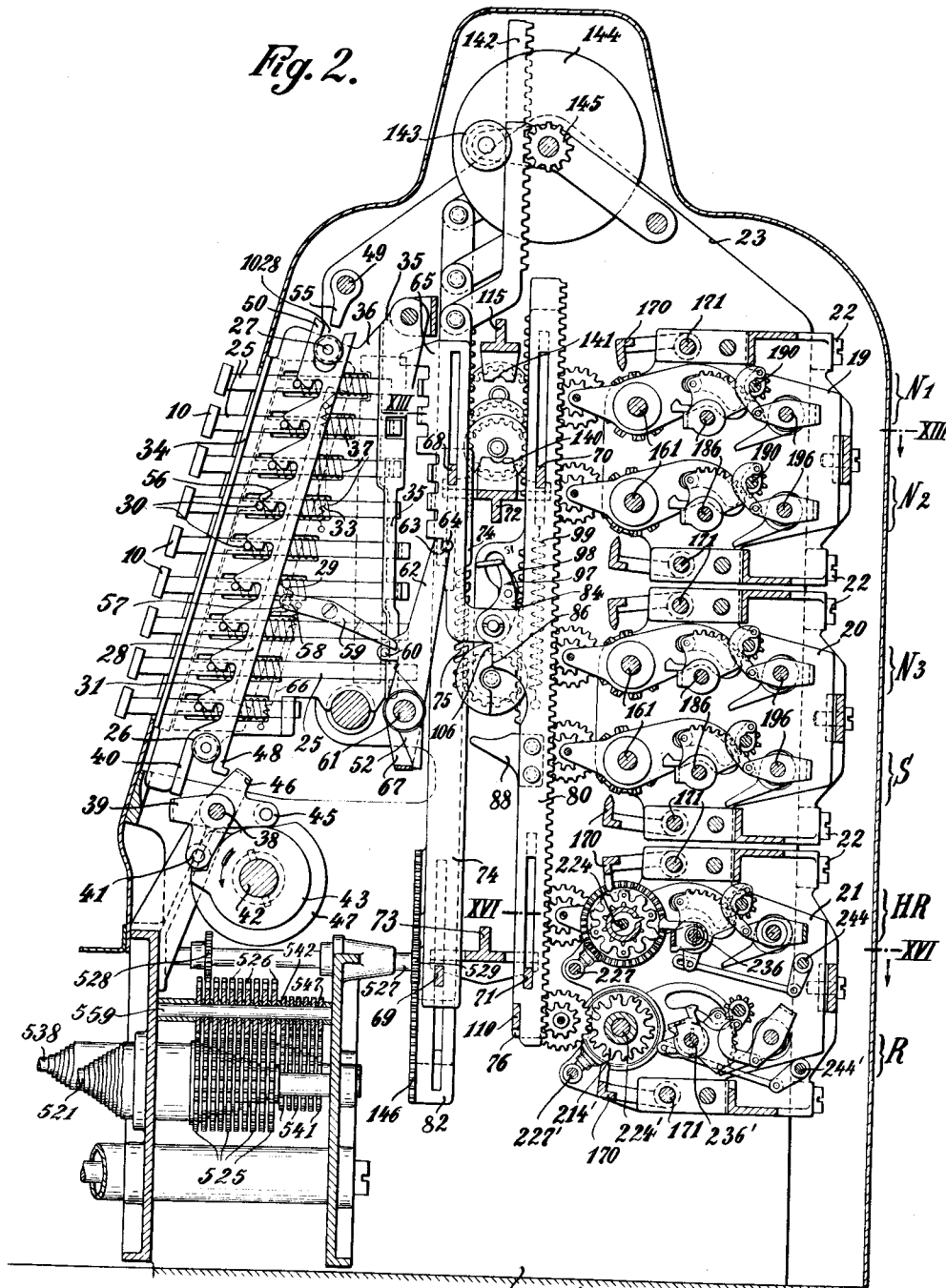
1,896,936

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42 Sheets-Sheet 2

Fig. 2.



23 Inventors
 Bruno Bornkessel
 Ernst Preitling
 Wilhelm Blauer
 Karl August Heilmann
 By *Kunze & Co. Attorneys*

Feb. 7, 1933.

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Fig. 3.

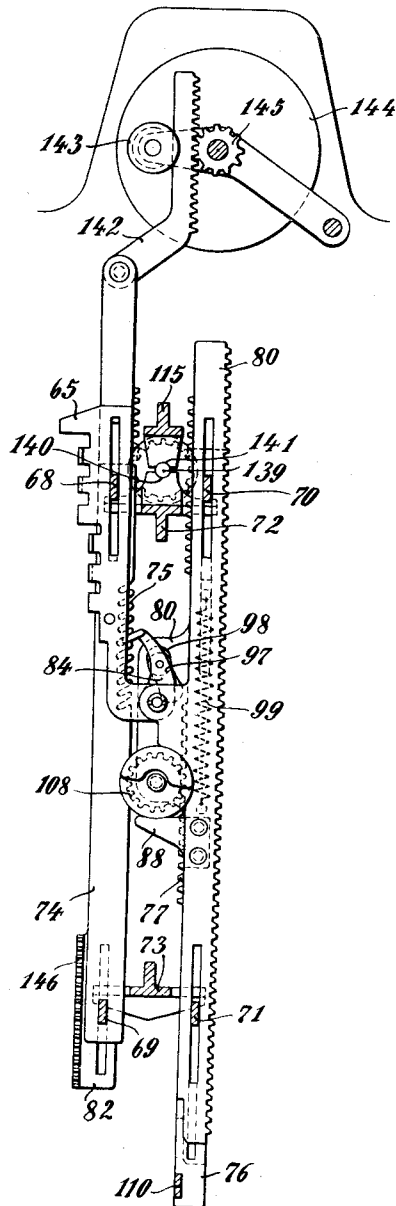
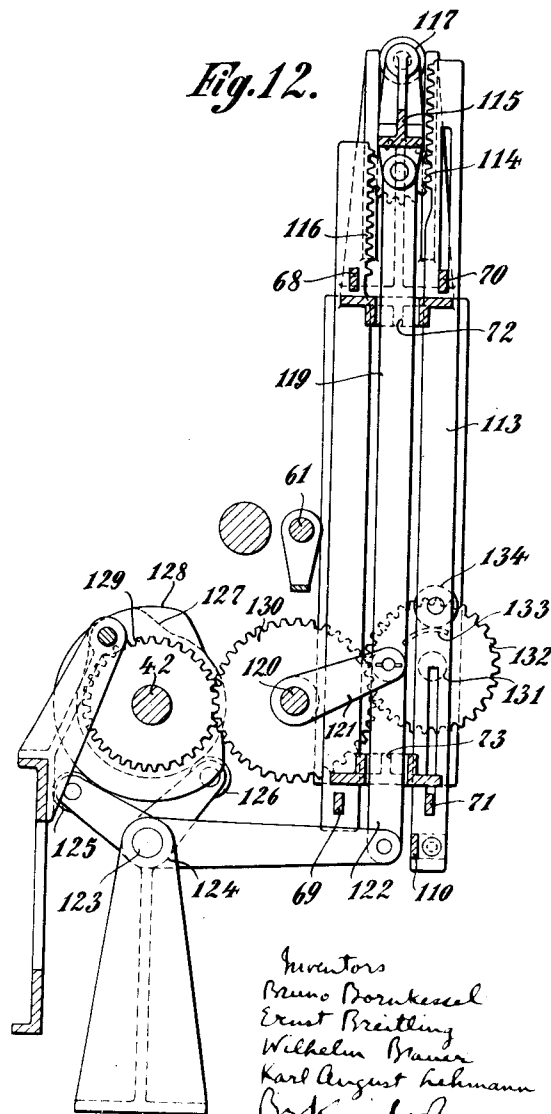


Fig. 12.



Inventors
 Bruno Bornkessel
 Ernst Breittling
 Wilhelm Brauer
 Karl August Lehmann
 By King & Co.,
 Attorneys

Feb. 7, 1933.

B. BORNKESSEL ET AL

1,896,936

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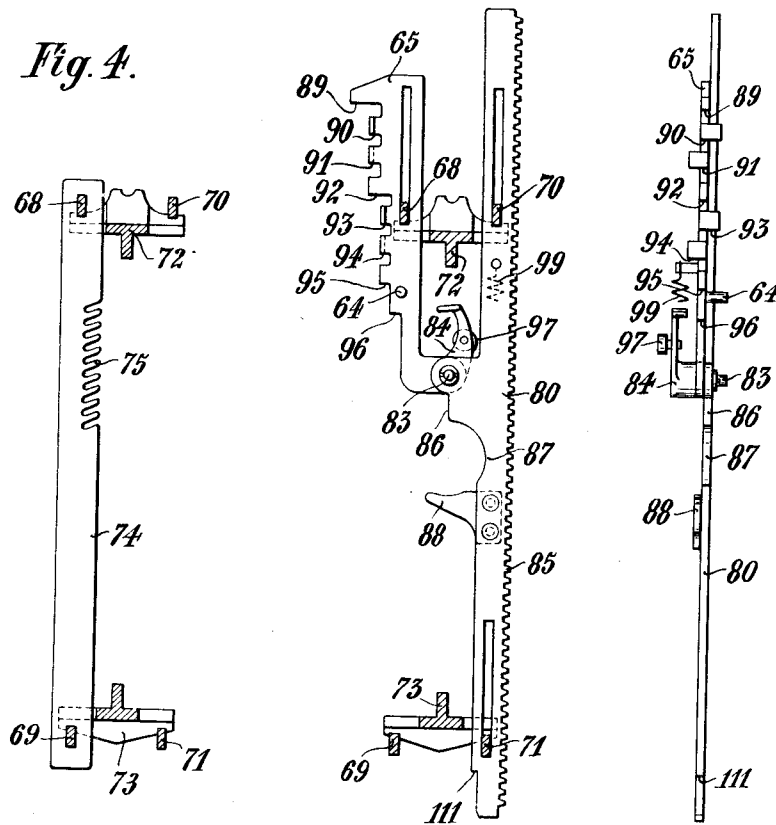
Filed Feb. 24, 1925

42 Sheets-Sheet 4

Fig. 5.

Fig. 6.

Fig. 4.



Inventors
Bruno Bornkessel
Ernst Breithung
Wilhelm Brauer
Karl August Lehmann
By *Kunze & Co.* atty.

Feb. 7, 1933.

B. BORNKESSEL ET AL

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Fig. 7.

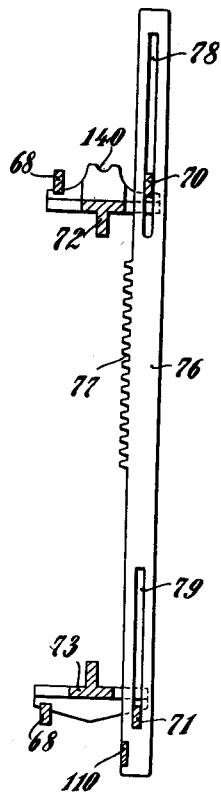


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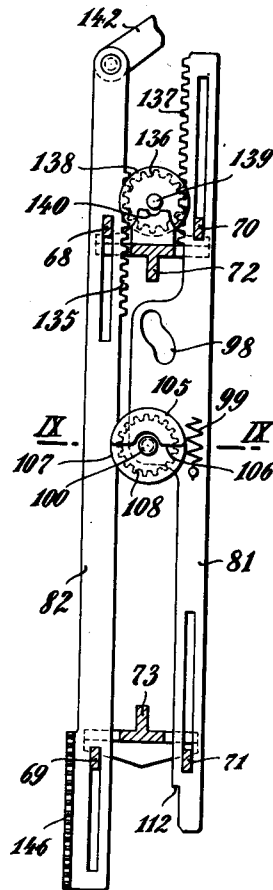


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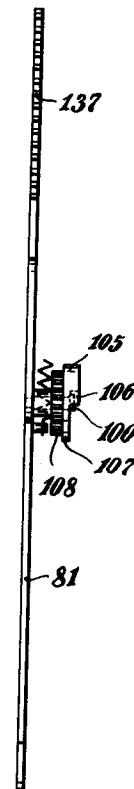
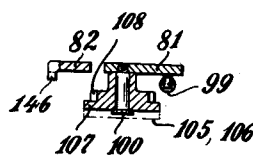


Fig. 9.



Inventors
 Bruno Bornkessel
 Ernst Breithling
 Wilhelm Brauer
 Karl August Lehmann
 By *Kunze & Co.*
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Feb. 7, 1933.

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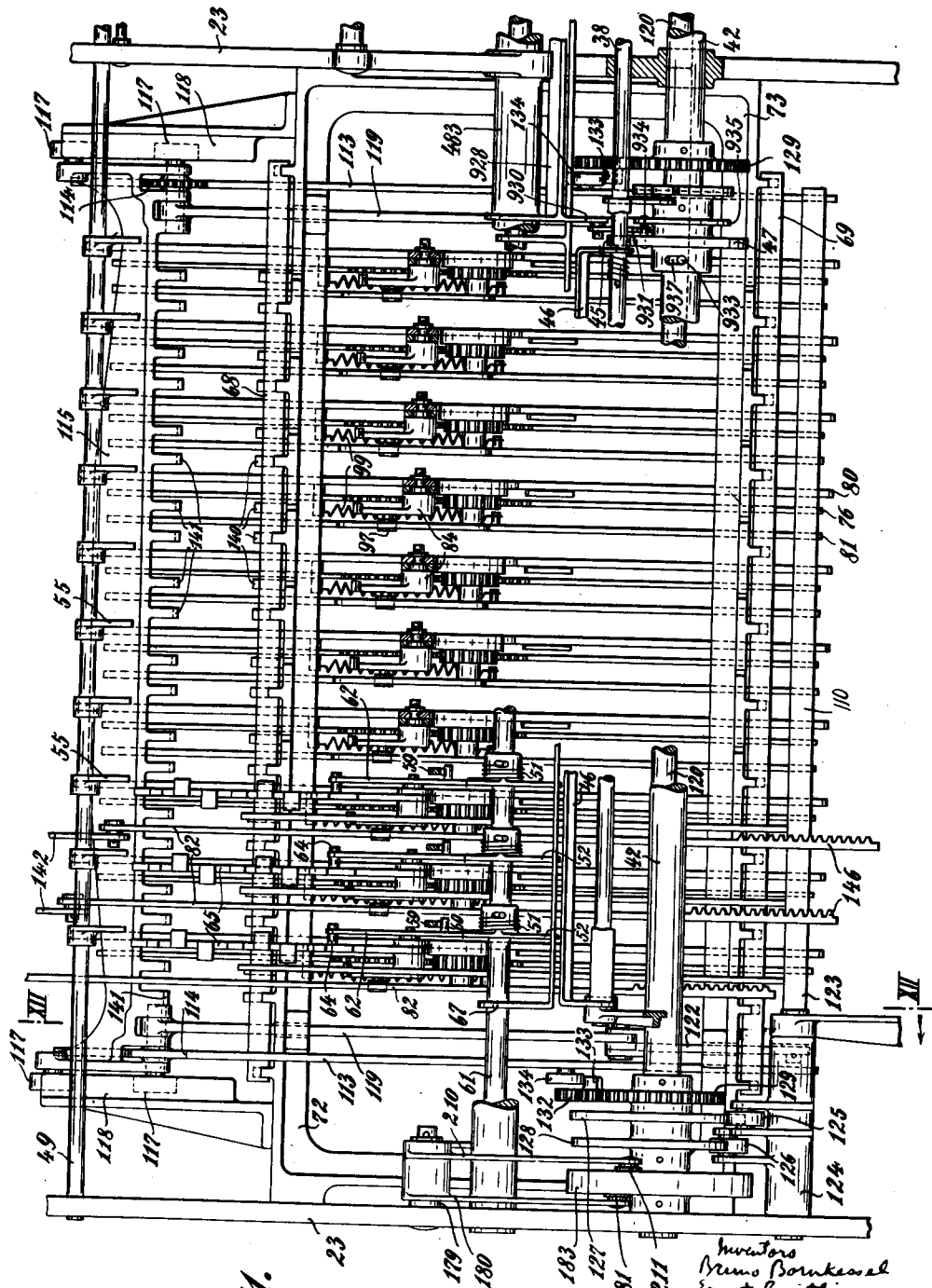


Fig. 11.

Inventors
 Bruno Bornkessel
 Ernst Breithling
 Wilhelm Bräuer
 Karl August Lehmann
 By *Kunz* Attorney

Feb. 7, 1933.

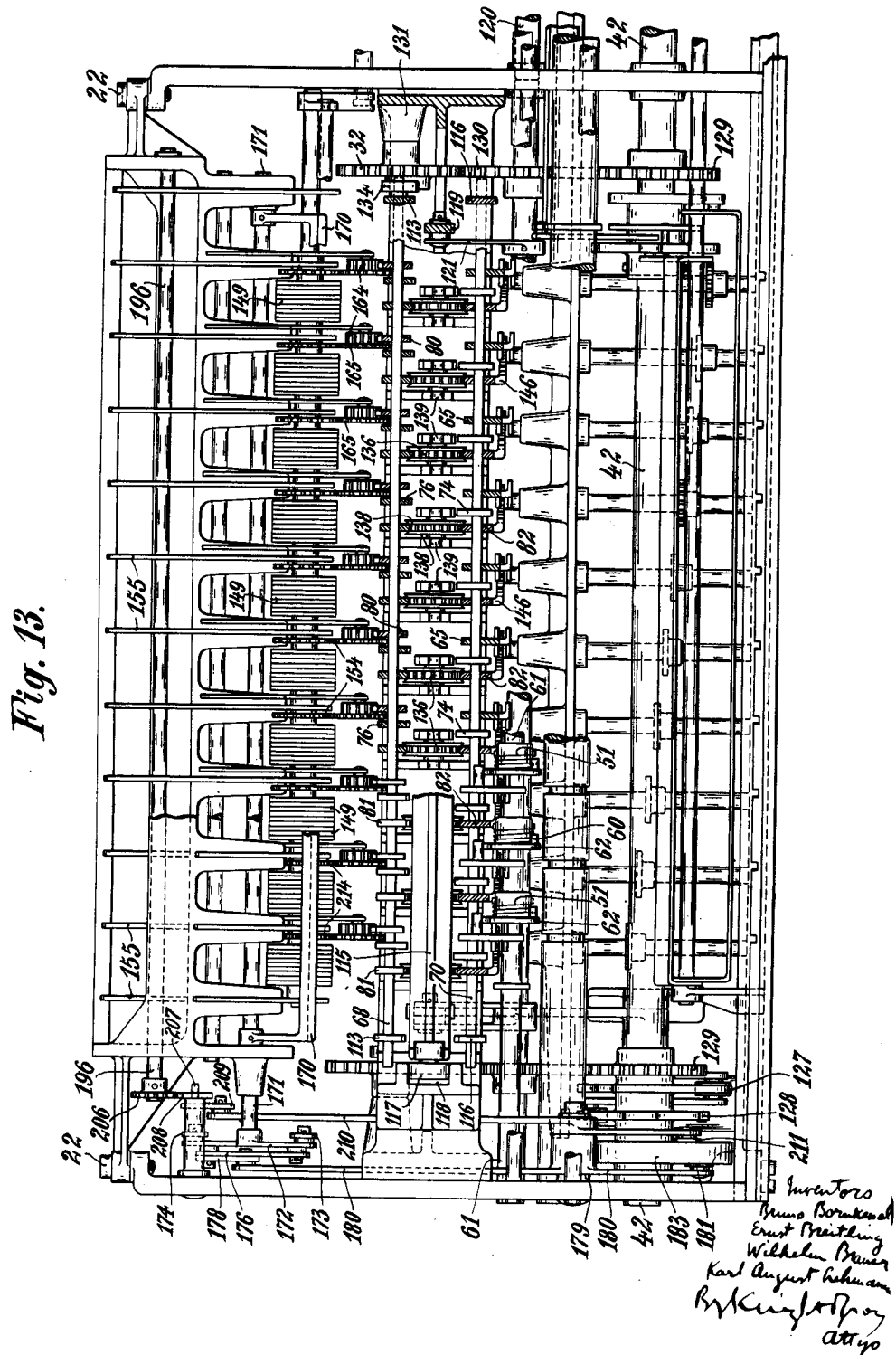
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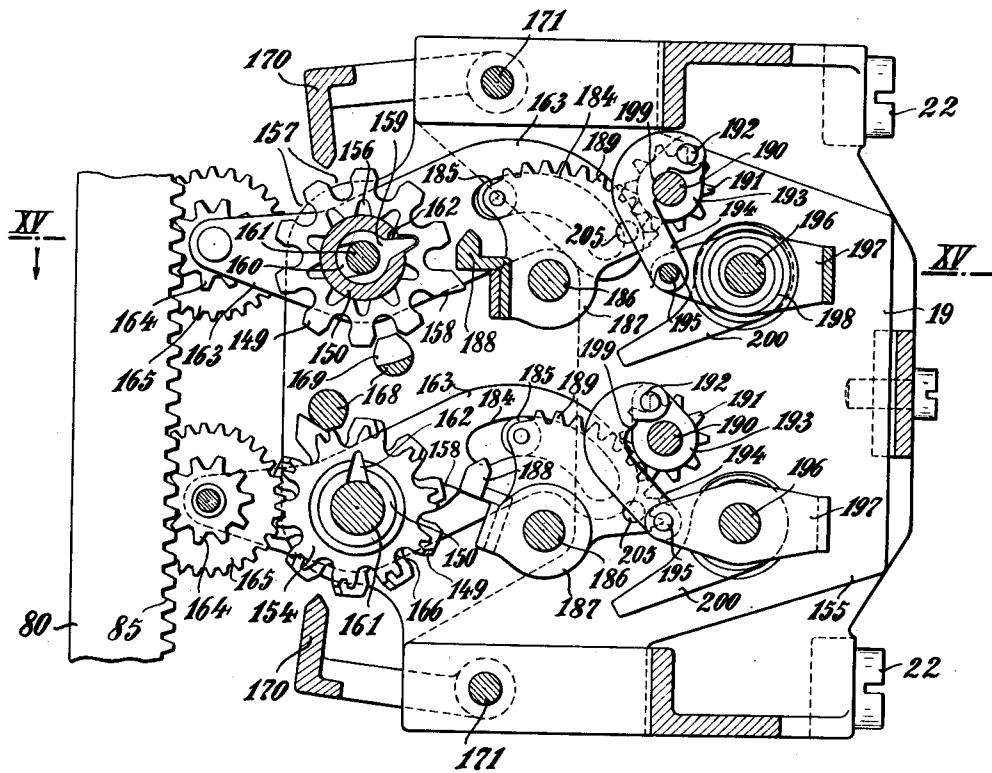
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Fig. 14.



Inventors
 Bruno Bornkessel
 Ernst Brütting
 Wilhelm Bruner
 Karl August Lehmann
 By King & Co
 Attys

Feb. 7, 1933.

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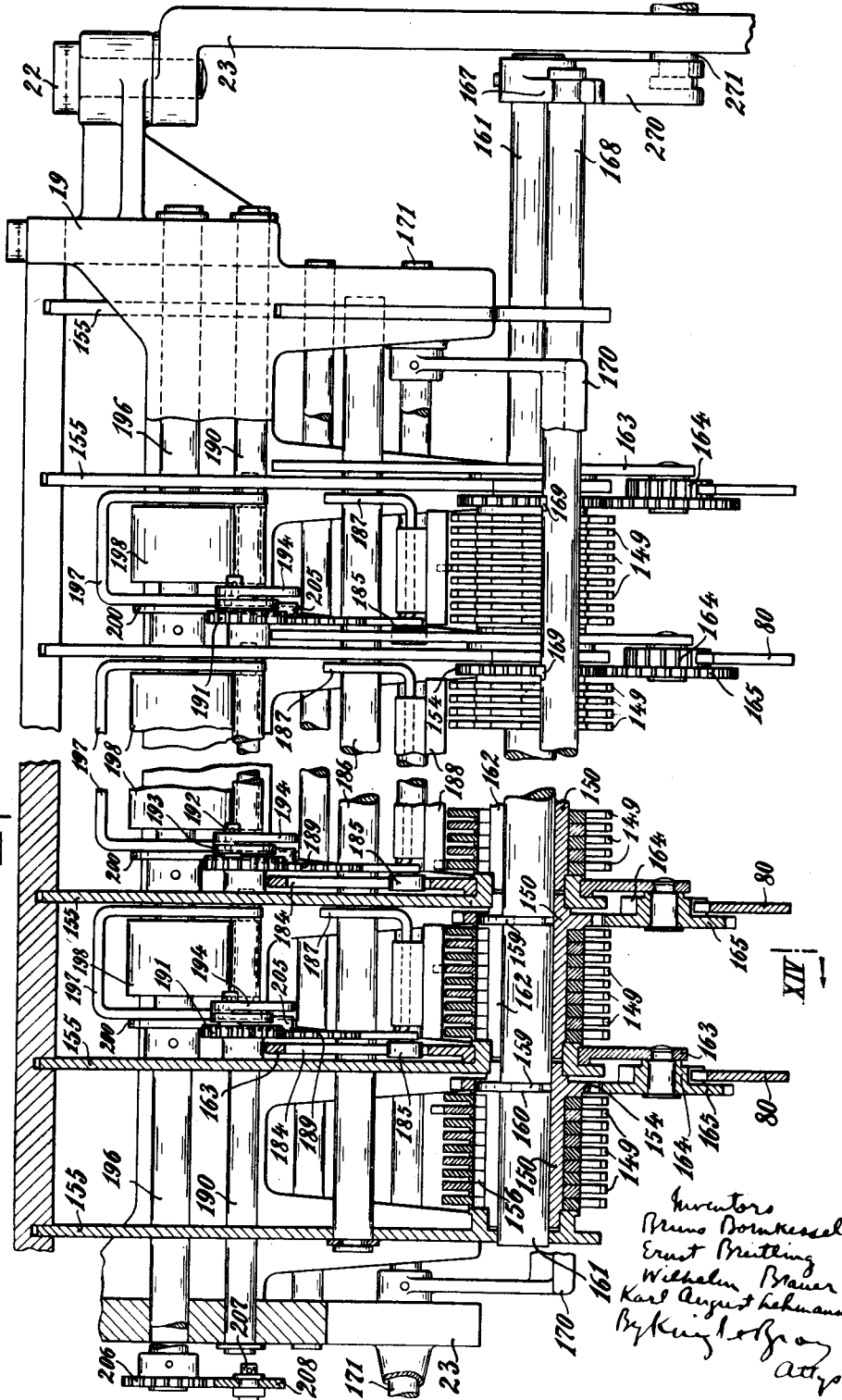
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Fig. 15.



Inventors
 Bruno Bornkessel
 Ernst Brütling
 Wilhelm Bräuer
 Karl August Lehmann
 By King & Johnson
 attys

Feb. 7, 1933.

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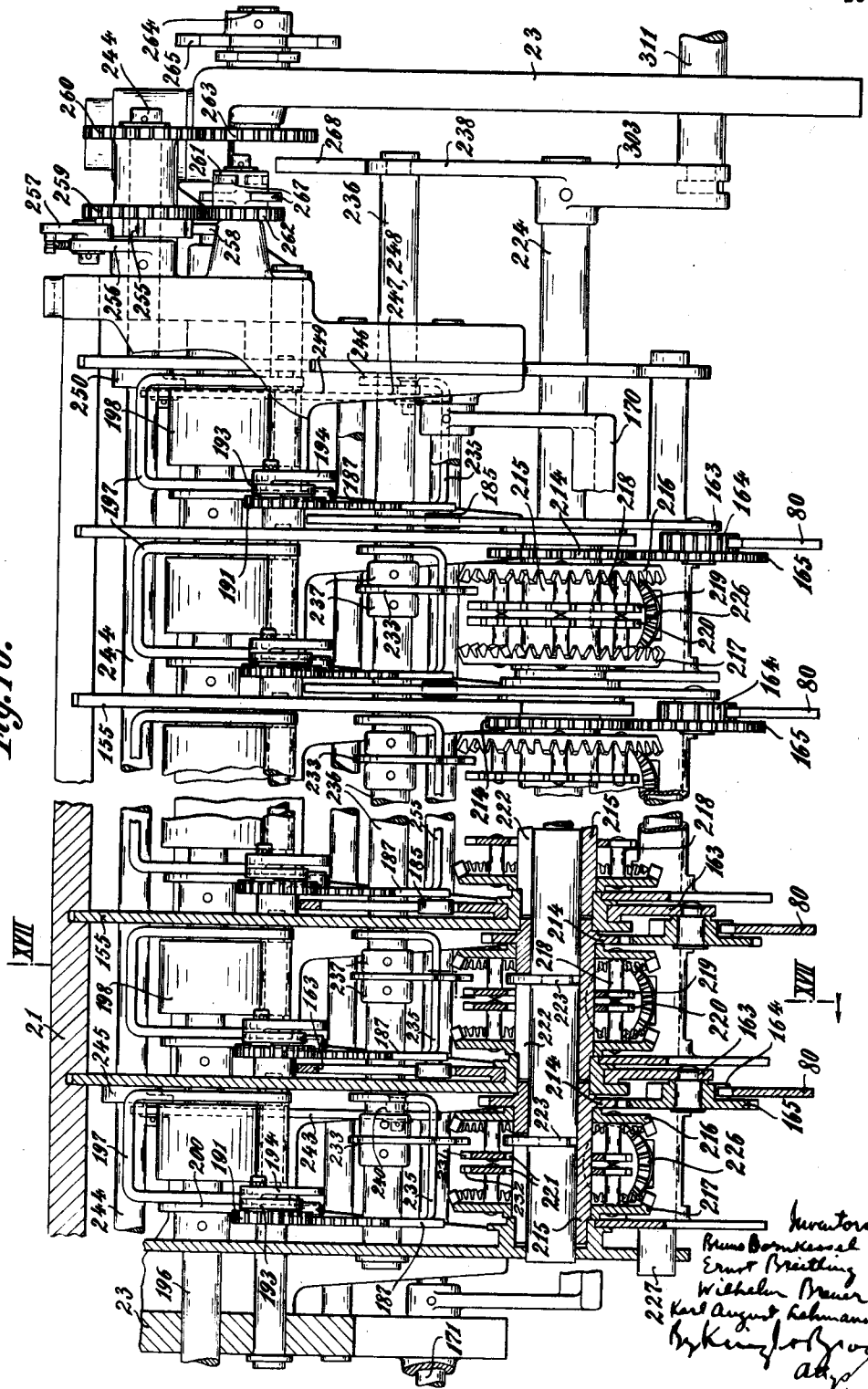
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Fig. 16.



Inventors
 Bruno Bornkessel
 Ernst Breithling
 Wilhelm Meier
 Karl August Lehmann
 By *Karl August Lehmann*
attys

Feb. 7, 1933.

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Fig. 17

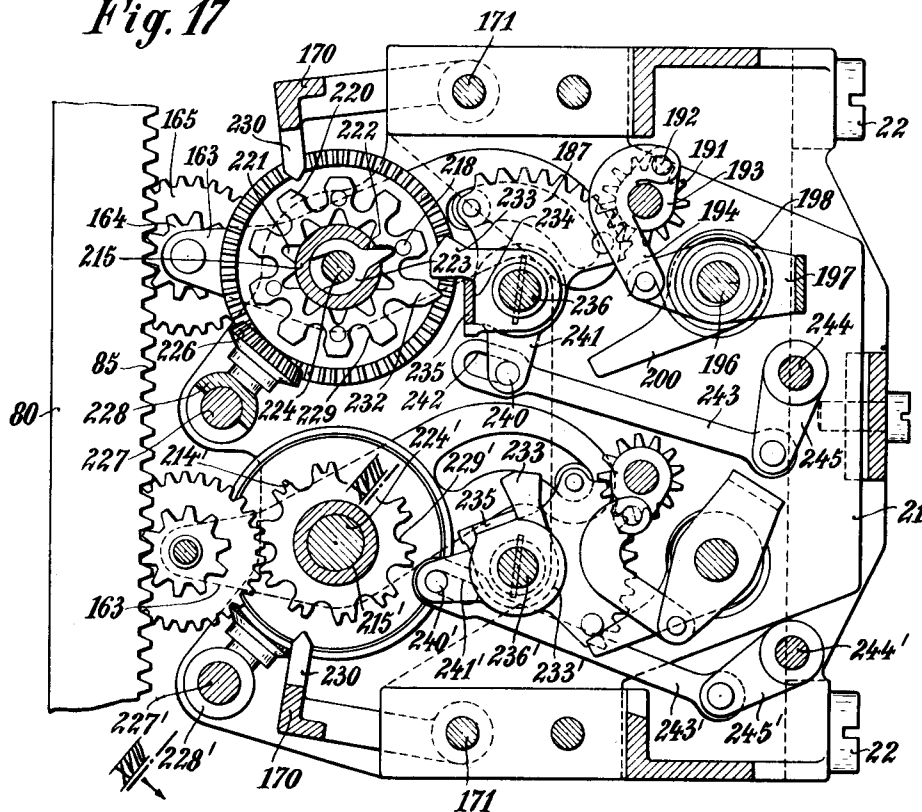


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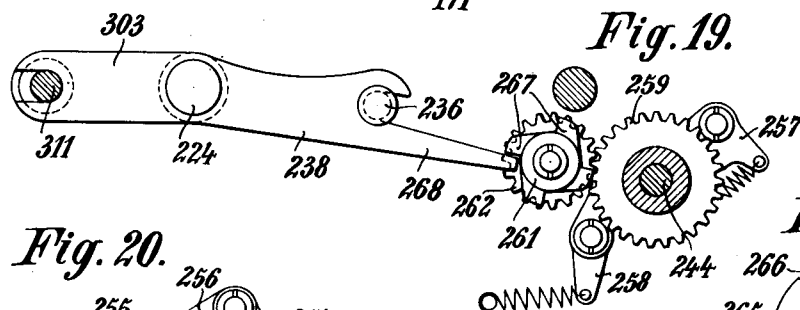


Fig. 20.

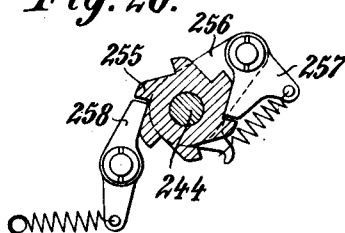


Fig. 21.

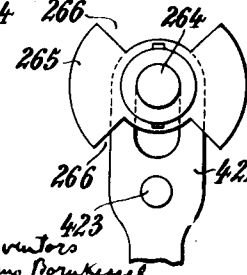
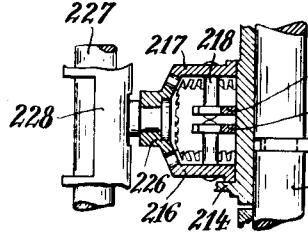


Fig. 18.



Inventors
 Bruno Bornkessel
 Ernst Breittling
 Wilhelm Mauer
 Karl August Lehmann
 By *Karl August Lehmann*

Feb. 7, 1933.

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Fig. 23.

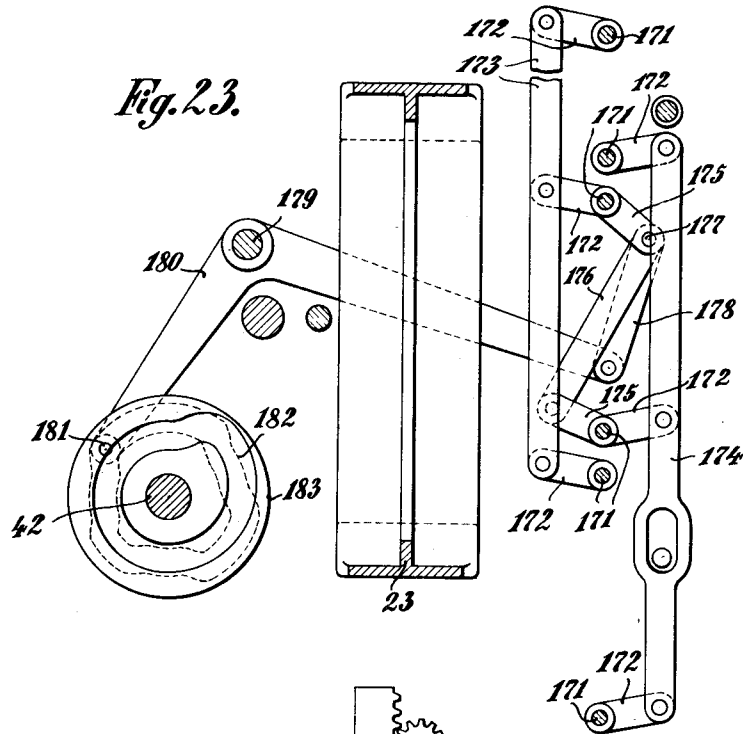
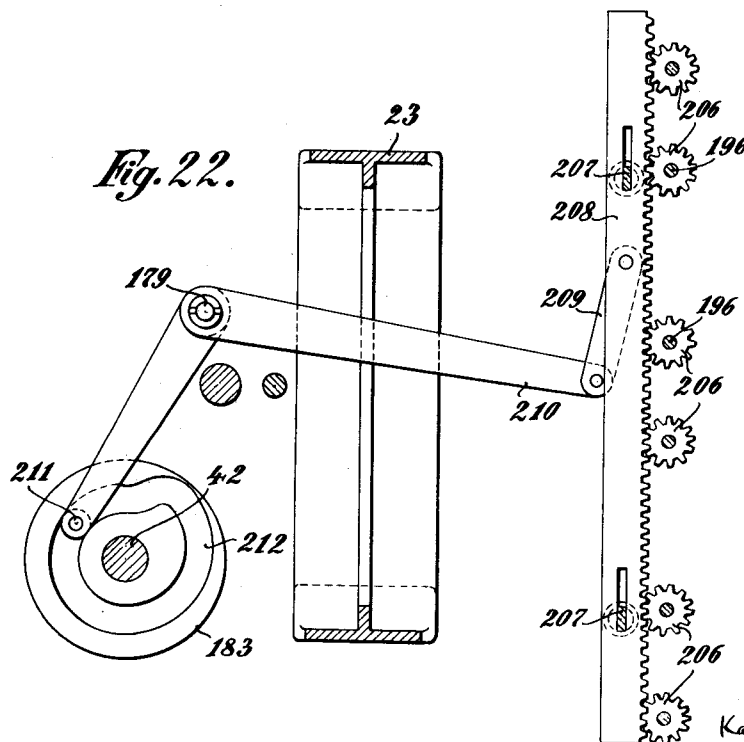


Fig. 22.



Inventors
Bruno Bornkessel
Ernst Breithling
Wilhelm Bräuer
Karl August Lehmann
By *Kunz & Co.*
Attys.

Feb. 7, 1933.

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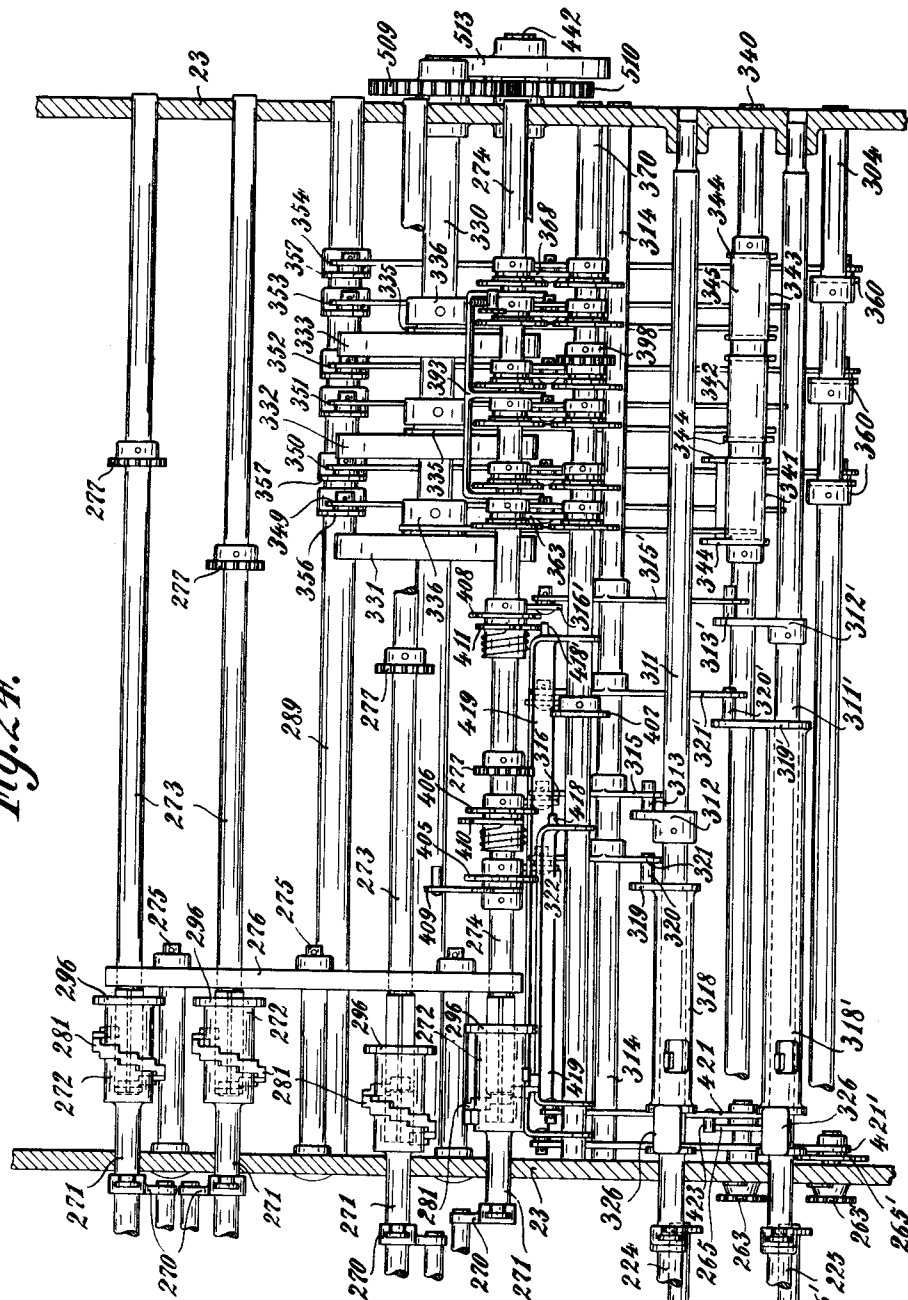
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Fig. 24.



Inventors
 Bruno Bornkessel
 Ernst Breitling
 Wilhelm Meier
 Karl August Schumann
 By *Kunze & Co.*
 atty.

Feb. 7, 1933.

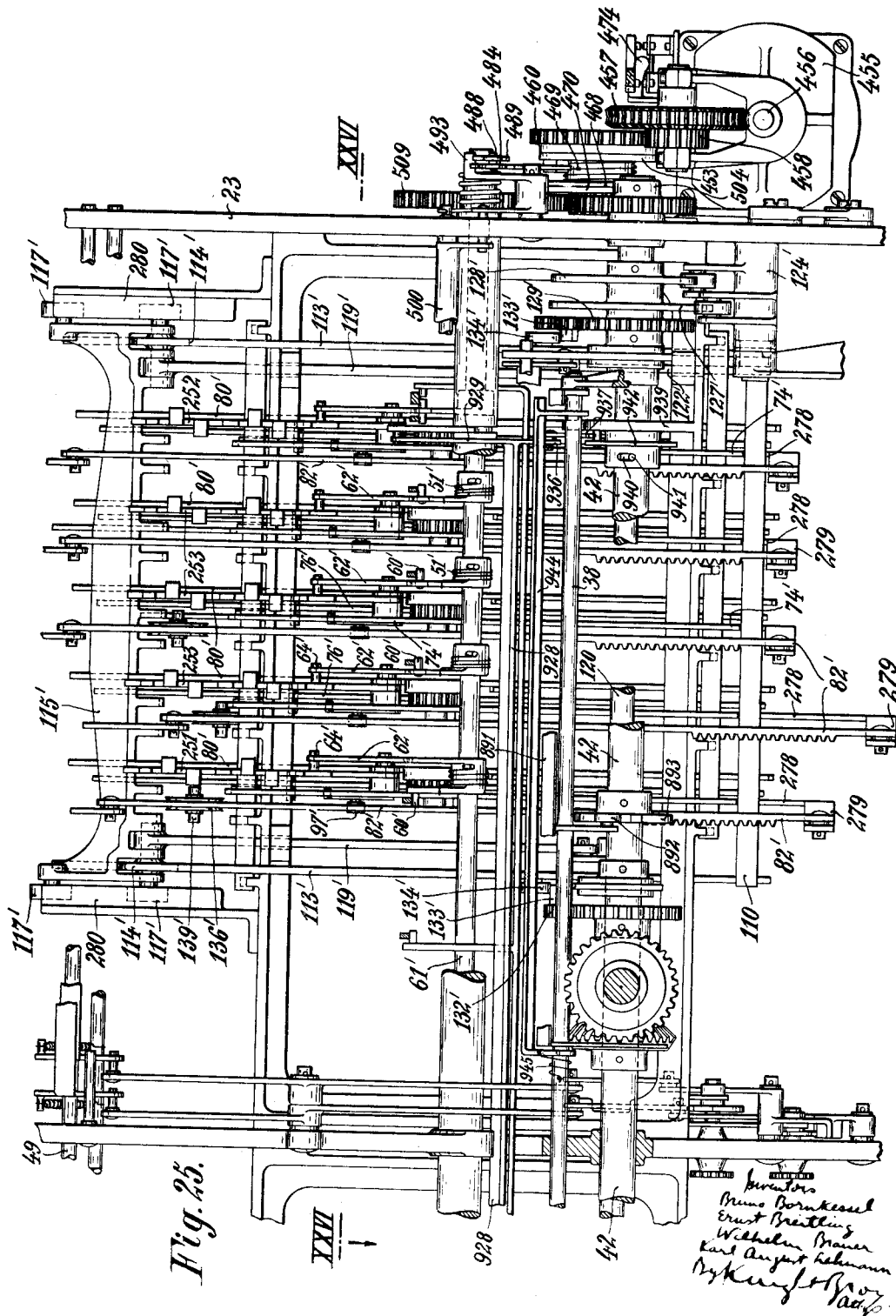
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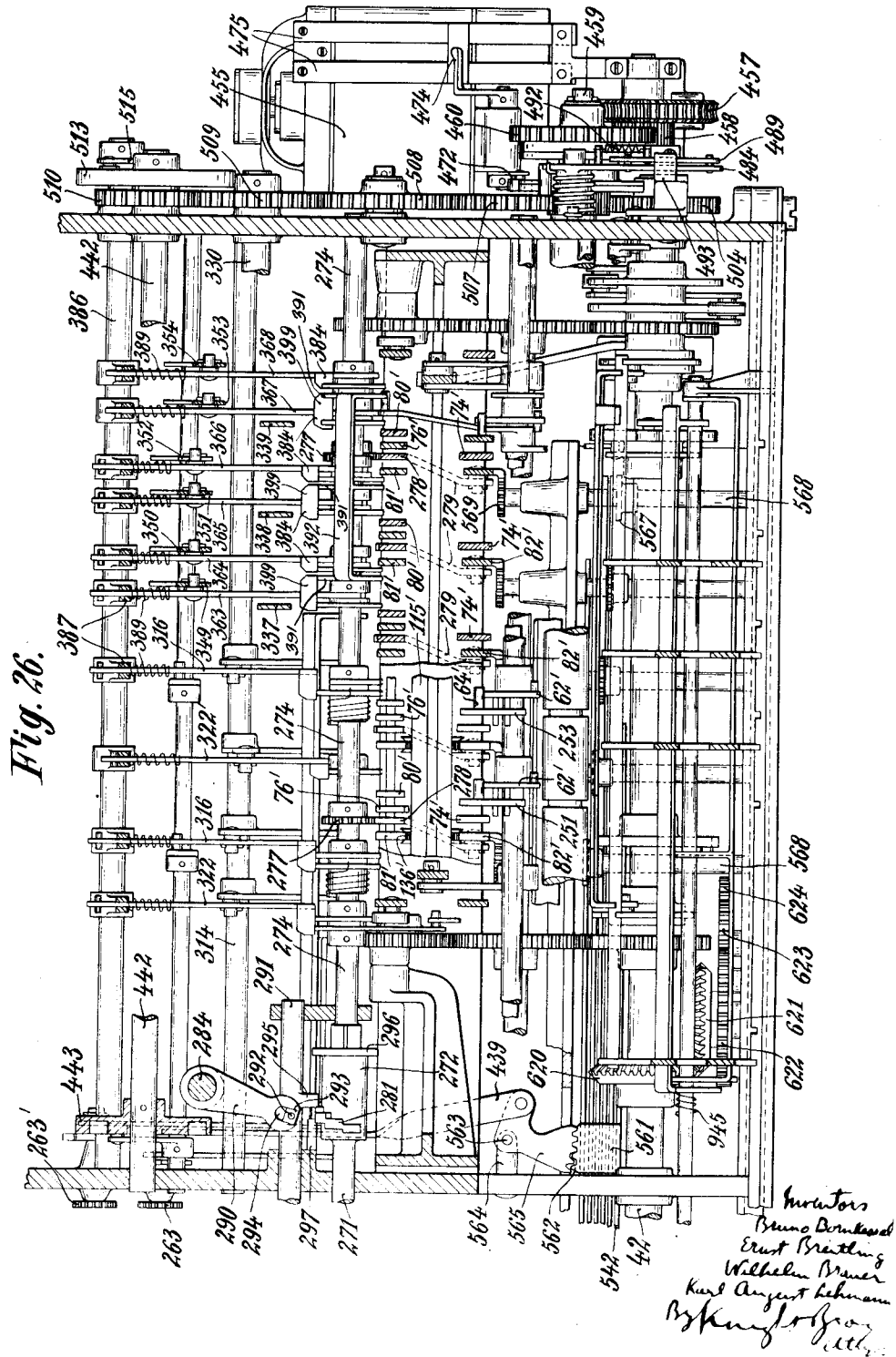
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Feb. 7, 1933.

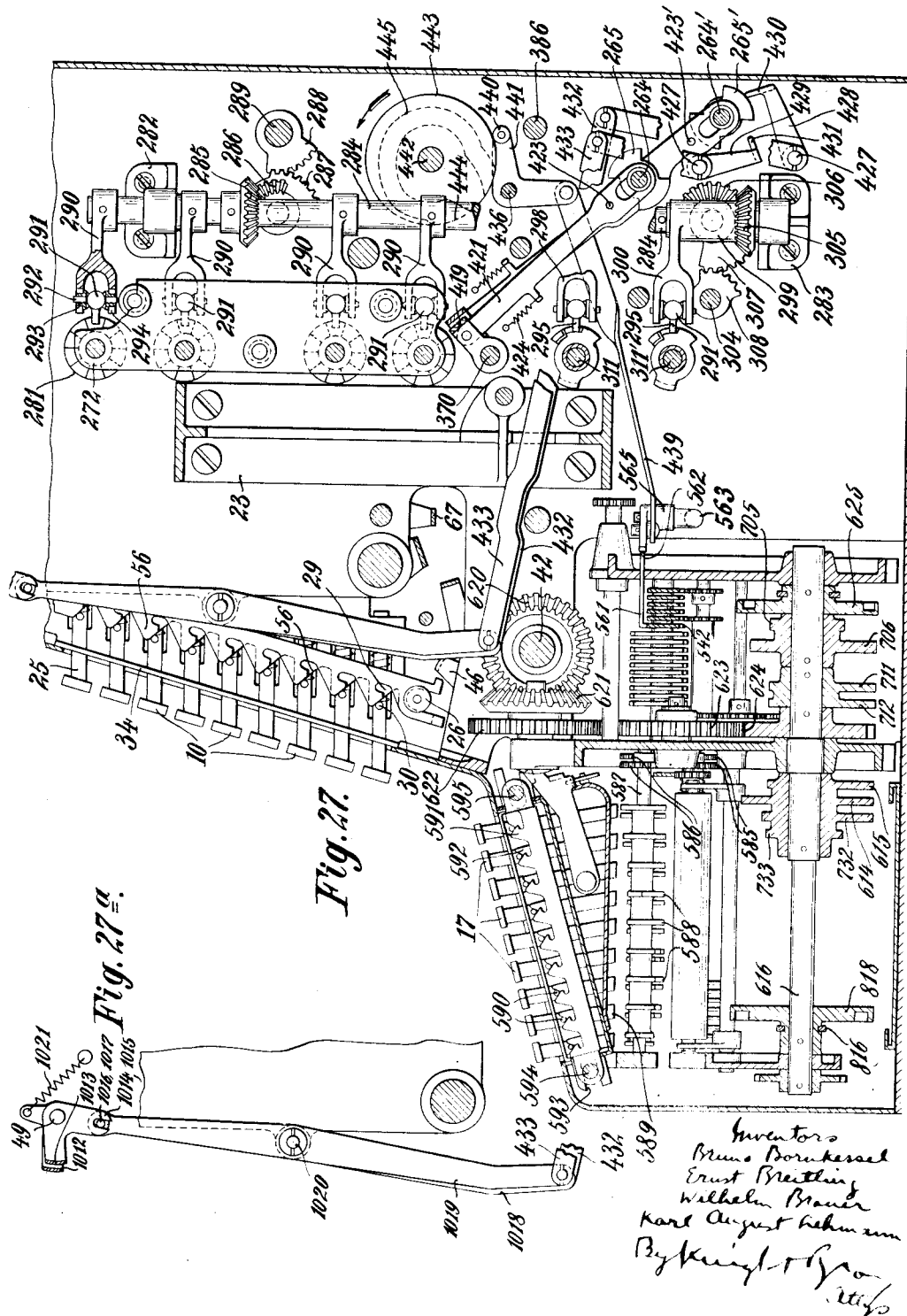
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Fig. 32 a.



Fig. 32.

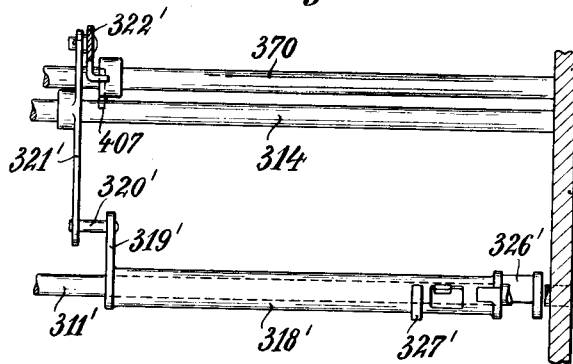


Fig. 31.

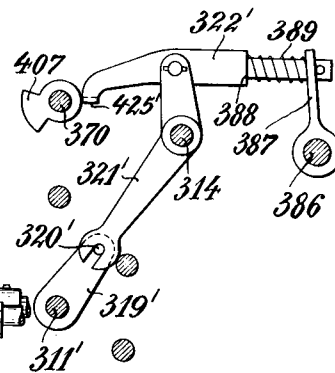


Fig. 29.

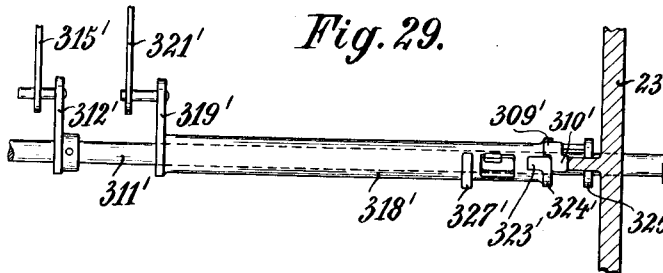


Fig. 30.

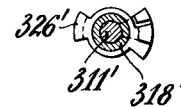
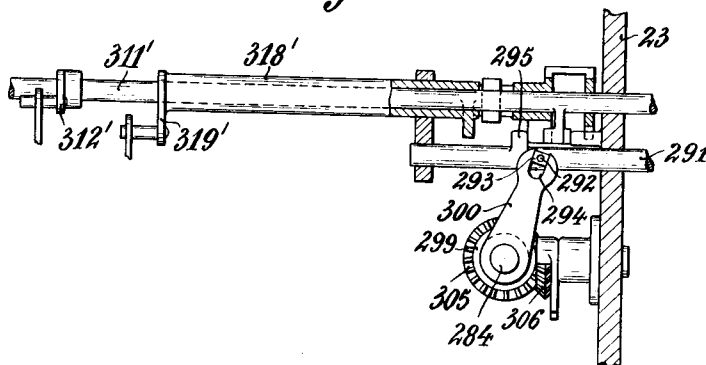


Fig. 28.



Inventors
Bruno Bornkessel
Ernst Breithing
Wilhelm Brauer
Karl August Lehmann
By *Reinhold & Co.*
att.ys

Feb. 7, 1933.

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Fig. 37^a.

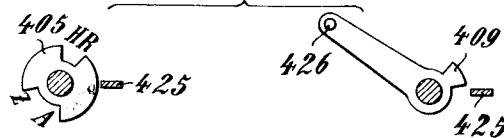


Fig. 37.

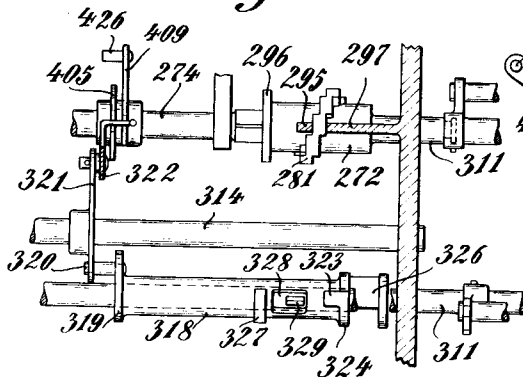


Fig. 38.

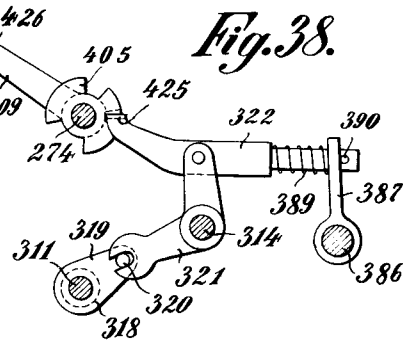


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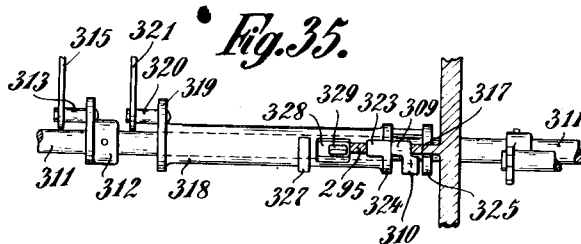


Fig. 36.

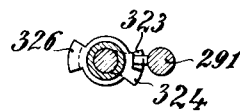


Fig. 34.

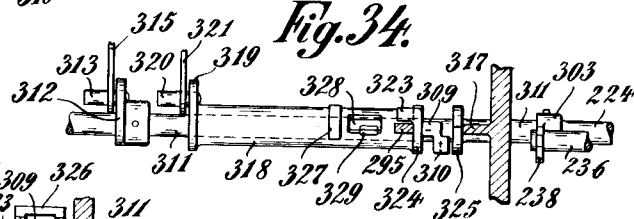
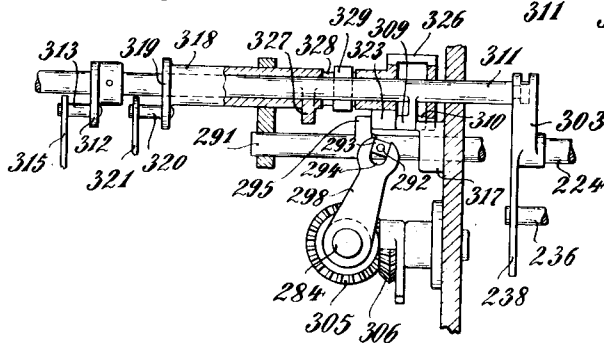


Fig. 33.



Inventors
 Bruno Bornkessel
 Ernst Breithing
 Wilhelm Brauer
 Karl August Lehmann
 By *Karl August Lehmann*

Feb. 7, 1933.

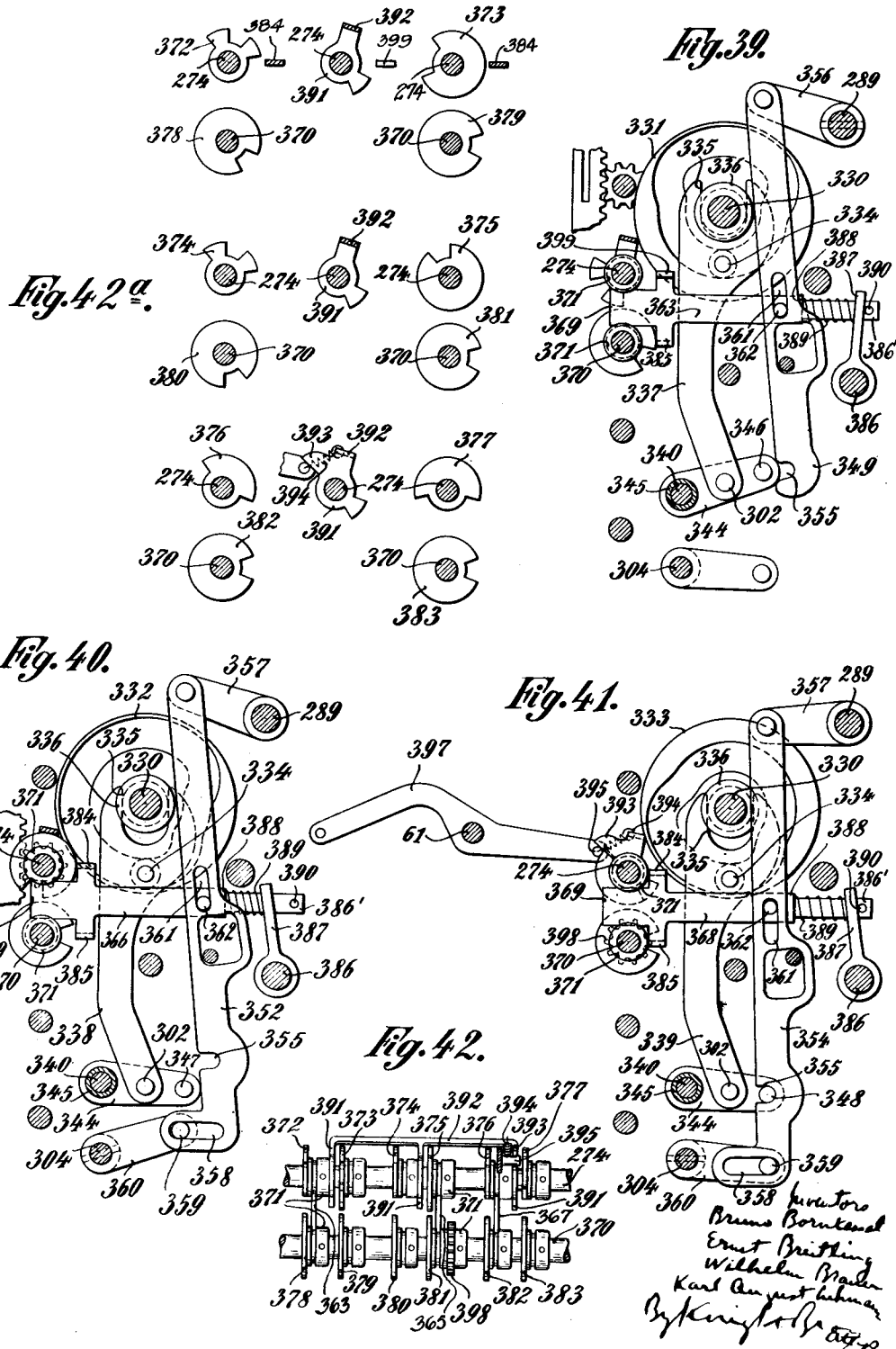
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Fig. 43^a.

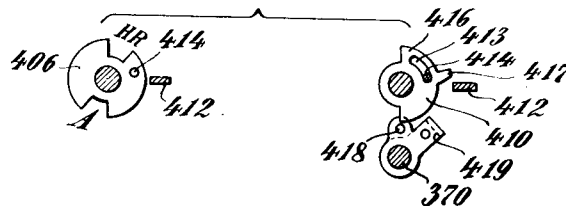


Fig. 43.

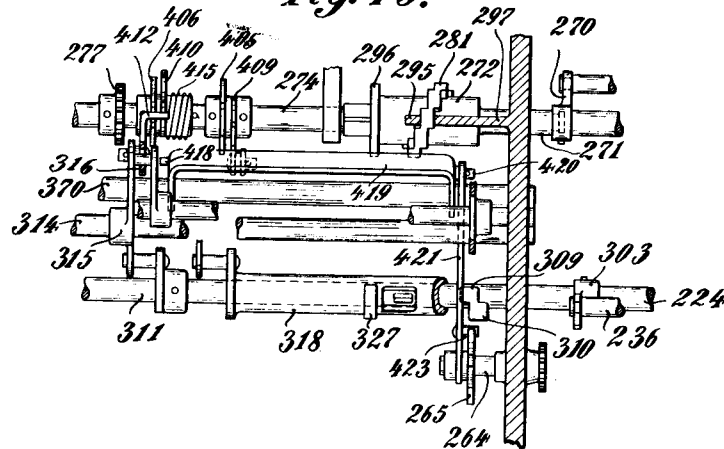
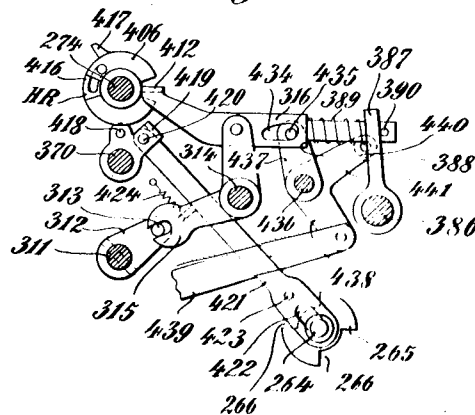


Fig. 44.



Inventors
 Bruno Bornkessel
 Ernst Brütling
 Wilhelm Trauer
 Karl August Lehmann
 By *Kunzschon*
 Attys

Feb. 7, 1933.

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1,896,936

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Fig. 45a.

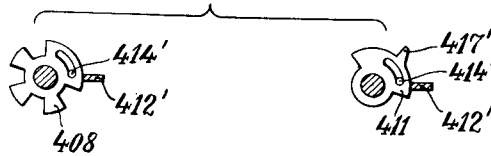


Fig. 45.

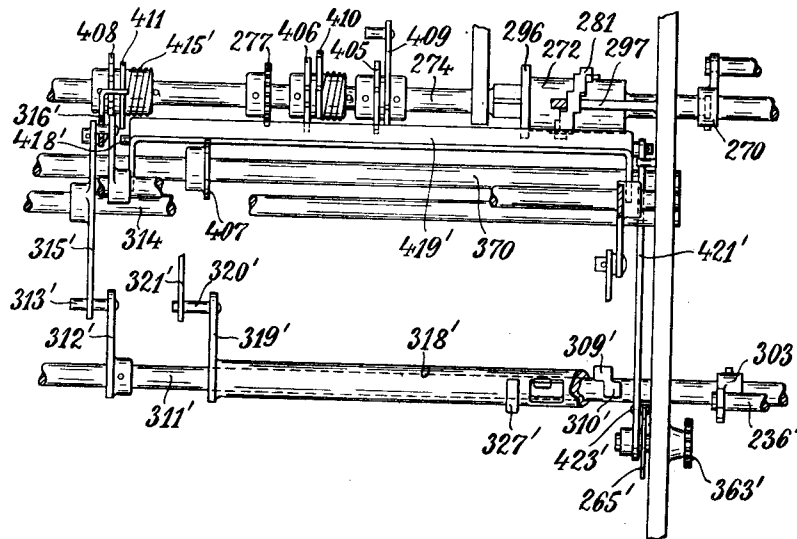
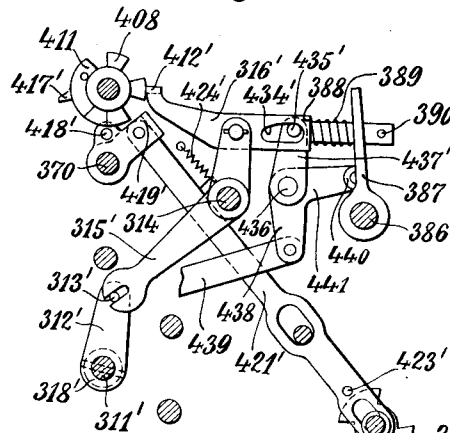


Fig. 46.



Inventors
Bruno Bornkessel
Ernst Meitling
Wilhelm Mauer
Karl August
Schindler
By King & Co.
1880

Feb. 7, 1933.

B. BORNKESSEL ET AL

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Fig. 47.

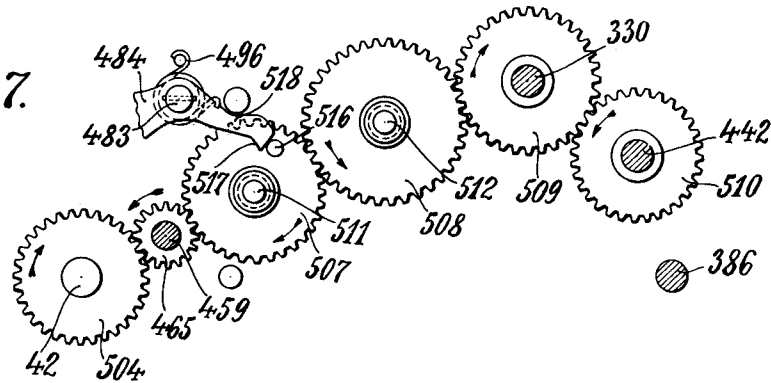


Fig. 48.

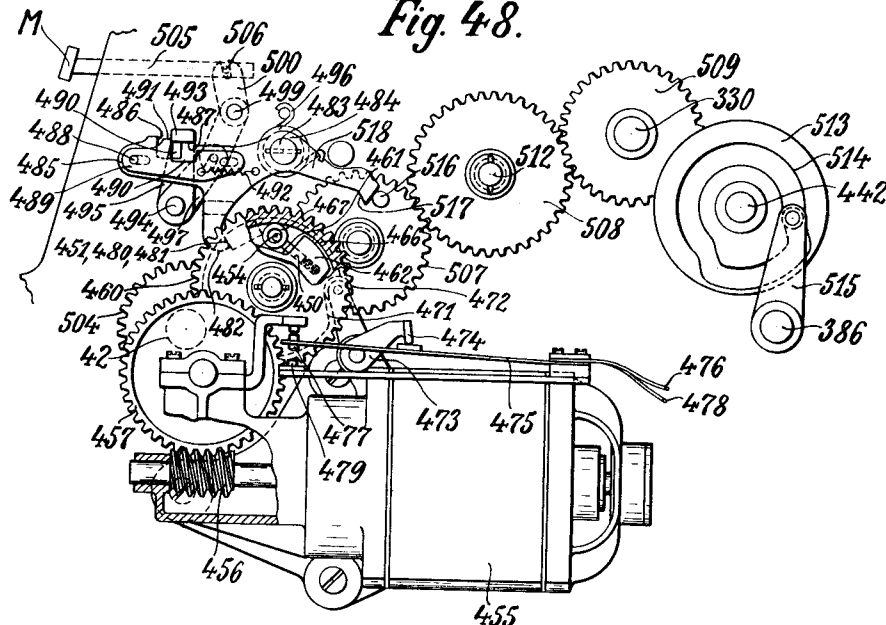


Fig. 49.

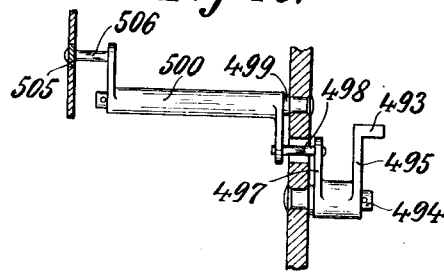
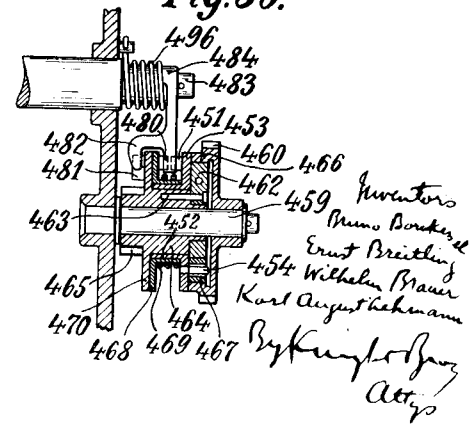


Fig. 50.



Inventors
Bruno Bornkessel
Ernst Breithling
Wilhelm Brauer
Kurt August Hehenmann
By *Karl Hoffmann*
Att'y.

Feb. 7, 1933.

B. BORNKESSEL ET AL

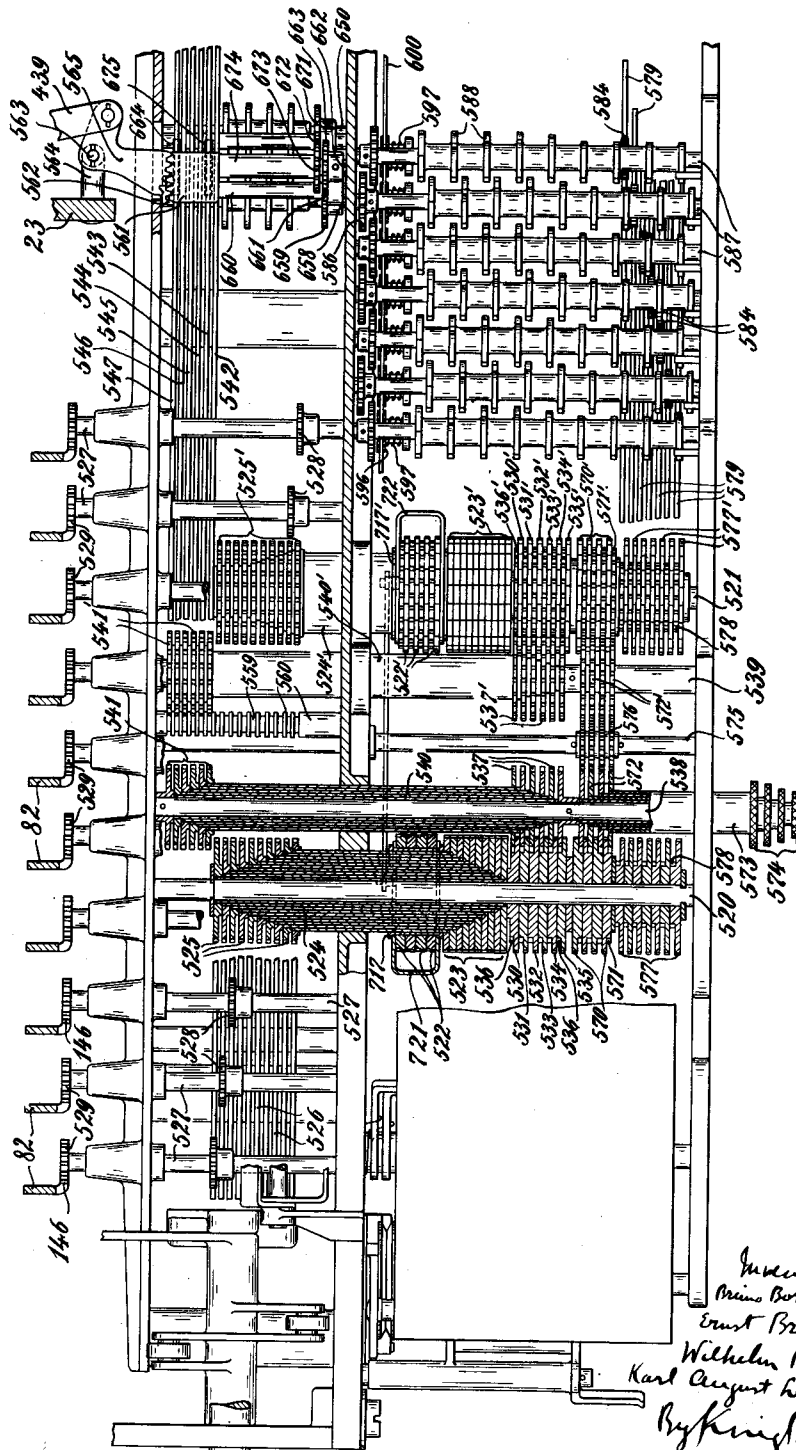
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Fig. 51.



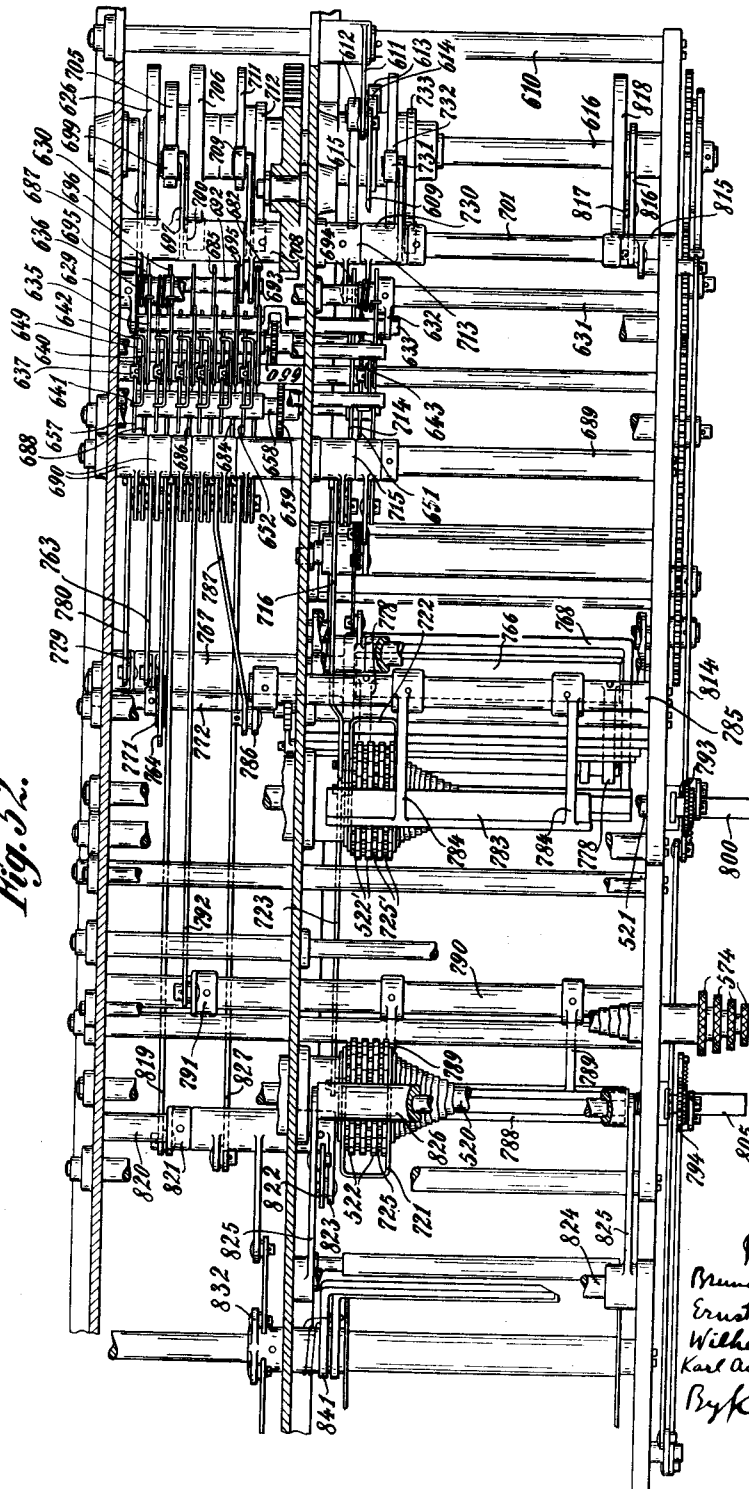
Inventors
Bruno Bornkessel
Ernst Breithing
Wilhelm Brauer
Karl August Lehmann
By *King & Sons*
Atty

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Fig. 52.



Inventors
 Bruno Bornkessel
 Ernst Breittling
 Wilhelm Bräuer
 Karl August Lehmann
 By King & Co
 Atty

Feb. 7, 1933.

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Fig. 54.

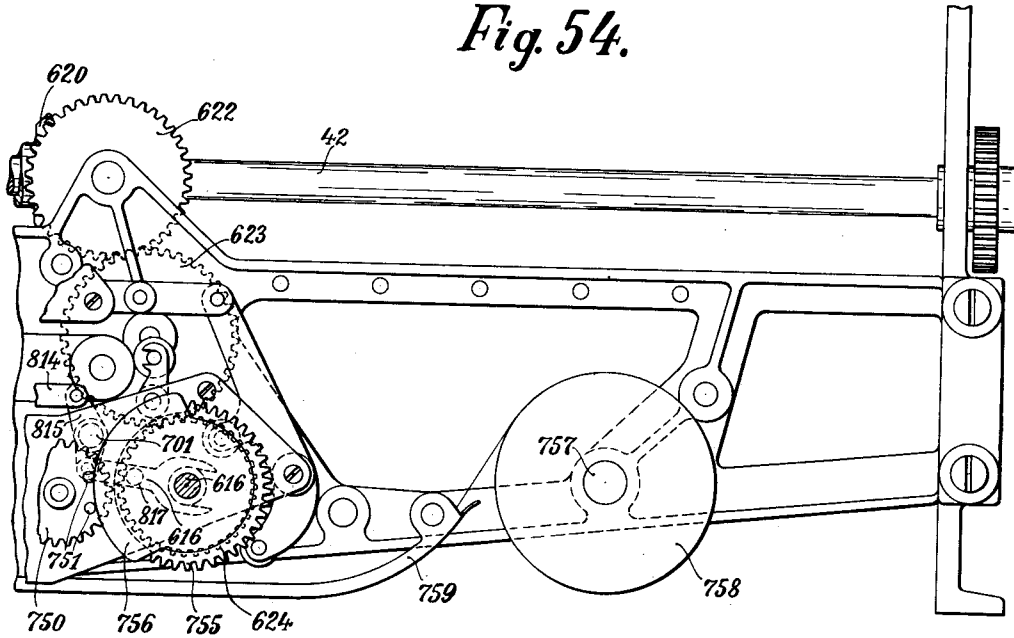
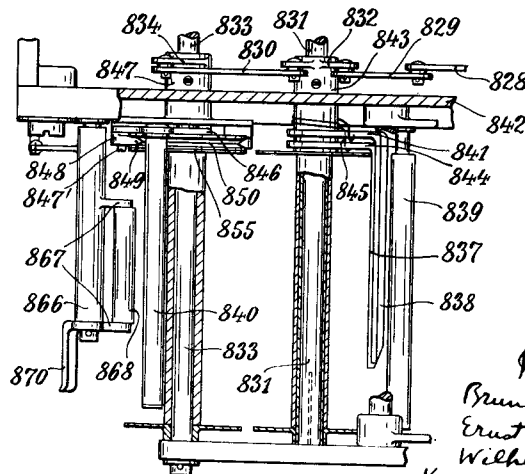


Fig. 53.



Inventors
 Bruno Bornkessel
 Ernst Breithling
 Wilhelm Brauer
 Karl August Lehmann
 By *Kunz & Co.* Attys

Feb. 7, 1933.

B. BORNKESSEL ET AL

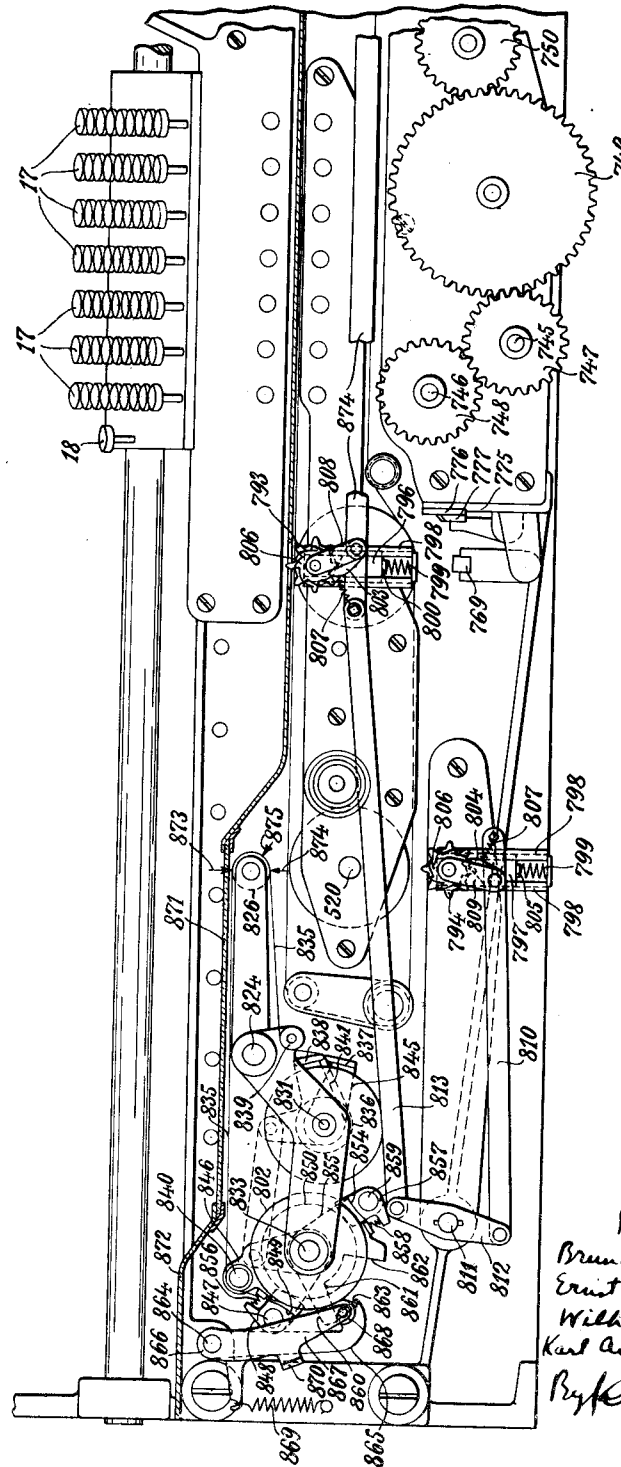
1,896,936

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Fig. 55.



Inventors
 Bruno Bornkessel
 Ernst Brethling
 Wilhelm Brauer
 Karl August Lehmann
 By *Karl August Lehmann*
Attys

1,896,936

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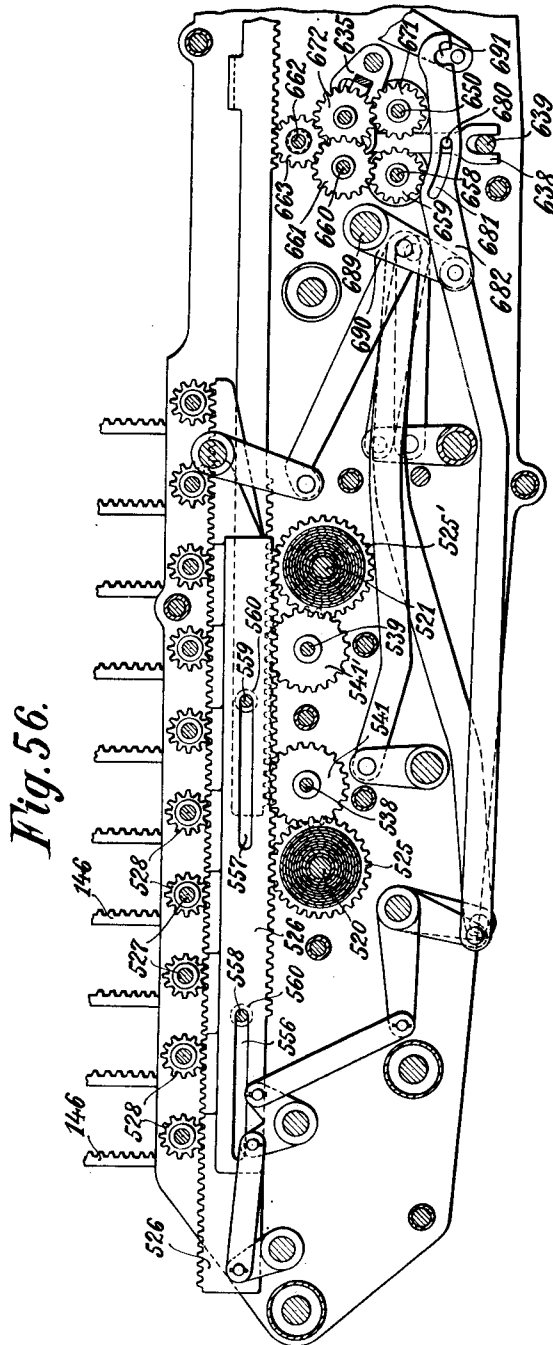
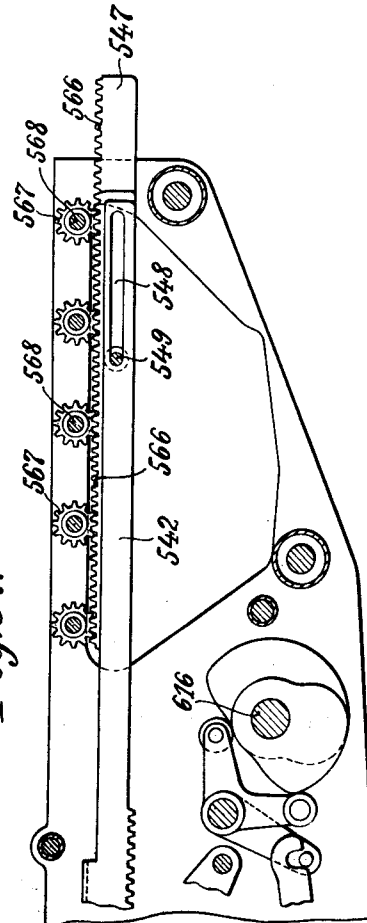


Fig. 57.



Inventors
Bruno Bornkessel
Ernst Breithling
Wilhelm Brauer
Karl August Lehmann
By King of the Art

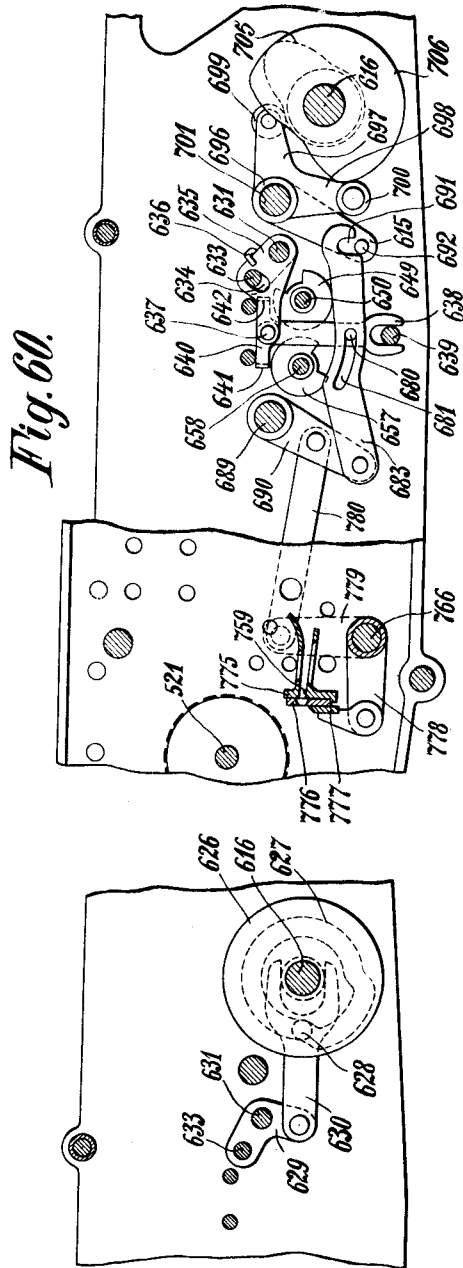


Fig. 60.

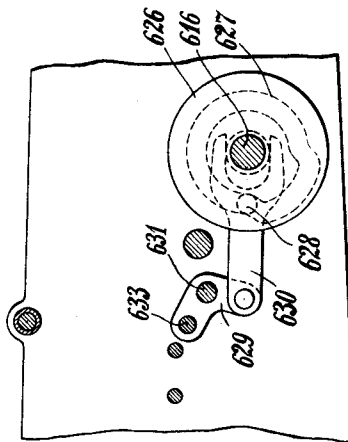
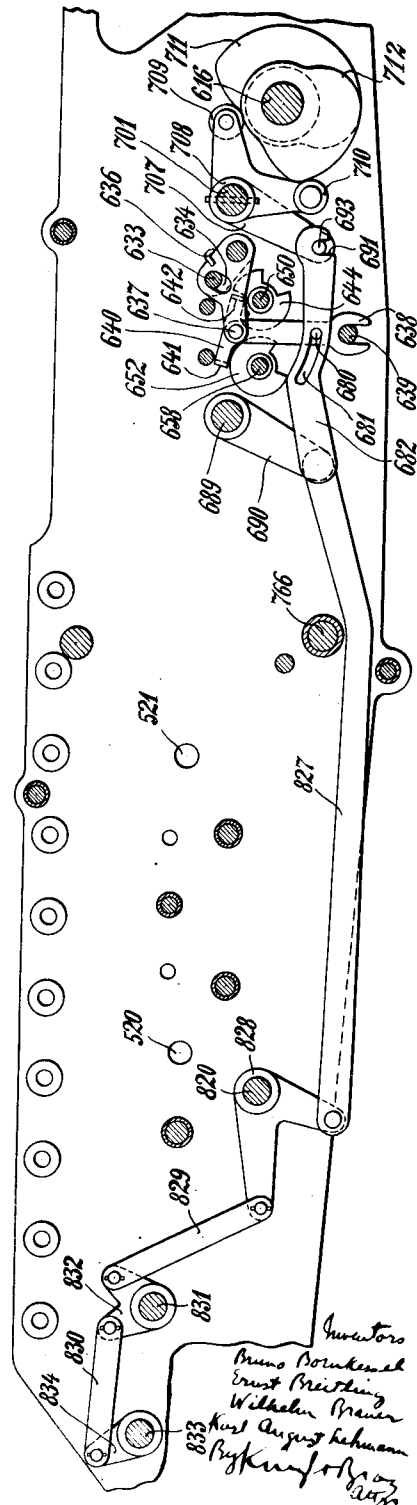


Fig. 58.

Fig. 59.



Inventors
Bruno Bornkessel
Ernst Breithing
Wilhelm Brauer
Karl August Lehmann
Zyklusfabrik
Aachen

Feb. 7, 1933.

B. BORNKESSEL ET AL

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Fig. 61.

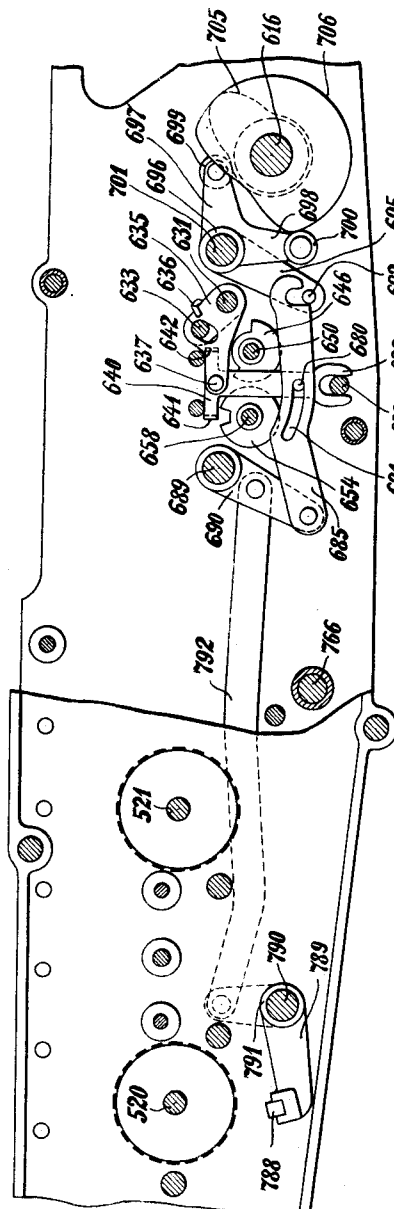
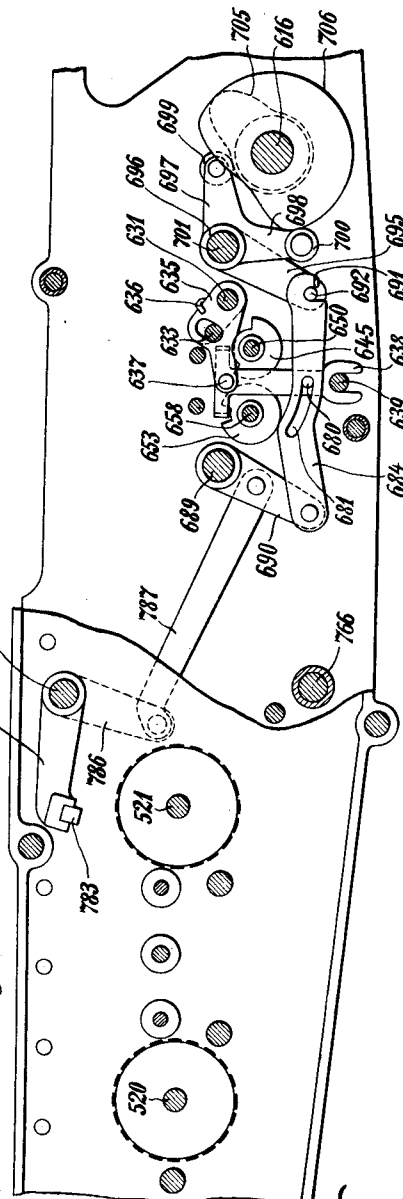


Fig. 62.



Inventors
Bruno Bornkessel
Ernst Breithing
Wilhelm Brauer
Karl August Lehmann
By King & Co.
Attys

Feb. 7, 1933.

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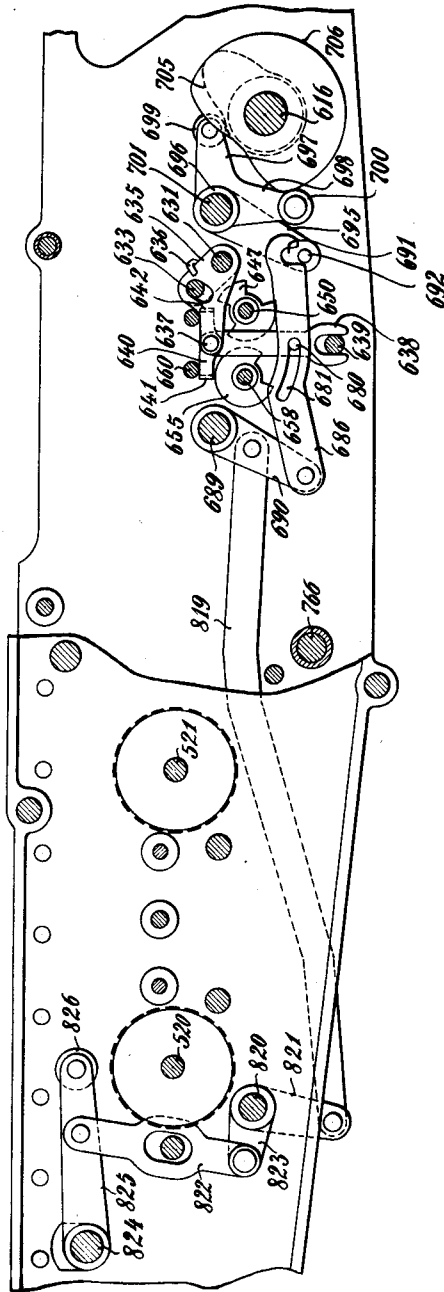


Fig. 63.

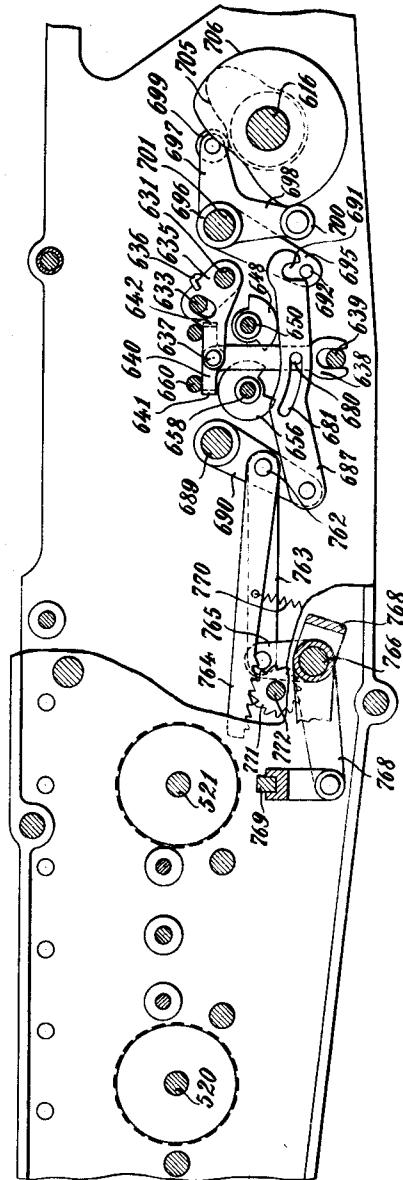


Fig. 64.

Inventors
 Bruno Bornkessel
 Ernst Breittling
 Wilhelm Mauer
 Karl August Lehmann
 By *Karl Lehmann*
 Attys

Feb. 7, 1933.

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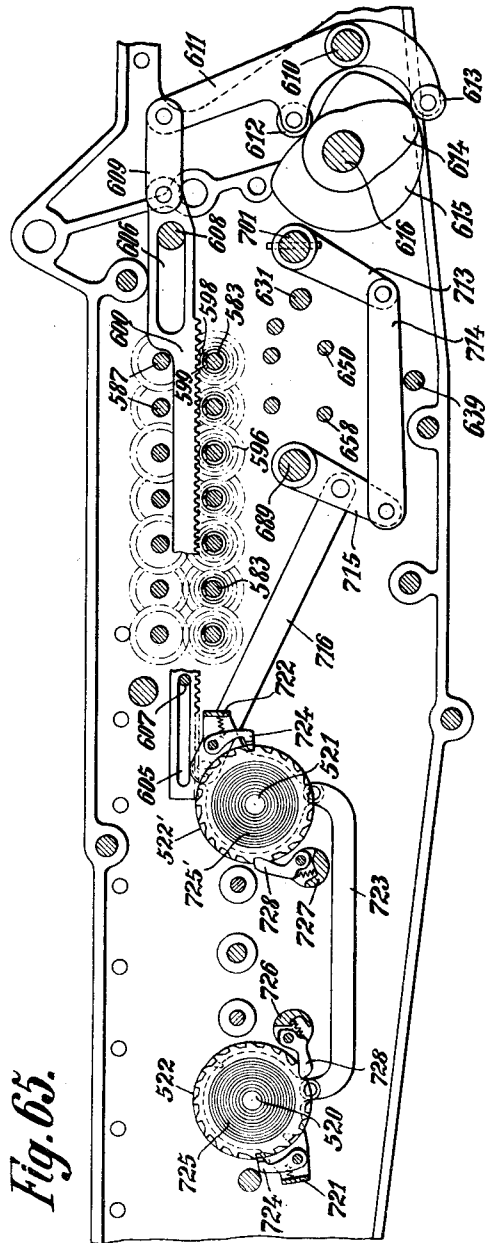


Fig. 65.

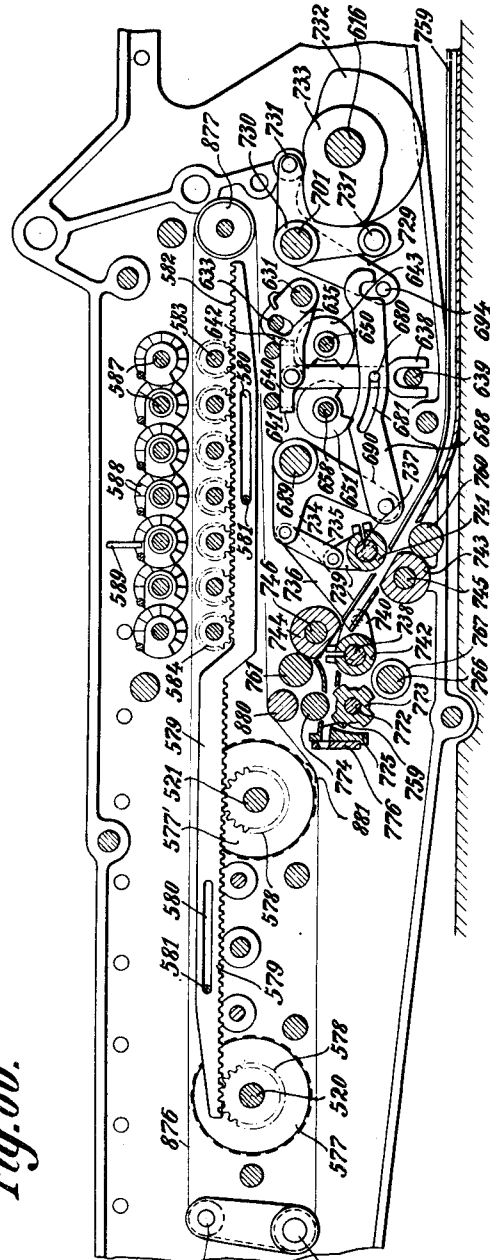


Fig. 66.

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Fig. 67.

Konten Nr.	Datum	Betrag				Lfd Nr
0 0 0 1 2 2 5	30. XI. 23	· 2 · ·	Zu +	0000243500	0 1 2 7	
0 0 0 1 2 2 5	30. XI. 23	· · · ·	b +	0000243500	0 1 2 8	
0 0 0 1 2 2 5	2. XII. 23	· 5 · ·	Zu +	0000025000	0 5 3 0	
0 0 0 1 2 2 5	2. XII. 23	· · 14 ·	Ab -	0000010000	0 5 3 1	
0 0 0 1 2 2 5	2. XII. 23	· · · 20	Zu +	0000030000	0 5 3 2	
0 0 0 1 2 2 5	2. XII. 23	· · · 26	Ab -	0000015000	0 5 3 3	
0 0 0 1 2 2 5	2. XII. 23	· · · ·	b +	0000273500	0 5 3 4	
0 0 0 1 2 2 5	10. I. 24	· · 12 ·	Ab -	0000300000	0 2 1 0	
0 0 0 1 2 2 5	10. I. 24	· · · ·	b -	0000026500	0 2 1 1	
0 0 0 1 2 2 5	20. II. 24	· 7 · ·	Zu +	0000100000	0 7 2 0	
0 0 0 1 2 2 5	20. II. 24	· · · ·	b +	0000083500	0 7 2 1	

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Fig. 68.

Konten Nr.	Datum	Betrag				Lfd. Nr.
0 0 0 1 2 2 5	30. XI. 23	• 2 • •	Zu +	0000243500	0 1 2 7	
0 0 0 1 2 2 5	30. XI. 23	• • • •	b +	0000243500	0 1 2 8	
0 0 0 1 2 2 5	2. XII. 23	• 5 • •	Zu +	0000025000	0 5 3 0	
0 0 0 1 2 2 5	2. XII. 23	• • 14 •	Ab -	0000010000	0 5 3 1	
0 0 0 1 2 2 5	2. XII. 23	• • • 20	Zu +	0000030000	0 5 3 2	
0 0 0 1 2 2 5	2. XII. 23	• • • 26	Ab -	0000015000	0 5 3 3	
0 0 0 1 2 2 5	2. XII. 23	• • • •	b +	0000273500	0 5 3 4	
0 0 0 1 2 2 5	20. II. 24	N • 12 •	Ab -	0000300000	0 4 8 6	
0 0 0 1 2 2 5	20. II. 24	N • • •	b -	0000026500	0 4 8 7	
0 0 0 1 2 2 5	20. II. 24	• 7 • •	Zu +	0000100000	0 7 2 0	
0 0 0 1 2 2 5	20. II. 24	• • • •	b +	0000083500	0 7 2 1	

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Fig. 69.

0 0 0 1 2 2 5	2. XII. 23 8 +	0000243500	0 5 2 9
0 0 0 1 2 2 5	2. XII. 23 . 5 . . Zu +	0000025000	0 5 3 0
0 0 0 1 2 2 5	2. XII. 23 . . 14 . Ab -	0000010000	0 5 3 1
0 0 0 1 2 2 5	2. XII. 23 . . . 20 Zu +	0000030000	0 5 3 2
0 0 0 1 2 2 5	2. XII. 23 . . . 26 Ab -	0000015000	0 5 3 3
0 0 0 1 2 2 5	2. XII. 23 b +	0000273500	0 5 3 4

Fig. 70.

0 0 0 0 0 0 0	2. XII. 23 ES . . . Ab -	0054321500	1 2 5 7
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Fig. 71.

0 0 0 2 6 7 8	2. XII. 23 . 9 . . Zu +	0000080000	0 5 2 3
0 0 0 0 7 8 6	2. XII. 23 . . 12 . Ab -	0000040000	0 5 2 6
0 0 0 0 0 0 0	2. XII. 23 ES . . . HR +	0000000000	0 5 2 8
0 0 0 1 2 2 5	2. XII. 23 . 5 . . Zu +	0000025000	0 5 3 0
0 0 0 1 2 2 5	2. XII. 23 . . 14 . Ab -	0000010000	0 5 3 1
0 0 0 1 2 2 5	2. XII. 23 . . . 20 Zu +	0000030000	0 5 3 2
0 0 0 1 2 2 5	2. XII. 23 . . . 26 Ab -	0000015000	0 5 3 3
0 0 0 0 0 0 0	2. XII. 23 ES . . . HR +	0000030000	0 5 3 5
0 1 2 5 7 3 8	2. XII. 23 . . 17 . Ab -	0000450000	0 5 3 7
1 7 5 0 0 2 6	2. XII. 23 . 6 . . Zu +	0000072000	0 5 4 0
0 0 0 0 0 0 0	2. XII. 23 ZS . 15 . . +	0002527500	0 5 4 2
0 0 0 0 0 0 0	2. XII. 23 ES . 15 . . +	0002527500	0 5 4 3
0 0 0 0 0 0 0	2. XII. 23 ES . . . b -	0125673400	0 5 4 4
0 0 0 3 5 6 8	2. XII. 23 . 3 . 21 Zu +	0000030000	0 5 4 6
0 0 0 3 5 6 8	2. XII. 23 . . 1827 Ab -	0000010000	0 5 4 7
0 0 0 3 5 6 8	2. XII. 23 RZ +	0000020000	0 5 4 8

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Fig. 72.

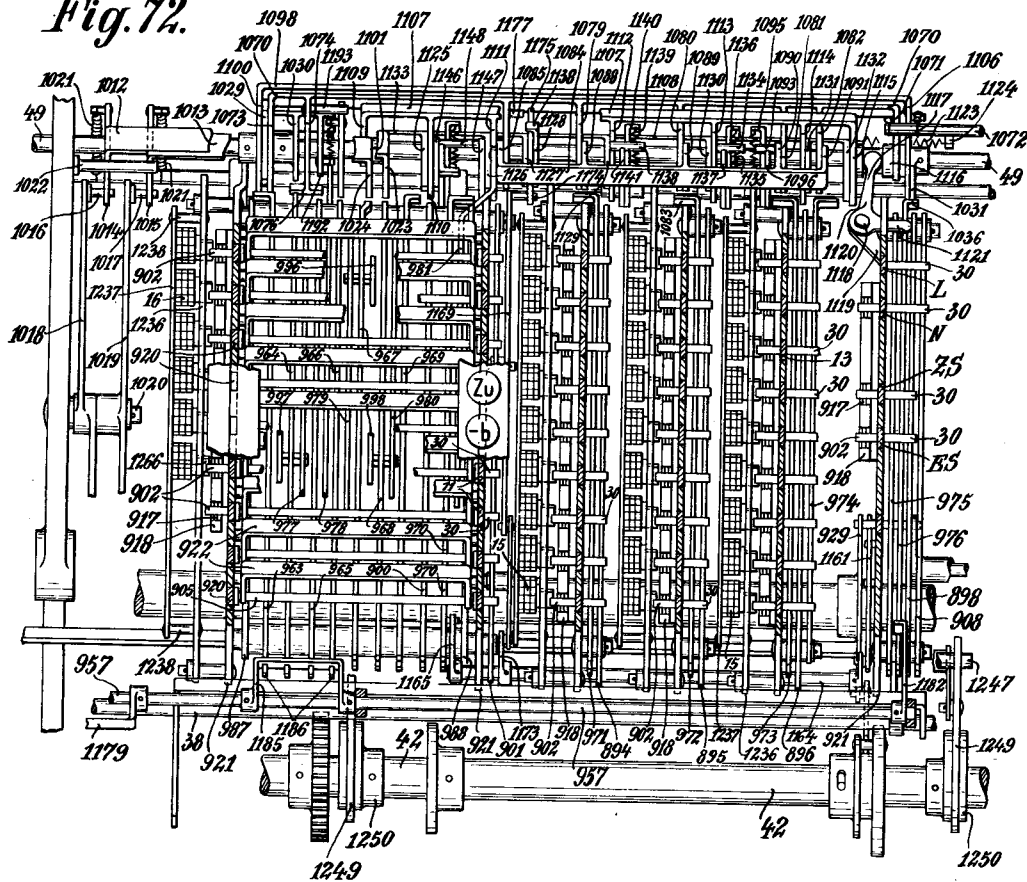
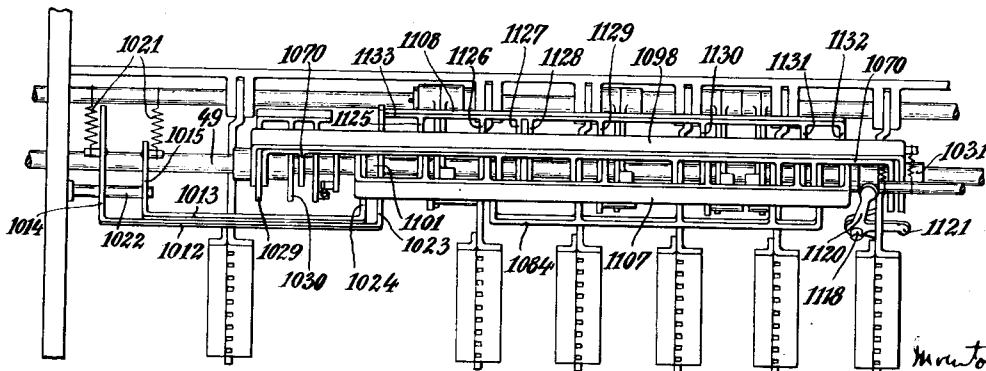


Fig. 73.

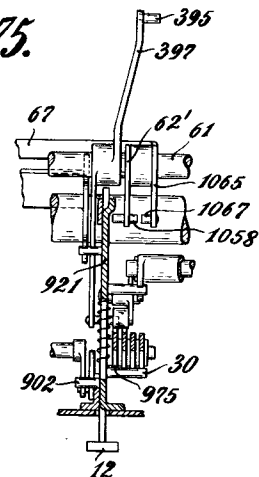


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Fig. 77.

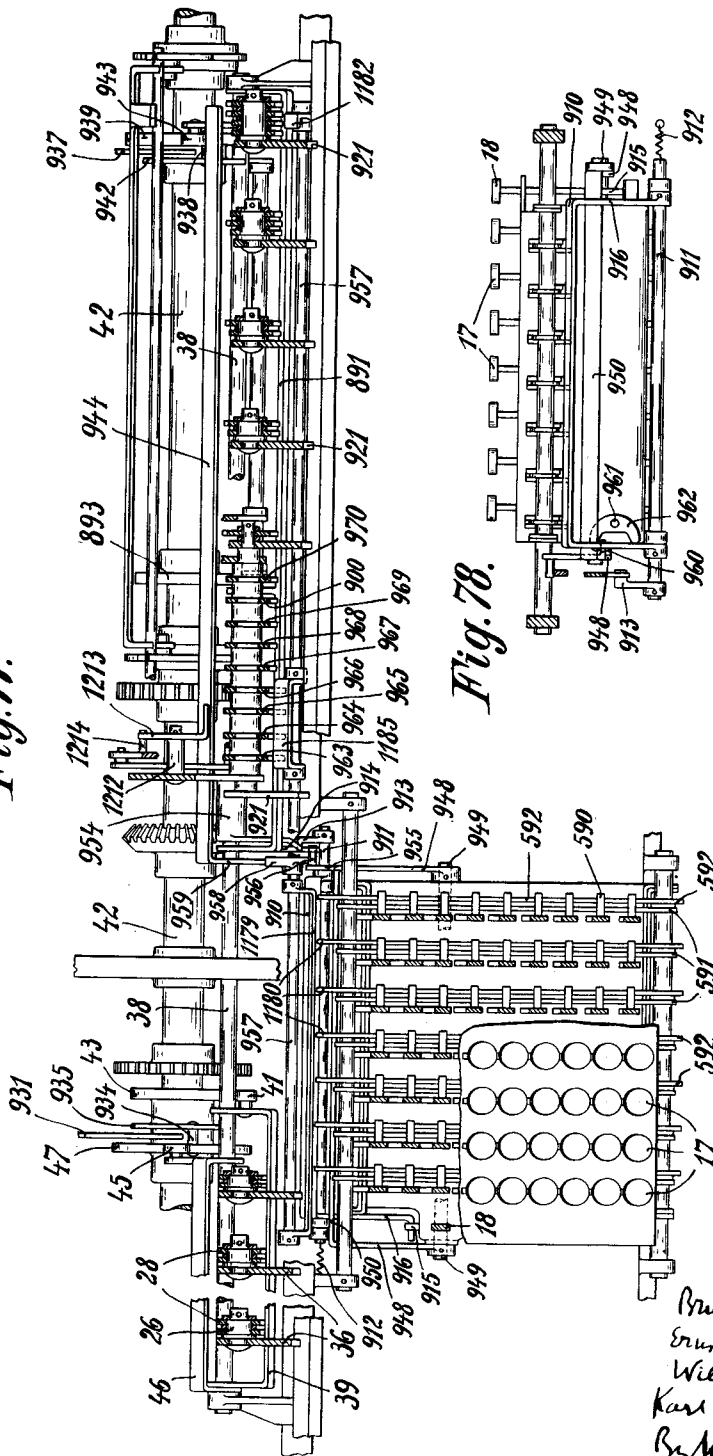
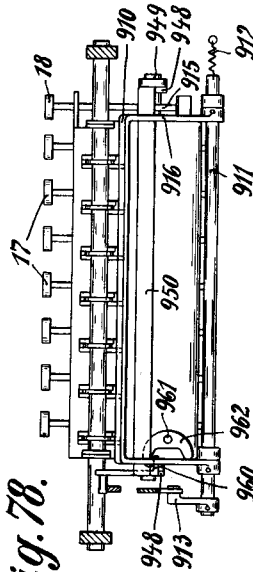


Fig. 78.



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Fig. 79.

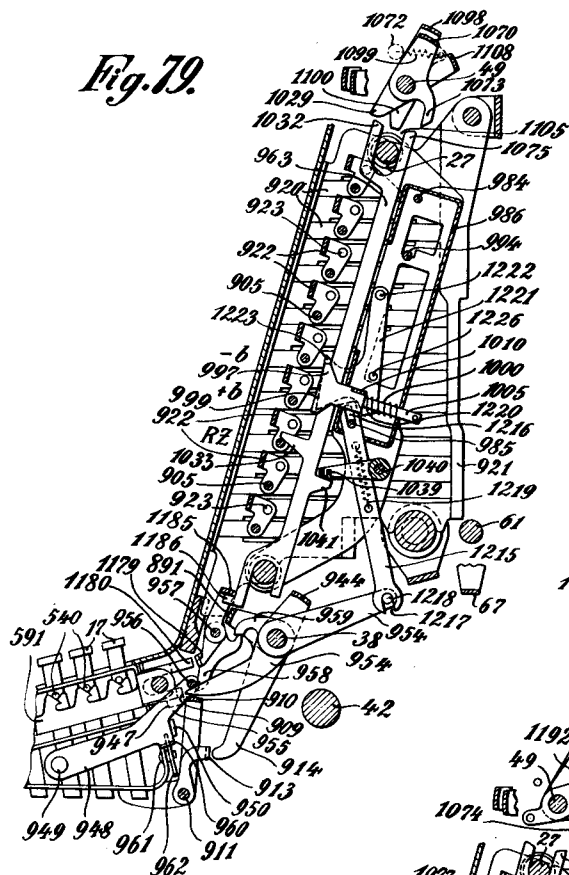


Fig. 80.

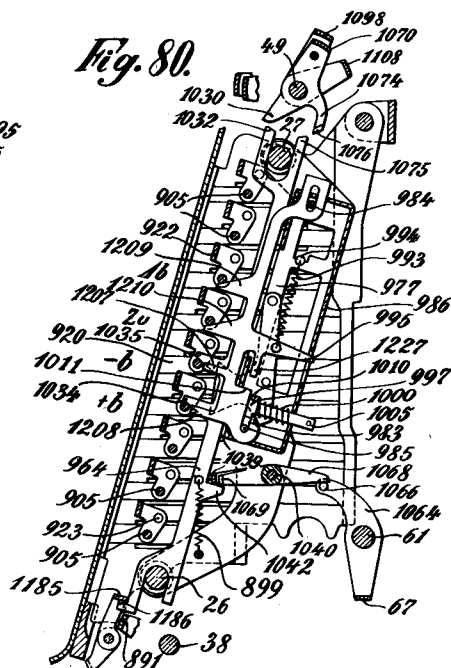
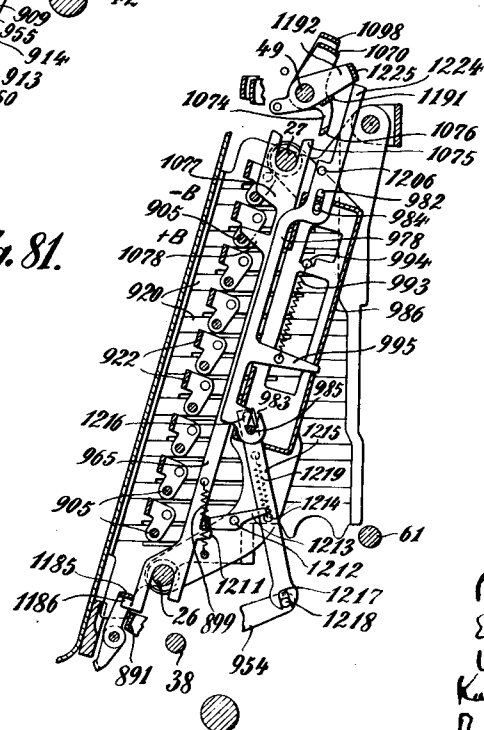


Fig. 81.



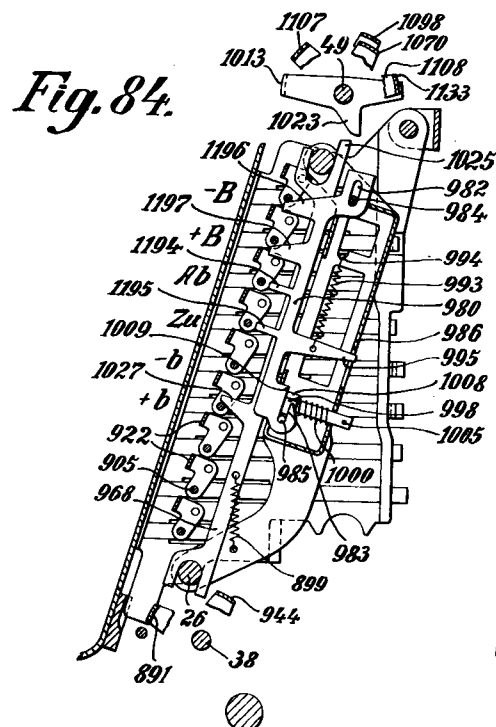
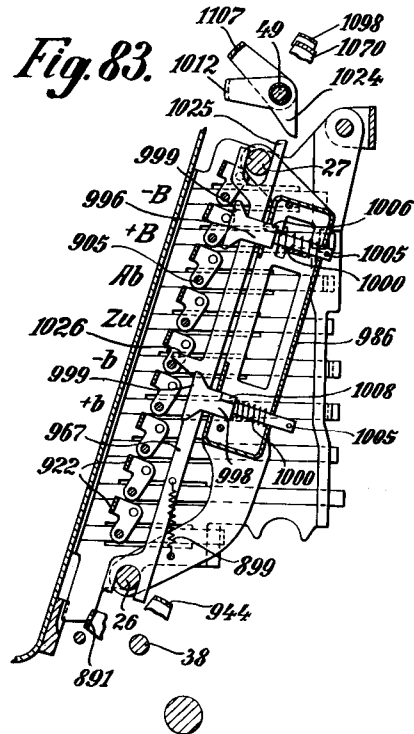
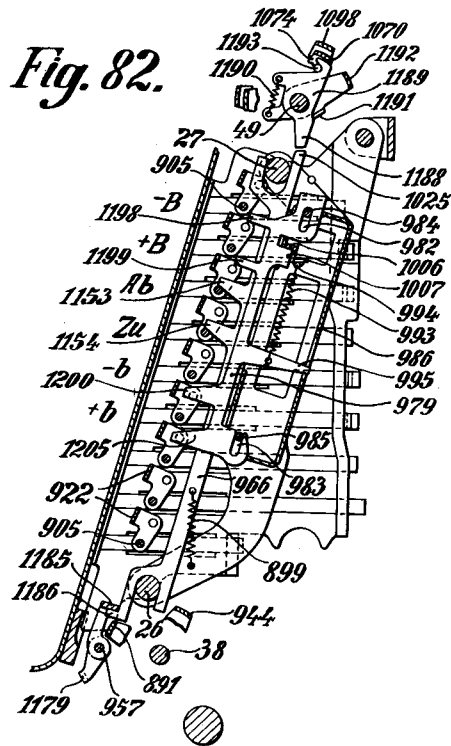
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Fig. 85.

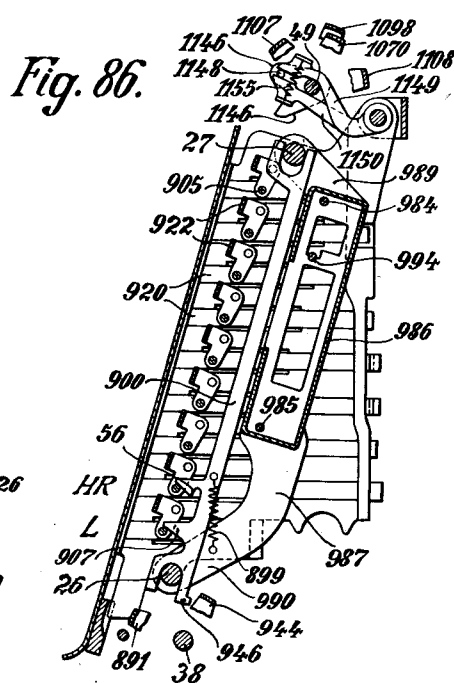


Fig. 86.

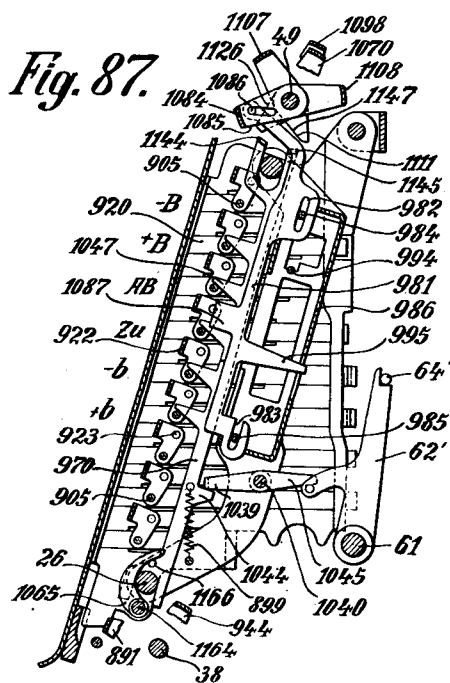


Fig. 87.

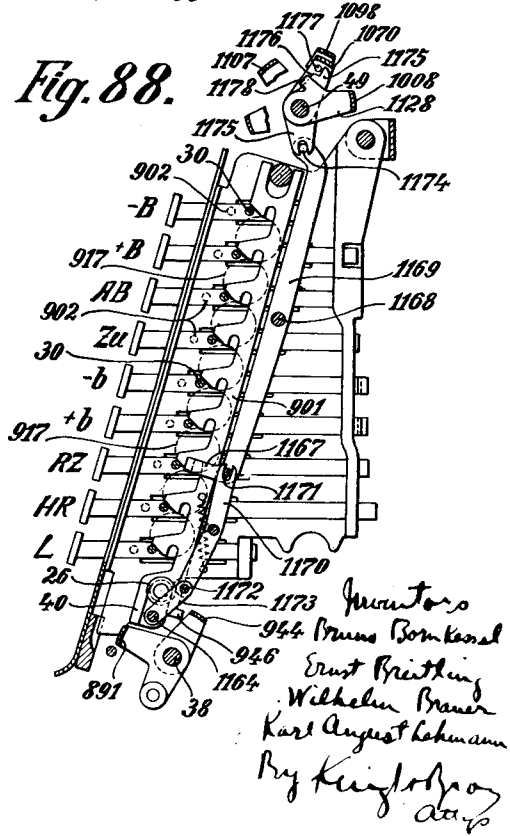


Fig. 88.

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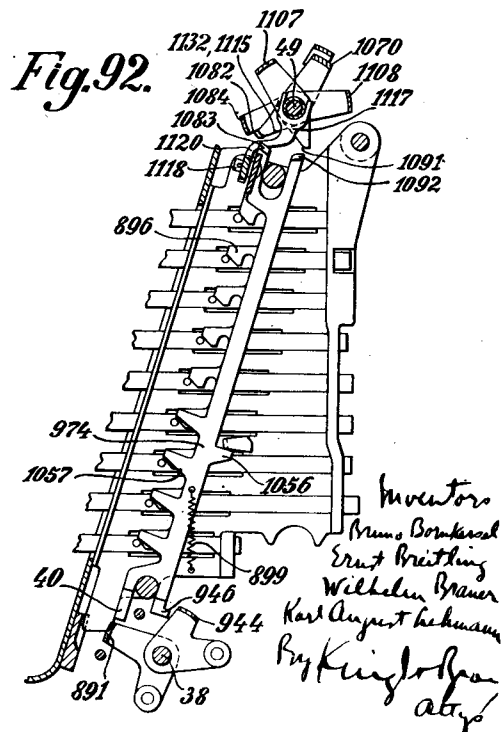
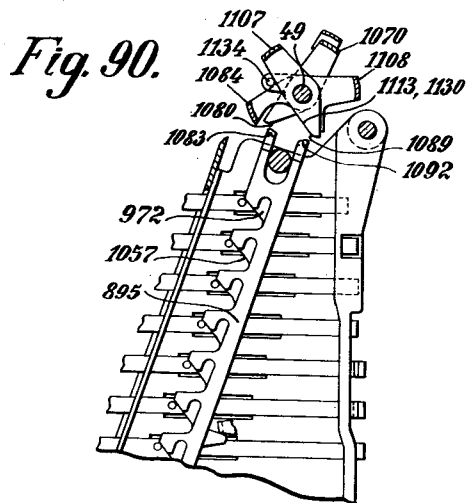
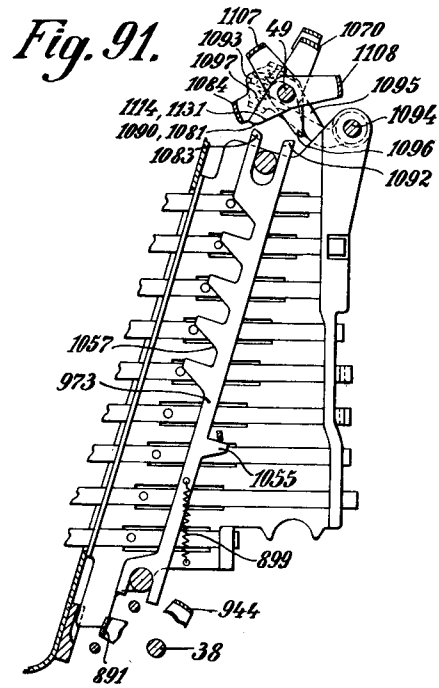
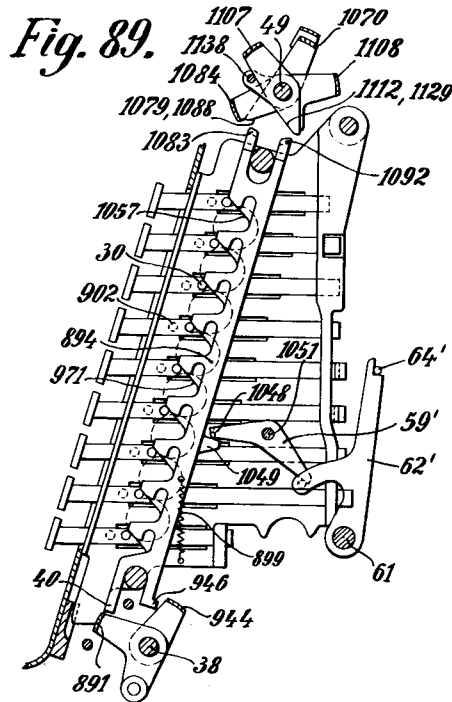
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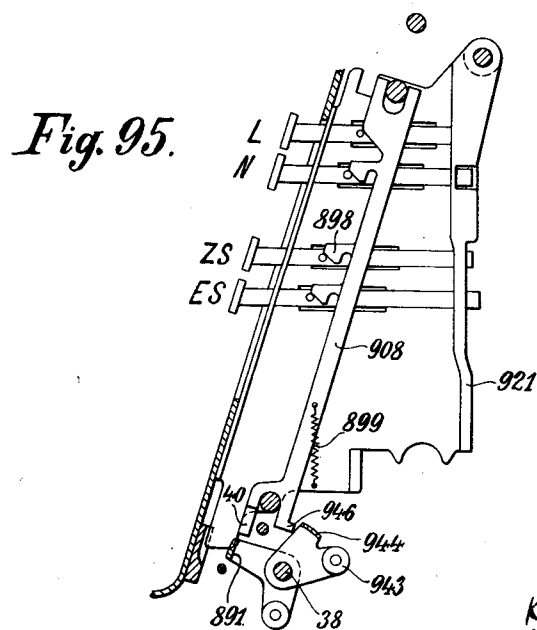
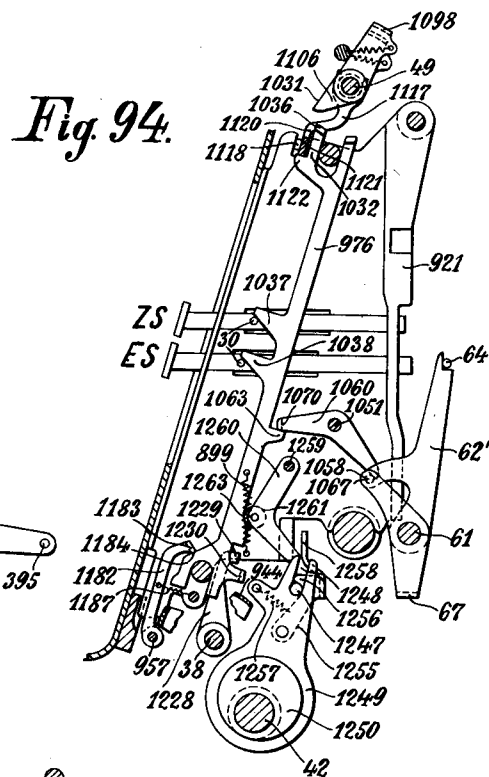
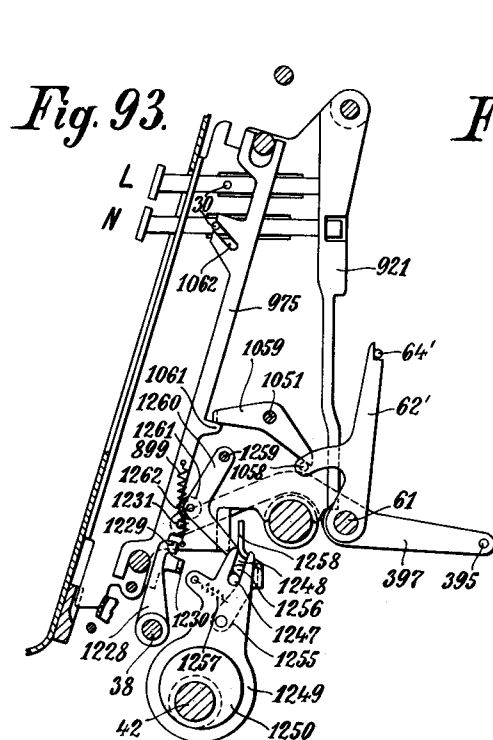
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Fig. 98.

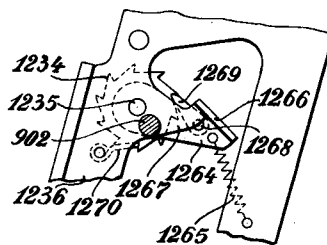


Fig. 96.

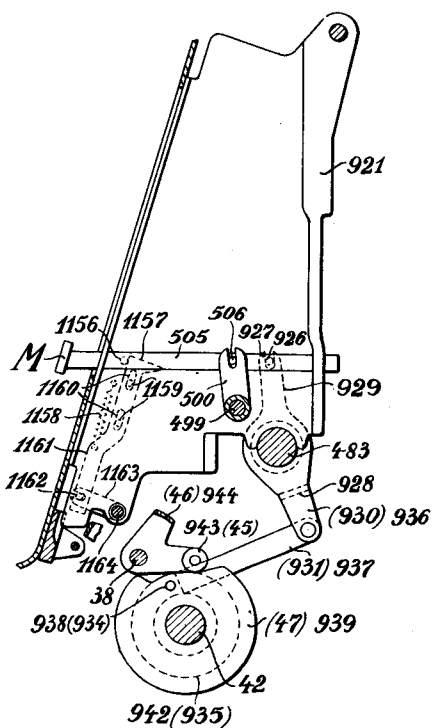
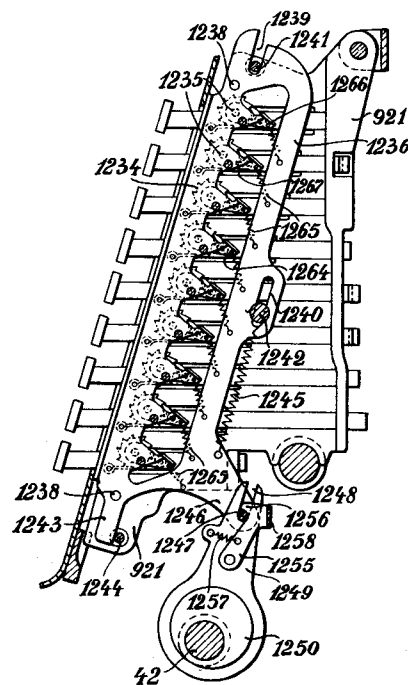


Fig. 97.



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BOOKKEEPING MACHINE

Application filed February 24, 1925, Serial No. 11,373, and in Germany February 25, 1924.

The invention relates to a book keeping machine for calculating and recording a new state of an account consisting of an old state of an account and the amounts received and paid out, and in particular to a machine of the character stated in which the amounts and the operations to be executed by the machine are set by means of keys and are transmitted by a separate drive to the totalizers and to the printing and display mechanism.

The spirit of the invention consists in the general common idea of providing devices which serve for easing the operator's effort of thought in the largest possible degree and to insure a reliable control of the transaction both for the office and for the customer.

For this purpose the different transactions including an action upon the control totalizers and the display mechanism and a record on different impression carriers, are set by as few manipulations as possible, the succession of the setting manipulations required for the different transactions being prescribed to the operator by the machine in a manner precluding error.

The invention comprises a new construction of totalizer permitting the arrangement of a greater number of totalizers in a small space, with which, further, both the totalizers and their tens transfer and locking mechanisms are arranged stationarily in the machine and with which, finally, the totalizers are selected by shifting the totalizer axles.

Another feature of the invention consists in the control mechanism for the totalizers by the aid of which the control, dependent on several rows of keys, of the totalizers of the different groups of totalizers can be carried out in any desired manner according to the different combinations of keys of the several rows of keys.

A further feature of the invention is formed by the devices designed to take negative totals. These devices automatically throw the machine over for printing the absolute value of the negative total if an account is overdrawn.

A further feature of the invention is formed by the drive of the item counters serving for the control of a number of special

keys, this drive being able to be thrown out of operation for certain transactions.

For the described purpose of the machine serves also the printing mechanism which possesses four printing places the different mechanisms of which are driven from a common driving and controlling mechanism in a manner corresponding to the set keys.

With these and incidental objects in view, the invention consists in certain novel features of construction and combinations of parts, the essential elements of which are set forth in appended claims, and a preferred form of embodiment of which is hereinafter described with reference to the drawings which accompany and form part of the specification.

In these drawings:

Fig. 1 is a front view of the machine,

Fig. 2 is a section through the machine on line II—II of Fig. 1;

Figs. 3 to 10 show parts of the differential mechanism for the amounts and the setting mechanism for the display and printing mechanisms, Fig. 6 being the front view of Fig. 5 and Fig. 9 being a section on line IX—IX of Fig. 8;

Fig. 11 is a front view of the amount differential mechanism,

Fig. 12 shows the operating means for the differential mechanism in section on line XII—XII of Fig. 11,

Fig. 13 is a top view of the amount differential mechanism, partly in section XIII—XIII of Fig. 2,

Fig. 14 is a section through a group of account totalizers on line XIV—XIV of Fig. 15,

Fig. 15 is a top view of a group of account totalizers, partly in section on line XV—XV of Fig. 14,

Fig. 16 is a top view of the auxiliary totalizer, partly in section on line XVI—XVI of Fig. 2,

Fig. 17 is a section through the auxiliary totalizer and main totalizer, partly in section on line XVII—XVII of Fig. 16,

Fig. 18 is a section on line XVIII—XVIII of Fig. 17,

Figs. 19 to 21 show details used for the drawing of negative totals,

Fig. 22 shows an elevation of the driving means for the return shafts of the tens transfer mechanism,

Fig. 23 is an elevation of the driving means for the locking bars of the totalizers,

Fig. 24 is a front view of the controlling mechanism for the totalizers,

Fig. 25 is a front view of the special differential mechanism for the selection of the totalizers,

Fig. 26 is a top view of Fig. 25, partly in section on line XXVI—XXVI of Fig. 25,

Fig. 27 is a section on line XXVII—XXVII of Fig. 1,

Fig. 27a is a detail belonging to Fig. 27,

Figs. 28 to 32a and Figs. 45 and 46 are details corresponding to Fig. 24, of the controlling means for the main totalizer,

Figs. 33 to 38 and 43 and 44 are details corresponding to Fig. 24, of the controlling means for the auxiliary totalizer,

Figs. 39 to 41 are elevations of the driving means for throwing-in the totalizers,

Fig. 42 is a front view of the controlling disks serving for destining the mode of operation of the totalizers,

Fig. 42a shows in detail the controlling disks of Fig. 42 in elevation,

Figs. 47 to 50 show the motor drive and its connections with the driving shafts of the machine,

Fig. 51 is a top view of the type wheel arrangement of the printing mechanism and of the positioning mechanism for the account numbers,

Fig. 52 is a top view of the control means for the printing mechanism and of the drive for said mechanism,

Fig. 53 is a top view of the control strip feeding mechanism,

Fig. 54 shows in elevation the connection of the drive of the printing mechanism to the main driving shaft of the machine,

Fig. 55 is an elevation showing the control strip feeding mechanism and the transport device for the book and the card,

Figs. 56 and 57 are elevations showing the connecting members between the type wheels and the differential elements, partly in section,

Fig. 58 is an elevation showing the drive for the control of the printing mechanism,

Figs. 59 to 66 are elevations, partly in sections, showing the driving and controlling means for the different sections of the printing mechanism,

Fig. 67 shows the impression on the card,

Fig. 68 shows that on the book,

Figs. 69 and 70 show impressions of two different kinds of ticket,

Fig. 71 shows the impression on the control strip,

Fig. 72 is a front elevation showing the

means mutually blocking the special or transaction keys,

Fig. 73 is a top view thereto,

Fig. 74 is a horizontal section on line LXXIV—LXXIV through the blocking means of the transaction keys, seen from the top,

Fig. 75 is a detail thereof,

Fig. 76 is a front elevation of the blocking means for the main keys,

Fig. 77 is a top view of the arrangement of the account keys and of the main driving shaft of the machine,

Fig. 78 is a rear view of the arrangement of the account keys,

Figs. 79 to 96 are sections parallel to the rows of keys of Fig. 72, all seen from the right,

Fig. 97 is the elevation of an item counter frame,

Fig. 98 is a detail thereto.

The book keeping machine hereinafter described is designed to take up the money transactions between an unlimited number of customers and a savings bank or bank. Each customer possesses an account number and the transactions in his account may take place by directly paying in or taking away amounts or by orders. For recording the transactions and the state of the account a continually impressed card and a continually impressed book are made use of, the card remaining in the office and the book remaining in the customer's hand. The book must be presented in the office for recording the amounts in consideration. In case this is impossible, for instance with orders, the record must be made on a later occasion.

For controlling the transactions, serves besides, a control strip on which all the operations necessary for this control of the machine are recorded. The machine further hands to the customer at each transaction a ticket whereon all the operations of the transaction are recorded. For the direct control of the set amount there is provided a display mechanism which may be read off both from the front and rear side of the machine.

One of the totalizers of the machine, the main totalizer, is designed to calculate a new state of account consisting of an old state and of the amounts received or paid out. Another totalizer, i. e. the auxiliary totalizer serves for calculating the arithmetic total from the amounts received and paid out in the different accounts of a determined book- ing period. Other totalizers, i. e. the transaction totalizers serve for controlling the single operations of the main totalizer, while in still further totalizers the amounts paid out and received relating to certain lines of business are added.

For setting the different operations of the machine keys are made use of exclusively,

some of said keys causing a plurality of operations to be executed simultaneously. These keys are connected by blocking means controlling the mode of each setting operation and the mutual conditions of the different transactions. Owing to these arrangements setting operations cannot be omitted in a transaction, as the machine cannot be started before all required setting operations have been made. A certain number of the keys are connected, for control purposes, with item counters. Each transaction to be executed by the machine, the total-taking included, requires an operation of the machine initiated by depressing a motor key. The machine is driven by an electric motor.

1. General arrangement

The setting mechanism of the machine (Fig. 1) consists of the amount keys 10, arranged in nine rows at the left-hand front part of the machine, of two rows of special keys 11 and 12, three rows of account totalizer keys 13 and of the motor key 14 at the right-hand front part of the machine. To the keys 13 are allotted the item totalizers 15 and to the six upper keys of the key row 11 are allotted item totalizers 16. The lower front part of the machine is occupied by the printing mechanism arranged across the machine (Figs. 1 and 27), said mechanism having at its upper side seven rows of keys 17 serving for setting the account number wheels. The key 18 is a general releasing key for the keys 17. In the upper part of the machine is arranged the display mechanism which may be read-off both from the front and rear side of the machine.

The left-hand part of the inner space of the machine is occupied by the amount differential mechanism and the totalizers, see Fig. 2. The complement of totalizers consists of: twenty-seven account totalizers which are superimposed so as to form three groups N_1 , N_2 , N_3 of nine totalizers each (Fig. 2); further: six transaction totalizers united so as to form a group S, an auxiliary totalizer HR arranged below said last-named group S and a main totalizer R. The main and auxiliary totalizers are designed to execute additions and subtractions while the other totalizers are adapted to be used for additions only. As will be seen from Fig. 2, each two groups of totalizers are supported on three blocks 19, 20, 21, the latter being fixed on parts of the frame 23 of the machine by means of screw bolts 22.

The right-hand part of the interior of the machine is taken up by the controlling devices for the totalizers, the blocking means for the special keys and by the driving mechanism.

2. Amount setting mechanism

Each row of the shafts 25 of the keys 10 (Figs. 2 and 27) has mounted beside it on rolls

26, 27 two bars, namely a locking bar 28 (Fig. 2) and a block bar 29 (Fig. 27), said bars cooperating with pins 30 mounted on the key shafts 25. Within the range of each key pin 30 the locking bar has a hook-shaped part 31 and, under the action of a spring 33, normally takes its lower end position in which it abuts against the guiding roll 26. The keys are mounted for horizontal shifting motion in a key board 34 and in bent-over portions of partitions 36. Springs 37 wound on their shafts keep them in their left-hand end position.

Upon depressing one of the keys 10 the bar 28 is pushed upwardly by the pin 30 engaging the oblique face of the hook-shaped portion and snaps downwardly as soon as the pin 30 has passed the point of the hook, thereby engaging with its hook-shaped portion 31 over the pin 30 and fixing the key in its setting position. In case another key 10 has been depressed in the same row, this latter key is released in the well-known manner by the upward motion of the bar 28.

A bow 39 is mounted on a fixed shaft 38 and is guided along prolongations 40 of the bars 28. This bow 39 carries on one side a roll 41 which is pressed by a spring against a cam disk 43 fixed on the shaft 42. This shaft 42 executes a revolution in anti-clockwise direction upon each operation of the machine. At the end of this revolution the cam of the disk 43 will engage the roll 41 and rock the bow 39 in clockwise direction, whereby all of the locking bars undergo an upward motion causing the release of the set keys. In order to release the set keys by hand, a general releasing key 44 is to be depressed (Fig. 1) which imparts to the bow 39 the rocking motion in clockwise direction required for the upward motion of the bar 28 in a manner not shown. Another bow 46 likewise mounted on the shaft 38 and provided with a roll 45 abuts against a cam disk 47 fixed on the shaft 42 under the action of a spring. Upon rotating the cam disk 47 the cross portion of the bow 46 engages over the hook-shaped lugs 48 of the bars 28 and keeps the latter in their lower end positions so that all of the keys are locked in their positions.

Above the roll 27 there is mounted in the frame of the machine a shaft 49 (Figs. 2 and 11) to which are rigidly connected arms 55 projecting into the range of the upper prolongations 50 of the bars 28. The shaft 49 is able to be rocked by the action of certain special keys, whereby the arms 55 engage over the prolongations 50 and cause a locking of the keys, like the bow 46.

The block bar 29, Fig. 27, shiftably mounted beside the bar 28 on the rolls 26, 27 has V-shaped recesses the oblique faces 56 of which cooperate with the key pins 30. A pin 58 of a lever 59 pivoted on the partition 36 engages a slot 57, Fig. 2, the other end of said

lever abutting against a pin 60 of a zero locking lever 62. This lever is pivoted on a shaft 61 and is acted upon in clockwise direction by a spring 51, see Figs. 11 and 13. A notch 63 of this lever 62 normally projects into the path of a pin 64 which is fixed on the differential member 65 belonging to the key row in question, said lever 62 locking the member 65 in zero position. A spring 66 attached between the frame of the machine and the lever 59 normally keeps the block bar 29 in its lower end position. Upon depressing a key the block bar 29 will be upwardly shifted by the pin 30 engaging the oblique face 56, whereby an anti-clockwise rocking motion is imparted to the zero locking lever 62 which thus releases the differential member in consideration.

In taking totals, in order to release all the members 65 before the beginning of the differential operation, there is mounted on the shaft 61 a bow 67 which engages behind lower prolongations 52 of the zero locking levers 62 and moves the notches 63 of said levers 62 out of the path of the pins 64 by an anti-clockwise rocking motion taking place with a rotation of the shaft 61.

3. Amount differential mechanism

In the rear of each row of amount keys are mounted, by means of cross bars 68, 69, 70, 71 (Figs. 2 to 5) and cross pieces 72, 73, differential elements, in particular: a locking member 74 (Fig. 4) rigidly mounted on the bars 68, 69, and showing at its upper portion recesses 75, a driving member 76 (Fig. 7) having a series of teeth 77 and shiftably mounted on the bars 70, 71 by means of slots 78, 79, a differential member 65, 80 (Fig. 5), a coupling member 81 and a setting member 82 (Fig. 8) for setting the display and printing wheels. The two parts 65 and 80 of the differential members (Fig. 5) which are shiftably guided on the rods 68, 70, 71, are connected to each other by a pin 83 carrying a rockable pawl 84 cooperating with the recesses 75 of the locking members 74 (Figs. 2 and 4). The differential member part 80 (Fig. 5) shows a rack 85, a straight face 86 and below the latter a circular guide formed by a recess 87 of the bar 80 and by a bracket 88 riveted to the bar 80. In a manner described hereinafter the differential member is in connection with the totalizers by means of the rack 85.

The part 65 of the differential member is provided, besides with the zero locking pin 64, with eight lugs 89 to 96 cooperating with the feet of the key shafts 25. The lugs 89, 92, 95, 96 are situated in the plane of the part 65 while the remaining lugs are bent over to the right or left (Fig. 6). The drawings show that the lugs are arranged in four different planes so that each of the lugs 89 to 96 will follow a special path upon positioning the

differential member 65, 80, and is able to cooperate only with the key foot allotted to it. The key feet are of corresponding length and are laterally bent correspondingly. The distances between the lugs 89 to 96 and the corresponding key feet are such as to cause the differential member when moving down to shift by the number of units corresponding to the depressed key. The shifting by nine units is not limited by the foot of the key 9 but by the rod 68 striking the upper wall of the guide slot of the differential member part 65.

The pawl 84, Fig. 5, has mounted on it a roll 97 engaging a curved slot 98 (Figs. 8 and 2) of the coupling member 81. This coupling member is shiftably mounted on the bars 70, 71 and is connected by a spring 99 to the differential member 65, 80. The spring 99 causes the roll 97 to normally abut against the lower wall of the slot 98, the pawl 84 being disengaged from the locking member 74 (Fig. 2). The coupling member 81 has mounted on it by means of a pivot 100 (Figs. 8, 9, 10) a rotary body which consists of a semi-circular lug piece 105, 106, cooperating with the straight face 86 (Fig. 5) and the recess 87 of the part 80 of the differential member 65, 80, of a cylindrical part 107 cooperating with the recess of the bracket 88, and of a toothed wheel 108 permanently in mesh with the teeth 77 (Figs. 7 and 3) of the driving member 76. The driving members 76 are connected by a return rod 110 (Fig. 7) cooperating with lugs 111 of the parts 80 of the differential members (Fig. 5) and with lugs 112 of the coupling members 81 (Fig. 8).

The return rod is supported on two rack bars 113 (Figs. 12, 11) arranged at the outer side of the differential mechanism and guided by slots on the cross bars 70, 71. The rack bars 113 are in mesh with differential wheels 114 which are mounted on a cross head 115 and, in their turn, are in mesh with stationary racks 116. The cross head 115 is shiftably mounted in vertical guides 118 of the frame of the machine by rolls 117 and is connected at both sides by thrust bars 119 to arms 121 rigidly mounted on a shaft 120.

One of the arms 121 is in connection, by a rod 122, with a three-armed lever 124 mounted on a shaft 123, the upper arms of said lever 124 carrying rolls 125, 126 cooperating with cam disks 127, 128. These disks are fixed on a shaft 42. By two toothed wheels 129 likewise fixed on the shaft 42 the rotation of the latter is transmitted, by means of intermediate wheels 130 loosely mounted on the shaft 120, to wheels 132 mounted on pins 131 of the frame of the machine, said wheels 132 carrying a curve piece 133 cooperating with a roll 134 of the racks 113.

The described differential mechanism works as follows:

In the position of rest the return rod 110

(Fig. 2), the driving member 76, the coupling member 81 and the differential member 65, 80 take their upper end positions. The pawl 84 is out of mesh with the rack 75, the radial face 106 of the body 105, 106 abuts against the straight face 86. When one of the keys 1 to 9 has been depressed and thereby the pin 64 has been released by the zero locking lever 62 in the known manner, the machine begins to operate. With this operation the shaft 42 (Fig. 12) makes a revolution by which a down and up motion is imparted to the cross head 115 by the intermediary of the thrust bars 119, the rod 122, the three-armed lever 124 and the cam disks 127, 128. With this motion the differential wheels 114 mounted on said cross head 115 roll along the stationary racks 116 and cause a down and up motion of the racks 113, of the return rod 110 and of all the driving members 76 by an amount which is double as great as the motion of the cross head itself. With the downward motion the driving member 76, the coupling member 81 and the differential member 65, 80 of each position of numeral value form a solid system, owing to the driving member 76 being in mesh with the wheel 108 of the body 105, 106 by its teeth 77 and this body being unrotatable for the present, as its radial face 106 is kept engaged with the notch 86 by the action of the spring 99 between the coupling member 81 and the differential member 65, 80.

When the lug corresponding to the depressed key, of the lugs 89 to 96 of the differential members reaches the key foot set into its path, the differential member is stopped, while the coupling member 81 is still taken along, overcoming the action of the spring 99. When this takes place, the roll 97 of the pawl 84 moves from the lower part of the curved slot 98 into the upper part thereof, whereby the pawl 84 comes to engage the rack 75 and the differential member 65, 80 is locked in its setting position corresponding to the depressed key (Fig. 3).

With the relative motion between the differential member 65, 80 and the coupling member 81 the radial abutting face 106 glides from the straight notch face 86 of the differential member, without rotation of the lug piece 105, 106. As soon as the uppermost edge of the face 106 reaches the recess 87, the said lug piece will begin to rotate. With this rotation the semi-circular abutting face 105 engages the recess 87 and the cylindrical part 107 engages the recess of the bracket 88, thus blocking the coupling member with the differential member, while the driving member moves to its lower end position. The uppermost edge of the radial face 106 and the face connecting the faces 86 and 87 (Fig. 5) are of such a shape as to cause the arrest of the coupling member 81 to take place gradually.

Before the beginning of the return move-

ment of the differential mechanism the totalizers to be thrown-in are coupled with the differential members 65, 80 in order to introduce the amounts. In the upward motion of the return rod 110 and of the driving members 76 now taking place the differential members 65, 80 and the coupling members 81 first remain in their setting position, the lug pieces 105, 106 rotating under the action of the engagement between the parts 77, 108, until the radial face 106 lies in the same plane as the notch 86. Thereupon the coupling members 81 are taken along by the return rod by means of the lugs 112. This causes the pawl 84 to come free from the rack 75 and the spring 99 to become relaxed, while the differential members 65, 80 are still at rest. The return rod 110 now reaches the lugs 111 of the members 65, 80 and moves the latter back into their initial position, the differential motion of the coupled totalizers thus taking place.

4. Positioning the display and printing wheels

The member 82 which is shiftably mounted on the cross bars 68, 69 (Fig. 8) is provided at its upper portion with a series of teeth 135, engaging one of the differential wheels 136. The latter is in engagement with a series of teeth of the coupling member 81. The differential wheel is laterally held in position by means of two disks 138 fixed at its front faces (Figs 8 and 13) and gripping over the coupling member 81 and the member 82. The axle taps 139 projecting beyond the disks 138 cooperate with corresponding recesses 140 (Figs. 2 and 13) of the solid cross piece 72 and with recesses 141 of the upwardly and downwardly movable cross head 115. The upper end of the member 82 has pivoted on it a rack 142 guided by a roll 143 and engaged by a toothed wheel 145 connected to the display wheel 144. The lower ends of the members 82 have teeth 146 by means of which they are in permanent connection to the corresponding type wheels of the printing mechanism.

The positioning of the display and printing wheels is effected directly from the old position into a new one, that is to say without return to zero position. When the member 82 takes its lower end position which corresponds to the zero position of the display and type wheels, and the coupling member 81 takes its upper end position (Fig. 6) the taps 139 are a certain distance away from the recesses 140. This distance amounts half the way required by the coupling member 81 for being locked with the differential member which is to be imagined stationary. When, therefore, the positioning member is standing on zero and the differential member 65, 80 is locked in zero position, the taps 139 will rest on the recess 140. If, then, in the further

course of the operation of the machine, the cross head is moved downwardly in the described manner that its recess 141 strikes the taps 139, no alteration will arise as to the set position of the differential member 65, 80. The display and printing mechanism remains in zero position, as it will correspond to the position on zero of the differential member 65, 80. In the following operation of the machine, upon setting the differential member 65, 80 to a figure, for instance, to 6, the coupling member 81 will move by 6 units, adding further the amount serving for locking it with the differential member. The differential wheel 136 is therefore rotated, after having engaged the recess 140 by its tap 139, by the coupling member 81 by six units whereby the display and printing wheels are set to 6 by means of the members 82.

Upon the return movement of the differential mechanism the coupling member moves upwardly by six units and by the said locking amount. Before the beginning of the return motion of the differential mechanism the positioning members are locked in the set position. During said return motion the differential wheel 136 rolls along the member 82 which is at rest, so that, in the position of rest of the machine, the taps 139 are at a distance from the recess 140 which corresponds to the position of the display and printing wheels, set with the preceding operation of the machine.

In case the figure which is set in the following operation of the machine is greater than that set before, for instance 9 instead of 6, the differential wheel first moves by six units and by the locking amount downwardly until its tap 139 abuts against the recess 140, without acting upon the member 82 which has been unlocked in the meantime but remains in its position owing to its greater inertia. When the tap 139 has reached the recess 140, the differential wheel rotates by three units which are transmitted to the member 82 by lifting it by three units and bringing the display and printing wheels directly from the position 6 into the position 9. In case, however, the figure set in the following operation of the machine is less than the preceding, for instance 2 instead of 6, the differential wheel 136 will move downwardly under the action of the coupling member 81, by two units without influencing the positioning member. In this case with the downward motion of the cross head the differential wheel 136 is taken along to its lower end position and rolls along the coupling member 81 which has been locked in the meantime, the member 82 thus being moved downwardly by four units and the display and printing wheels reaching directly from position 6 to position 2. As will be seen the positioning of the display and print-

ing wheels takes place during the positioning motion of the differential mechanism.

5. The totalizers

The four groups of account totalizers and transaction totalizers N_1 , N_2 , N_3 , S (Fig. 2) supported by the removable blocks 19, 20, consist of nine adding mechanisms each, the counting wheels 149 of which (Fig. 15) of the same order are loosely arranged on the prolonged hub 150 of a differential wheel 154 which is common to the totalizers of the same order of the group in consideration. Only the first six transaction totalizers of the lower group S of the transaction totalizers are made use of for the transactions to be recorded by the machine. The remaining three totalizers are not used and are built in for fabricatory reasons only.

The differential wheels 154 are mounted for loose rotation on partitions 155 of the frame 23 of the machine. The counting wheels 149 (Fig. 14) show on their inside ten recesses 156 and outside ten notches 157 and a tens transfer tooth 158. A rider 159 is adapted to cooperate with the recesses 156, said rider being non-shiftable but rotatably held in a circular groove 160 of a rider axis 161 loosely passing through the differential wheels and projecting through a longitudinal slot 162 (Fig. 15) of the hub 150. The riders 159 are arranged at a distance apart on the axle 161 corresponding to the distance of the numeral positions of the several groups of counting wheels, so that with an axial shifting motion of the axle 161, the right-hand first, second, third, etc., counting wheels of each order will be coupled successively with their differential wheels 154. The differential wheels 154 are permanently in mesh with the teeth of the differential members 65, 80 by means of spur gears 164, 165 which are mounted on a carrier 163 of the next lower order (Figs. 14 and 15). The differential wheels have been cut out at each third tooth to make notches 166 similar to the notches 157.

A locking bar 168 cooperates with the notches 157, said bar being axially shiftable and rigidly connected to the rider axle 161 by a traverse 167 (Fig. 15). This bar 168 has recesses 169 allowing for the passage of the tens tooth 158 and arranged accurately opposite the riders 159, so that in every position of the axle 161 all the counting wheels 149 are locked against rotation, excepting that which is coupled by the corresponding rider with its differential wheel 154.

During the shifting motion of the rider axle 161 and of the locking bar 168, which may take place at three different moments as will be described hereinafter, the counting and differential wheels are alined with one another by means of an adjusting beam 170 (Figs. 14, 15, 2). These beams 170 are

mounted by arms on shafts 171 rotatably carried by the frame 23 of the machine. In the same manner as with the transaction totalizers and the account totalizers there are provided such beams 170 also with the auxiliary totalizer HR and the main totalizer R (Fig. 2). In order to simultaneously rock inwardly all the beams 170 and in particular, to rock those of the totalizers N₁, N₂ and HR downwardly and those of the totalizers N₃, S and R upwardly, the shafts 171 are provided, on the left-hand side of the totalizers, with arms 172 (Figs. 23 and 13) which are connected by rods 173, 174. The two middle arms carry prolongations 175 connected to one another by a rod 176. A thrust bar 178 is attached to the upper pivot pin 177 of the rod 176, the lower end of which thrust bar is connected with a double lever 180 loosely mounted on a fixed pin 179 of the frame. A roll 181 of this double lever 180 engages a curved groove 182 of a cam disk 183 which is rigidly mounted on the driving axle 42. The curved groove is of a shape such as to cause the beams 170 to execute three oscillations on each operation of the machine.

6. The tens transfer mechanism

This mechanism is illustrated in the Figures 14 and 15. The carrier 163 of the intermediate wheels 164, 165 is mounted on the partitions 155 (Fig. 15) coaxially with the rider axle 161. This carrier has a curved slot 184 (Fig. 14) engaged by a roll 185 of a bow-shaped rocking piece 187 which is loosely rotatable on the shaft 186. The rocking piece 187 has a transfer trip tooth 188 extending along the nine counting wheels 149 of the order in question, and a series of teeth 189 engaged by a toothed wheel 191 mounted for rotation on the fixed shaft 190. An arm 194 is pivoted on a pin 192 of an arm 193 which is connected to the toothed wheel 191, the lower end of said rod 194 being connected by a pin 195 to a bow 197 rotatable on the shaft 196. A spring 198 the one end of which is attached to a slot of the shaft 196 and the other end of which engages the pin 195, tends to turn the bow 197 in anti-clockwise direction (Fig. 14) the rod 194 abutting with a face 199 against the shaft 190 as long as no tens transfer takes place.

The shaft 196 has rigidly mounted on it return arms 200 cooperating with pins 205 of the rocking pieces 187. In order to enable the shafts 196 to rotate simultaneously for returning the actuated tens transfer members, these shafts 196 engage, by means of spur wheels 206 mounted on their left-hand ends (Figs. 15, 22, 13) a rack 208 which is vertically guided by pins 207 on the frame of the machine. The rack 208 is connected, by a rod 209 (Fig. 22) to an angle lever 210

mounted on a pin 179, the other end of said lever engaging by a roll 211 a curved groove 212 of the cam disk 183.

In the position of rest of the machine the rider axle 161 takes its right-hand end position, (Fig. 15), in which the riders 159 are disengaged from the toothed wheels 149 and engage the differential wheels 154. When an amount is to be introduced in one of the counters which is selected by depressing the corresponding key 11, 13, then the rider axle 161 remains, during the downward motion of the differential members 65, 80, in the position of rest so that the differential wheels 154 are rotated idly by the intermediary of the intermediate wheels 164, 165 in clockwise direction (Fig. 14). Before the beginning of the differential motion (upward motion) of the differential members 80, the axial shifting motion of the rider axles takes place in a manner hereinafter described and according to the set counter key 11, 13, so that the counting wheels 149 of the corresponding account totalizer are coupled with their differential wheels 154 by the riders 159. While during the differential motion of the differential members all of the counting wheels 149 were locked by the locking bar 168, now those wheels 149 which are coupled with the differential wheels 154, are released by the recesses 169 of said locking bar. Upon the motion of the differential members the coupled counting wheels 149 are rotated in anti-clockwise direction by the amount set by the amount keys 10.

In the initial position the tens transfer members assume the position as in the upper totalizer of Fig. 14. The line connecting the pins 192, 195 is situated on the right of the middle of the shaft 190, whereby the lug 199 abuts under the action of the spring 198 against the shaft 190 and the roll 185 lies in the left-hand part of the slot 184 which is concentric to the shaft 186. By this the intermediate wheels 164, 165 are held in their upper end positions.

When, during the actuating operation, a transfer from 9 to 0 takes place in one of the counting wheels 149, the tens transfer tooth 158 of this totalizer strikes the transfer trip tooth 188 and pushes it into the position as illustrated in the lower totalizer of Fig. 14. When this takes place, the rocking piece 187 is swung out and turns the arm 193 by intermediary of the teeth 189, 191 against the action of the spring 198 to such an extent, that the line connecting the pins 192, 195 is shifted the left of the shaft 190, so that the rocking piece 187 is able to complete its turning motion initiated by the tens transfer tooth, in clockwise direction and the roll 185 occupies the right-hand portion of the slot 184 which portion is concentric to the shaft 186 when the rocking piece 187 is in operating position. While the roll 185

moves from the left-hand into the right-hand portion of the slot 184, an anti-clockwise turning motion is imparted to the carrier 163 whereby the intermediate wheels 164, 165 are brought into their lower end positions. While the wheel 164 is rolling along the bar 80, the wheel 165 causes the differential wheel 154 of the next higher order to execute an additional turning motion by one unit, no matter whether the member 80 is stationary or still in motion. The tens transfer operation is thus accomplished, in which, as evident, the preparation and the action coincide with the amount differential actuating operation.

The return of the displaced tens transfer members 187, 188, 163, 193, 194, 197 takes place during the first part of the next operation of the machine before the positioning of the actuating members. At this time the rider axles 161 take again their right-hand end positions, in which the counting wheels 149 are locked by the bars 168. The cam disk 183 (Fig. 22) causes a rapid downward motion of the rack 208, whereby all the shafts 196 together with the arms 200 (Fig. 14) are rocked in clockwise direction. When this takes place, the arms 200 engage the pins 205 and bring the rocking pieces 187, the arms 193, the rod 194 and the bow 197 back into their initial positions, as illustrated in the upper totalizer of Fig. 14.

As will be seen from the shape of the curved groove 212 (Fig. 22) the return arms 200 will be slowly brought back into their lower end position during the whole further part of the operation of the machine. As the shafts 196, which have fixed to them the ends of the springs 198, are first rotated in clockwise direction, said springs 198 will thereby be relaxed. In this manner the return of the displaced tens transfer member is effected without overcoming the sum of the actions of the springs 198 and can therefore take place within the short time at disposal, without any unequal effort of the driving mechanism of the machine.

The springs become tensioned by turning back the shaft 196, upon the downward motion of the return arms 200 which, as will be seen from the shape of the curved groove 212 (Fig. 22) takes place slowly and during a rather long section of the operation of the machine. At the beginning of the next differential motion of the differential mechanism the springs 198 are tensioned so that a new tens transfer operation is able to be effected in the described manner.

7. Drawing totals

When the grand total is to be drawn from one of the account or transaction totalizers, the selected totalizers are coupled with the differential members by shifting the rider axles 161, before the positioning motion of

the differential mechanism. Any depressing of amount keys 10 is prevented by rocking the arms 55 (Fig. 2) over the prolongations 50 of the locking bar 28; the differential members 65, 80 are released in the described manner by rocking the zero locking levers 62 by means of the bow 67 (Fig. 2).

Upon the downward motion of a differential member 65, 80 the wheel 149 coupled therewith will turn in clockwise direction up to its zero position in which the tens tooth 158 (Fig. 14) strikes from above its zero stop tooth 188. This is the same tooth referred to above as the transfer trip tooth and it will be noted that it has the two functions of tripping the tens transfer mechanism and stopping the wheels at zero in total taking. This latter not being able to give way downwardly owing to the lug 199 abutting against the shaft 190, the wheel 149, and therewith the differential member, will be stopped and locked, exactly as in the setting of an amount, by the coupling member 81 being caused to execute its locking movement by means of the driving member 76. During this operation the differential member travels through a distance corresponding to the amount which was contained in the counting wheel. The positioning of the total amount in the display and printing wheels takes place in the manner described for positioning them for an amount entered.

At the end of the positioning motion of the differential members 65, 80 the rider axles 161 are transferred into their right-hand end positions so that the counting wheels from which the total has been drawn remain in zero position, while the differential members are brought back to their initial positions.

In case a sub-total is to be taken, which means that the counting wheels are to be brought back again into the position they assumed before the drawing of the total was begun, the uncoupling of the counting wheels from their differential members is effected only after the return motion of the differential members is accomplished.

The machine has nine rows of amount keys, while the totalizers and the display and printing mechanism have ten numeral positions. In order to be able to draw the total from the counting wheels of the highest position, there is arranged still a tenth differential member 65, 80 (Fig. 11) fitted in the same way as the other members 65, 80, but not co-operating with any key.

8. Main totalizer and auxiliary totalizer

In the lower block 21 (Fig. 2) are lodged the two totalizers for additive and subtractive calculations, the auxiliary totalizer HR and the main totalizer R. As both these totalizers are identical as to their construction, only one of them, the auxiliary totalizer, is

described hereinafter, the reference letters denoting the corresponding parts of the main totalizer being provided with an index (').

5 As in the account and transaction totalizers there are provided differential wheels 214 (Figs. 16 and 17) which are permanently in mesh with the differential members 65, 80
10 by means of intermediate wheels 164, 165. The latter are mounted on carriers 163 of the next lower numeral position. The hubs 215 of the differential wheels 214 have loosely mounted on them bevel wheels 216, 217, which have rigidly connected to them, by pins 218,
15 the counting wheels (adding and subtracting wheels 219, 220 respectively). These adding and subtracting wheels have ten recesses 221 (Fig. 17) with which cooperate riders 223 projecting through a slot 222 of the hubs 215. The riders 223 are mounted for rotation in circular grooves of the rider axle 224 (Figs. 2 and 17). By shifting this axle 224 they can be brought into engagement either with the adding or with the subtracting
20 wheels or be transferred into an idle position where they are disengaged from the counting wheels. The two bevel wheels 216, 217 are permanently in mesh with one another by a reversing wheel 226 (Figs. 16, 17, 18) which is mounted on a sleeve 228 rigid with a bar 227.

The adding and subtracting wheels 219, 220 as well as the differential wheels 214 have at their peripheries locking notches 229 with
25 which a locking beam 170 fixed to the shaft 171 is able to cooperate. The beams 170 for the main totalizer and for the auxiliary totalizer are provided with recesses 230 (Fig. 17) in order not to hinder, in the locking position of the beams 170, the free rotation of the bevel wheels 216, 217. The adding wheel 219 has a tens tooth 231 and the subtracting wheel 220 a tens tooth 232 (Fig. 17). With exception of the transfer trip tooth the details of the tens transfer mechanism are the same as in the account and transaction totalizers and are similarly denoted. In the present case the transfer trip tooth 233 (Figs. 16, 17) is not rigidly connected to the rocking piece 187, but embraces by a recess 234 a cross part 235 of said piece 187, thus being shiftably connected to the latter but not capable of rotating alone. Its lateral position is determined by the shaft 236 of the rocking piece on which said transfer trip tooth 233 is rotatably held between washers 237 (Fig. 16). The shaft 236 is rigidly connected to the rider axle 224 by an arm 238 so as to take part in the axial shifting motions of the latter. The transfer trip tooth 233 is arranged in a plane with the riders 223. If, therefore, one of the counting wheels 219, 220 has been coupled with the differential wheel 214 by the rider 223, also the transfer trip tooth 233 stands in the plane of said counting wheel.

Upon a pair of adding or subtracting wheels 219, 220 being positioned to zero, the tens tooth 231 of the adding wheel is just above the transfer trip tooth 233, while the tens tooth 232 of the subtracting wheel takes the position shown in Fig. 17 (upper totalizer).

In order that the mode of operation of the described arrangement may be more readily understood, one may imagine numeral drums to be rigidly connected to the adding wheels 219, which drums may be read off through display holes of the frame and the figures of which increase in additive sense upon adding rotation of the adding wheels. Then it will be evident, that upon the adding wheels 219 being coupled with the differential wheels 214, the differential operation and the tens transfer operation take place as with one of the account totalizers. In this operation the revolutions of the adding wheels 219 are taken part in by the subtracting wheels 220 but, due to the action of the reversing wheels 226, in opposite direction.

If, however, the subtracting wheels 220 are coupled with the differential wheels 214, the actuation and the tens transfer of the imagined numeral drums take place in opposite direction, that is to say in subtractive sense.

9. Mechanism for drawing negative totals

The main and the auxiliary totalizer are provided with devices enabling the transmission of the totals contained therein, even in case it is a matter of negative values, to the printing mechanism, as to the absolute value of these totals.

If the totalizer contains a positive total, then the tens teeth 231 of the several adding wheels 219 are distant from the zero stop teeth 233 by spaces which correspond to the several digits of the sum. By returning the tens teeth 231 in subtractive rotary direction up to the zero stop tooth, the sum in question is transmitted to the printing and display mechanism. If, however, the totalizer contains a negative total, then the tens teeth 231 are distant from the zero stop teeth 233 by spaces which correspond, in the right-hand positions up to the first position containing a digit greater than zero, to the complements which must be added to the absolute values of the negative total for those positions to make 10, and which correspond in the remaining positions to the complements which must be added to the absolute values of the negative total for said remaining positions to make 9. Upon drawing the total by means of the adding wheels 219 a certain complementary value therefore would be transmitted to the printing and display mechanism. If, for instance, the negative total has the value of -560, the number 9,999,999,440 would be transmitted. As will readily be understood, the tens teeth

232 of the subtracting wheels are away from their zero stop teeth each at a distance corresponding to the complement which must be added to the distance separating the tens teeth 231 of the adding wheels 219 from the zero stop tooth 233 to make 9, both distances measured in clockwise sense in Fig. 17. If, therefore, instead of the adding wheels 219 the subtracting wheels 220 are coupled with the differential wheels 214 upon drawing a total, then, for the example chosen, the value 0,000,000,559 is transmitted to the printing and display wheels. This amount is in every case by one unit less than the absolute value of the negative total. In order to rectify this amount, there is provided in the units position a subtractive tens transfer device. In order to be able to rightly continue the calculation, this subtractive tens transfer must be restored again, after the negative total has been drawn, by an additive tens transfer.

In the present machine an arrangement has been made enabling the supplemental subtractive tens transfer to be utilized in case the total contained in the totalizer becomes negative. This will occur in case an amount is being subtracted greater than a positive amount just contained in the totalizer. When this takes place the counting wheel of the highest order will execute a passage from 0 to 9. Inversely, the additive tens transfer will be utilized in case the negative total goes over into a positive one, that means upon the passage of the counting wheels of the highest order from 9 to 0.

The supplementary tens transfers to the units position are thus rendered independent of the normal passages of the counting wheels of the highest order upon continued addition or subtraction, the arrangement being such as to cause all the passages from 0 to 9 and from 9 to 0, not due to the change in sign of the total, but occurring with the ordinary surpassing of the range of positions of the totalizer to be without influence on the operation of the supplementary tens transfer.

The arrangements used for the operations hereinbefore explained are illustrated in Figures 16 to 20. The highest position of numeral value of the main totalizer and auxiliary totalizer (Fig. 16) is fitted with the tens transfer mechanisms 233, 235, 193, 194, 197, 198, 200. In contradistinction to the other positions the roll 185, the carrier 163 and the intermediate wheels 164, 165 are dispensed with. Therefore the rocking piece 187 has a downward projection 241 fitted with a pin 240 (Fig. 17). This pin 240 engages the slot 242 of a rod 243 which is pivoted to an arm 245 rigidly connected to a transmitting shaft 244. In front of the units position (Fig. 16) are arranged the tens transfer members 163, 164, 165, 185, 187, 193, 194, 197, 198. As in the other positions the intermediate wheels 164, 165 connect the differen-

tial member 80 to the differential wheel 214 of the units position. The rocking piece 187 has, as in the highest position, a downward projection 246 (Fig. 16) which is connected with a rigid arm of the transmitting shaft 244 by the pin and slot connection 247, 248 and a rod 249.

When a passage takes place in the counting wheel of the highest order, the rocking piece 187 is turned in clockwise direction, the pin 240 striking against the left-hand wall of the slot 242 and imparting, upon its further motion assisted by the spring 198, a clockwise rotation to the transmitting shaft 244 by means of the rod 243 and the arm 245. This rotation is transmitted, by means of the arm 250 and the rod 249 to the piece 187 arranged in front of the units position, and causes the spring 198 and the other tens transfer members to be released, whereby a supplementary unit is transmitted to the differential wheel 214 of the units position. When this transmitting motion is accomplished, the parts take the position according to Fig. 17 (lower totalizer).

The sign of the unit transmitted supplementarily depends on the position of the corresponding rider axle 224. If this axle is in adding position, only positive passages can arise, that is from 9 to 0. Accordingly the unit annexed in the units position is a positive one. If the rider axle is in subtractive position, only negative passages, from 0 to 9, will arise; the unit annexed in the units position is a negative one.

On the right-hand end of the transmitting shaft 244 (Figs. 16 and 20) is loosely mounted a ratchet wheel 255 which cooperates with a pawl 257 mounted on a rigid arm 256 of the shaft 244, and with a counter pawl 258 mounted on the frame of the machine. The ratchet wheel 255 is rigidly connected with spur wheels 259, 260, one of which is in mesh with a spur wheel 262 mounted on the frame of the machine and provided with a cam hub 261, while the other spur wheel engages a spur wheel 263 likewise mounted on said frame. The bearing pin 264 rigidly connected to the spur wheel 263 carries on its other end a fixed differential disk 265 having two recesses 266, this disk serving, as hereinafter described for automatically bringing the rider axles 224 into the subtractive position upon a negative total being made.

The cam hub 261 is provided with four cams 267, displaced from one another by 90° and arranged in two planes. They cooperate with a lug 268 (Fig. 19) of the arm 238 which latter is laterally shiftable together with the rider axle 224. In the subtracting position of said axle 224 the lug 268 lies in the plane of the left-hand pair of cams, in the adding position of said axle in the plane of the right-hand pair. If the rider axle 224 takes the adding position, one of the cams

267 rests, in the initial position of the parts, on the lug 268 (Fig. 19) so that the transmitting shaft 244 is locked against a clockwise rotation.

5 When a passage from 9 to 0 takes place in the highest numeral position which passage in the present case can only be caused by a surpassing of the range of the numeral positions, as the totalizer has been actuated for
10 addition, then, in accordance with the foregoing explanations, no supplementary unit will be transmitted to the units position. The complete rocking motion of the piece 187 of the highest numeral position is hindered by the transmitting shaft 244 being
15 locked. The same will take place in case further passages arise due to surpassing of the range of the numeral position.

If, now, the rider axle is displaced into the
20 subtracting position and the first passage from 0 to 9 occurs in the calculation, this passage is caused by a change in sign of the total. In this case the transmitting shaft 244 is not in locked state. On the contrary,
25 owing to this passage a unit is transmitted in subtractive sense to the units position. With the partial rotation of the shaft 244 in clockwise direction then taking place, the pawl 257 and the ratchet wheel 255 together with the cam hub 261 are turned so far
30 as to cause one of the cams 267 to abut on the lug 268 and thus to lock the transmitting shaft 244. In case further passages will occur with this subtracting position of the rider
35 axle 224, the same are due to subtractive surpassings of the range of numeral positions of the machine, and do not cause a unit to be annexed in the units position. Only if the rider axle takes again the adding position,
40 the shaft 244 is able to additively annex a unit to the units position, upon the first passage in the highest numeral position of the totalizer due to the change of the negative total over into a positive one. When this takes
45 place, one of the cams 267 will again reach the lug 268. Upon continuing the calculation, the described operation will be repeated.

10. Totalizer controlling mechanism

50 As described, the several totalizers are brought into and out of connection with the differential members 80 by shifting the rider axles 161, 224, 224'. In the four upper groups of totalizers this shifting of the rider axles
55 161 causes at the same time the selection of the totalizers, in the lower two totalizers, the positioning for addition or subtraction.

The rider axles 161 are so connected, by cross pieces 270 (Figs. 15, 24), to shafts 271
60 (Fig. 24) mounted in the frame of the machine and carrying step drums 272 that the latter are freely rotatable but must take part in the axial shifting motions of the rider axles 161. There are further provided differential shafts 273, 274 the squared ends of

which project into said step drums 272, said shafts being mounted in the machine frame and in a partition 276 supported by bolts 275.

The step drums 272 are shiftably mounted
70 on the differential shafts 273, 274, which latter are permanently in mesh by means of spur wheels 277 with vertically shiftable racks 278 (Fig. 26). The racks 278 are pivoted by bows 279 (Figs. 25, 26) to the setting members 82' of the special differential
75 mechanism arranged behind the key rows 11, 12, 13 (Fig. 1).

This special differential mechanism (Figs. 25, 26) is of a construction similar to that of the amount differential mechanism (Fig. 80' 13). The reference letters of identical parts are the same but are provided in the special differential mechanism with an index ('). In correspondence with the five rows of keys 11, 13, 12 (Fig. 1) the special differential
85 mechanism has five groups of differential elements. The differential member allotted to the keys 11 is denoted by 251, 80' (Fig. 25), that allotted to the keys 13 by 253, 80' and that allotted to the keys 12 by 252, 80'.
90 The differential members are held in their position of rest by zero pawls 62' as long as no key of the row in question is being depressed. Among the keys 12 only those denoted by N, ZS and ES cooperate with the
95 differential member 252, 80' so that the differential member 252, 80' is able to assume, besides the zero position, still three other differential positions only. The keys L and M are without influence on the pawls 62' of
100 this row of keys. The same is the case as to the relation of key L of the row of keys 11 to the differential member 251.

The differential member parts 80' are not fitted with a series of teeth corresponding to
105 the teeth 85. The locking members 74', driving members 76', coupling members 82' and differential wheels 136' are identical with the corresponding parts of the amount differential mechanism so that it is not necessary to
110 describe them and their mode of function in detail.

The driving motion of the special differential mechanism is effected in the same way
115 as that of the amount differential mechanism by means of a cross head 115' (Fig. 25) which is vertically guided by rolls 117' on parts 280 of the machine frame and is moved down and up during the operation of the machine by means of rods 119', a three-armed
120 lever 124' and curved disks 127', 128' mounted on the main shaft 42. The curved disks 127', 128' are however so shaped that the positioning motion for the differential and positioning members of the special differential
125 mechanism takes place at the beginning of the operation of the machine and has been accomplished before the positioning motion of the amount differential mechanism begins. The setting members 82' (Fig. 26) are
130

brought from the old position directly into the new one in the manner described with the amount differential mechanism. Upon setting the setting members also the step drums 272 (Fig. 24) are so turned by means of the racks 278, spur wheels 277 and differential shafts 273, 274 that the step 281 corresponding to the depressed key takes its working position. The steps 281 are arranged along screw lines on the periphery of the drums 272 and are all of the same thickness.

Mounted vertically on two carriers 282, 283 (Fig. 27) is a shaft 284 to which is imparted, by means of a pair of bevel wheels 285, 286 and of two toothed segments 287, 288, a swinging motion from a shaft 289 mounted in the frame of the machine.

The shaft 284 has rigidly mounted on it four arms 290 which embrace axially shiftable rods 291 (Figs. 26, 27) and are permanently connected to these rods by means of pins 292 and squared pieces 293 mounted thereon and engaging slots 294 of the arms 290. Fingers 295 arranged on the rods 291 project into the path of the steps 281 and of a flange 296 of the step drums. A stop 297 (Figs. 26, 43) is fixed on the frame of the machine within the path of the fingers 295. In the position of rest the arms 290, the rods 291 and the fingers 295 take their extreme right-hand position (Fig. 26) in which also the step drums 272 and rider axles 161 are kept by the finger 295 co-operating with the flange 296 of the step drums (position of the two upper step drums in Fig. 24). After the rotation of the step drums according to the key depressed in the allotted row of keys, has taken place, the arms 290 are brought into their left-hand end positions (Fig. 26) by the shaft 289 rocking (Fig. 27), in which position the fingers 295 approach the fixed stop 297 till they are separated by the thickness of a step. At the end of the swinging motion of the arms 290 the steps 281 lying in the path of the fingers 295 are positioned between the stops 297 and the fingers, whereby the step drums and rider axles have been brought into their positions corresponding to the depressed totalizer keys. Herewith also the totalizers which correspond to the depressed keys have been coupled with the differential mechanism. Upon the arms 290 returning to their initial positions the uncoupling of the totalizers from the differential mechanism is effected.

The rider axles 224, 224' of the auxiliary totalizer and of the main totalizer are adapted to assume three different positions by means of the control mechanism. The extreme right-hand position (Fig. 16) is the idle position in which the totalizer is thrown-out, the medial position is the adding position and the extreme left-hand position is the subtracting position.

The positioning of the axles 224, 224' is

controlled by two mechanisms independent of one another. One of them determines the adding or subtracting position while the other determines the thrown-in or idle position.

Besides the four arms 290 (Fig. 27) the shaft 284 has mounted on it a fifth arm 298 (Fig. 33) adapted to position the rider axle of the auxiliary totalizer, which arm, like the arms 290 is attached to a rod 291 having a finger 295.

The lower extremity of the shaft 284 (Fig. 27) loosely carries a sleeve 299 which has fixed to it a sixth arm 300 and a bevel wheel 305. The arm 300 is in connection with the rod 291 the finger 295 of which is adapted to act upon the controlling parts for the rider axle 224' of the main totalizer. The bevel wheel 305 is connected by means of a bevelled segment 306 and two toothed segments 307, 308 to a controlling shaft 304 to which an oscillating motion can be imparted independently of the controlling shaft 289. While the upper four groups of totalizers and the auxiliary totalizer are controlled in common from the shaft 289, the shaft 304 controls merely the main totalizer.

The rider axle 224 of the auxiliary totalizer is so connected, by a cross piece 303 (Fig. 33) to a shaft 311 having two steps 309, 310 as to cause said rider axle to take part in all the shifting movements of the shaft 311, but to permit the latter to turn independently of the rider axle. On the shaft 311 is rigidly fixed an arm 312 (Figs. 24, 33, 44) which is in connection, by means of a pin 313 and an angle lever 315 loosely rotatable on a shaft 314, with a controlling slide 316. As described hereinafter this slide 316 is adapted to so adjust the shaft 311 that either step 309 (subtracting position) or the step 310 (adding position) comes to lie in the direction of the finger 295 and of a fixed stop 317.

The shaft 311 has rotatably and shiftably mounted on it a tube-shaped throwing-out member 318 having an arm 319 (Figs. 24, 37, 38) which is in connection with the controlling slide 322 by means of a pin 320 and an angle lever 321 loosely rotatable on the shaft 314. The slide 322 causes the adjustment of the member 318 either in the throwing-in rotary position (Fig. 35) or in the throwing-out rotary position (Fig. 34). The right-hand end of the member 318 has two step stops 323, 324 and a stop 325 which is connected by a bow 326 (Figs. 36, 37) with the other parts of the member 318. Besides this member has a return stop 327 and two openings 328, situated diametrically opposite one another into which a wedge 329 fixed in the shaft 311 projects.

In the position of rest of the machine the finger 295 assumes its left-hand end position (with respect to Fig. 33) in which position the member 318 is also kept by the return stop 327. In this position the right-hand

wall of the opening 328 comes to abut against the wedge 329 and maintains the shaft 311 and the rider axle 224 likewise in their left-hand end positions. The auxiliary totalizer 5 is out of operation (right-hand end position of the rider axle, Fig. 16). If the rider axle 224 is to be brought over into the subtracting position (Fig. 35), then both the stop 309 of the shaft 311 and the stop 323 of the member 10 318 are brought into operative position by means of the slide 316 and the slide 322 respectively (Fig. 35). If now the motion of the finger 295 to the right takes place (Fig. 35), this finger takes with it the stop 323 and 15 this stop takes with it the stop 309 until the latter strikes the fixed stop 317. When this takes place the shaft 311 and the rider axle are positioned in their right-hand end position (subtracting position, Fig. 35).

20 If the rider axle is to be brought into adding position (middle position), the stop 310 and the stop 323 are brought into operative position by the slide 316 (Fig. 44) and the slide 322 (Fig. 38) respectively. After the 25 adjusting motion of the fingers 295 the stops assume the position of the corresponding stops in Fig. 29, which shows the adjusting means for the rider axle 224' of the main totalizer.

30 If the auxiliary totalizer is to be thrown out and the rider axle thus to remain in its left-hand end position with reference to Fig. 33, no matter whether the shaft 311 is in adding or subtracting position, then the slide 35 322 (Fig. 38) effects a rotation of the member 318 which causes the stop 324 and simultaneously the stop 325 to be brought into operative position. Fig. 34 shows the position of the stops when the finger 295 has accom- 40 plished its adjusting motion. The member 318, the shaft 311 and the rider axle 224 take their right-hand end position (idle position, Fig. 16). It will be seen from Fig. 34 that it is immaterial whether the stop 309 is in op- 45 erative position or the stop 310.

The device for adjusting the rider axle 224' of the main totalizer and illustrated in the Figs. 24, 28 to 32 and 45, 46, is the same as that of the auxiliary totalizer and there- 50 fore does not need to be described in detail. The corresponding parts are denoted by the same reference letters, but have an index ('). The member 318' is somewhat longer than that of the auxiliary totalizer and is con- 55 nected to the controlling slide 322' (Fig. 31), while the shaft 311' cooperates with a controlling slide 316' (Fig. 46).

The controlling shafts 289 and 304 cause the throwing-in and -out movement of the 60 rider axles. The mechanism operating these two shafts is described hereinafter.

A shaft 330 mounted in the frame of the machine (Fig. 24) carries near its right-hand 65 end three cam disks 331, 332, 333 engaged by rolls 334 (Figs. 39, 40, 41). These rolls

are mounted on rods 337, 338, 339 which are guided in annular grooves of the hubs 336 of said cam disks by means of forks 335.

The shaft 340 has loosely mounted on it three rocking frames 341, 342, 343 (Fig. 24) 70 formed each of two arms 344, and tubes 345 and rods 346, 347, 348 (Figs. 39, 40) connecting these arms. Each of these frames is pivoted on one of the rods 337, 338, 339 by pins 302. With each of said rods 346, 347, 348 75 cooperate a pair of rockable rods 349 to 354 (Fig. 24) which may be brought by a recess 355 in engagement with the rods 346 to 348. The left-hand rods 349, 351, 353 (Fig. 24) 80 of each pair are pivoted to arms 356 rigid to the shaft 289 (Fig. 39) while the right-hand rods 350, 352, 354 of each pair are pivoted to arms 357 which are loosely mounted on the shaft 289 (Figs. 40, 41). The lower ends 85 of the rods 350, 352, 354 show slots 358 engaged by pins 359 of arms 360 rigidly fixed to the controlling shaft 304. All the rods 349 to 354 have at their middle portions, slots 361 (Figs. 39, 40, 41) permanently en- 90 gaged each by a pin 362 of six controlling slides 363 to 368 (Figs. 26, 24, 39 to 41).

The controlling slides are guided by a projection 369 (Fig. 41) in annular grooves of hubs 371 rigidly fixed to the differential shaft 274 and to a differential shaft 370. 95 The hubs 371 carry controlling disks 372 to 377 and 378 to 383 (Fig. 42) with which lateral projections 384 (Figs. 26, 39 to 41) and 385 of the several controlling slides are adapted to cooperate. To each controlling 100 slide is allotted one of the controlling disks of the shaft 274 and one of those of the shaft 370.

The right-hand ends 386' (Figs. 39 to 41) of the controlling slides are tap-shaped and project into holes of arms 387 rigidly fixed 105 on a shaft 386. Springs 389 are arranged between projections 388 and said arms 387 and tend to keep a lug 390 of the controlling slides in contact with the right-hand face 110 of the arms 387. On each operation of the machine the shaft 386 receives a swinging motion from the driving means of the machine upon which motion the arms 387 are brought from the right-hand position illus- 115 trated in Fig. 39 into the left-hand position of Figs. 40 and 41 and back into the first named position.

Upon the swinging motion of the arms 387 the controlling slides are taken along im- 120 positively by the springs 389 if the lateral lugs 384, 385 are able to enter recesses of the corresponding controlling disks. Upon the motion towards the left, of the controlling slides the corresponding rods 349 to 354 enter 125 into engagement, by their recesses 355, with the rods 346, 347, 348. If a full circumferential portion of a controlling disk is standing opposite to one of the lateral lugs 384, 385 of a controlling slide, the controlling 130

slide in question is retained in its right-hand end position and no coupling of the corresponding rods 349 to 354 with the rocking rod 346 to 348 belonging thereto, will take place.

The shaft 330 which as described carries the cam disks 331, 332, 333, has a revolution imparted to it from the driving mechanism upon each operation of the machine. When this takes place, the several rocking frames 341, 342, 343 (Fig. 24) are moved up and down by means of the cam disks. The upper rocking position of these frames corresponds to the throw-out position of the rider axles (right-hand end position, Figs. 15, 16), their lower rocking position to the throw-in position of said rider axles. As will be seen from the different form of the grooves of the cam disks 331 to 333, the up and down motion takes place at different times with the different rocking frames 341 to 343. At the beginning of the operation of the machine the rocking frames take their upper position in which the throwing in and out of the controlling slides takes place. The cam disks 331 (Fig. 39) causes the rider axles, coupled thereto by the frame 341 and the controlling shafts 289 and 304 respectively, to be brought back into their throw-in position before the positioning motion of the amount differential members takes place, and to be brought back into their throw-out position at the end of the positioning motion of the amount differential members, that is, the selected totalizers are thrown in during the positioning motion of said amount differential members (taking the grand-total).

The cam disk 332 (Fig. 40) causes the rider axles coupled with the frame 342 to be thrown in before the positioning motion of the differential members and to be thrown out again only after the return motion of the differential members has been finished, that is, the selected totalizers are thrown in during the positioning and return motion of the amount differential members (taking a sub-total).

The cam disk 333 causes the rider axles coupled with the frame 343 to be thrown in before the return motion of the amount differential members and to be thrown out after this motion has been finished, that is, the selected totalizers are thrown in during the return motion of the differential members (setting an amount).

Special controlling disks 391 (Figs. 26, 42, and 42a) cooperate with flanges 399 of the controlling slides 363, 365, 367, (Fig. 26) that is, of those slides which effect the coupling of the rocking frames 341, 342, 343 with the controlling shaft 289, said controlling disks 391 being connected by a common bow 392 (Figs. 26 and 42) and arranged on the right of their respective slides 363, 365, and 367 (Fig. 26). A lug 393 (Figs. 41 and 42) on the right end of the bow 392 abuts, under the action of a spring 394 against a pin

395 of a double lever 397 (Fig. 41) which is mounted on the frame of the machine by a pin 61 and the left-hand end of which is connected to the key N (addendum key) of the row 12. Upon depressing the key N the lever 397 executes a swinging motion in clockwise direction and the high parts of the special controlling disks 391 are brought into the path of the flanges 399 (see Fig. 42a). Then, with the motion to the left of the arms 387 (Figs. 39 to 41), that is, when the key N is depressed, no coupling of the corresponding rods with the rocking frames takes place, and the four upper groups of totalizers and the auxiliary totalizer are thrown-out, no matter which position is taken by the controlling shafts 274 and 370. As evident, the throwing in and out of operation of the main totalizer is not influenced by the key N, because the disks 391 do not cooperate with the slides 364, 366, 368 which control the main totalizer.

While the differential shaft 274 is positioned by means of the spur wheel 277 from the positioning member acted upon by the row of keys 11, the positioning of the differential shaft 370 is effected by means of a spur wheel 398 fixed thereon (Figs. 24, 41) from the positioning member 82' acted upon by the keys ZS, ES (Fig. 1). The differential shaft 274 (Fig. 24) has rigidly fixed on it, at both sides of the spur wheel 277, controlling disks 405, 406, 408. These disks control, together with controlling disks 409, 410, 411, loosely mounted beside them, and with another controlling disk 407 rigidly fixed on the shaft 370, the displacement of the rider axles 224 and 224' into their three positions: idle, adding and subtracting position, by adjusting the shafts 311, 311' into the adding and subtracting position and the members 318, 318' into the throw-in or -out position.

With the controlling disk 406 (Figs. 43 and 43a) cooperate the lateral lug 412 of the controlling slide 316 (Fig. 44) which is connected by the angle lever 315 with the shaft 311 for the auxiliary totalizer. The slide 316 is guided, in a manner similar to that of the slide of Figures 39 to 41, at its right-hand end in an arm 387 (Fig. 44) fixed on the shaft 386. If the full circumferential portion of the controlling disk is opposite the lateral lug 412, the slide 316 is retained in its position of rest and the shaft 311 in its adding rotary position. If a recess, however, of the controlling disk is opposite the lug 412, for instance the recess A (Fig. 43a), in case the key Ab has been depressed, with the rocking of the arm 387 towards the left, the slide 316 is moved likewise towards the left and the shaft 311 is rotated into its subtracting rotary position.

If the total is to be taken from the auxiliary totalizer, the recess HR (Fig. 43a) is brought

into working position, after the key HR (Fig. 1) has been depressed. The total may be a positive or a negative one. In the first case the shaft 311 must remain, according to the premises explained hereinbefore, in its adding angular position; that is, the controlling slide 316 must be blocked. In the latter case the shaft must be brought into its subtracting angular position for which purpose the lug 412 of the slide 316 must be capable of entering the recess HR. The shifting of the rider axle 224 of the auxiliary totalizer into its adding or subtracting position upon totalizing is controlled by the auxiliary controlling disk 410 and the differential disk 265 (Figs. 21, 27, 44). The auxiliary disk 410 (Fig. 43a) has a slot 413 engaged by a pin 414 of the controlling disk 406. A spring 415 (Fig. 43) the ends of which are attached to the hub of the disk 406 and to the auxiliary disk 410 respectively, causes the pin 414 to normally engage the lower end of the slot 413. When so, the circumferential portion 416 of the auxiliary disk 410 lies beside the recess HR and covers it. A pin 418 (Figs. 43, 44) of a bow 419 loosely rotatable on the shaft 370, cooperates with a nose 417 (Fig. 43a) of the disk 410. This bow 419 is pivoted by a pin 420 to a rod 421 which embraces the pin 264 by a slot 422 and cooperates by a pin 423 with the differential disk 265. A spring 424 permanently tends to pull the rod 421 upwardly so that the pin 418 normally lies in the path of the nose 417. If, after depressing the key HR (Fig. 1) upon adjusting the controlling disks the recess HR reaches the operating position for the purpose of taking a total, the nose 417 hits the pin 418 (from the left in Fig. 44). If when this occurs, a recess 266 of the differential disk 265 is opposite the pin 423 of the rod 421,—this is always the case when the auxiliary totalizer contains a positive total—the pin 418 is pushed away by the nose 417, the spring 415 being considerably stronger than the spring 424. The auxiliary disk 410 is able to follow the controlling disk 406 unhindered, the recess HR remains covered so that the slide 316 is retained upon the driving motion, and the rider axle 224 is brought into adding position.

If, however, a negative total is contained in the auxiliary totalizer, the pin 423 is opposite a full circumferential portion of the differential disk 265, the pin 418 is unable to give way, and will retain the auxiliary disk 410 by the nose 417 so that the lug 416 is out of operative position and the lug 412 may enter the recess HR upon the driving movement of the controlling slides. The rider axle 224 is hereby adjusted in subtracting position as this will correspond to the operations in taking negative totals.

The controlling disk 405 (Fig. 37a) is provided with recesses HR, Z and A which take their operative positions upon depressing the

corresponding keys HR, Zu, or Ab (Fig. 1), and cause the member 318 which is retained in throw-out position by a full circumferential portion of the disk 405 by means of the lug 425 of the slide 322, to be moved into throw-in position. With the lug 425 of the slide 322 cooperates also the auxiliary controlling disk 409 (Fig. 37a). This disk is so connected to the key HR by a pin 426 in a manner not shown, that its full circumferential portion lies in the path of the lug 425 as long as the key HR is not depressed. In this case also the auxiliary totalizer would remain out of operation upon depressing the keys Ab or Zu. If, however, the key HR is depressed, the full portion of the disk 409 comes out of the path of the lug 425 and the member 318 is adjusted in its throw-in position, when one of the key Ab or Zu is depressed.

The control mechanisms for the main totalizer and serving for the same purposes are illustrated in the Figs. 24, 26 to 32, 45, 46. The reference letters of corresponding parts have an index (').

As shown in Fig. 24, the shaft 311' and the member 318' for the main totalizer are arranged below the shaft 311 of the auxiliary totalizer. The controlling slide 316' (Figs. 24, 46), of the main totalizer, attached to the shaft 311', cooperates with the controlling disks 408 and 411 of the controlling shaft 274. The adjustment of the rider axle 224' of the main totalizer into adding or subtracting position, upon taking a total in dependence on the sign of the total contained in the main totalizer, takes place in the same manner as with the auxiliary totalizer, by the differential disk 265' (Figs. 46, 27) allotted to the main totalizer by intermediary of the bow 419'. This bow 419' extends over the bow 419 so that these two will not hinder one another from moving. The controlling slide 322' connected to the member 318' cooperates with a disk 407 of the shaft 370 (Fig. 32a) which disk, in the position of rest of said shaft, brings a recess opposite to the slide 322'. Upon moving the shaft 370 out of its position of rest after depressing the key ES or ZS, a full portion of the disk will be opposite to the slide. The main totalizer is in this case out of operation.

A disk corresponding to the auxiliary controlling disk 409 has not been provided for the main totalizer. This latter is thus unable to be permanently thrown out of operation independently of the setting of other keys by depressing a special key, as is the case with the auxiliary totalizer. The remaining arrangements and modes of operation of the controlling mechanisms for the auxiliary totalizer and main totalizer are identical so that a description in detail is not required.

The keys +b and -b (Fig. 1) are to be depressed when the grand total is to be taken

from the main totalizer. The key $+b$ effects the taking of a positive total, the key $-b$ a negative total. In order to insure that only the key corresponding to the sign of the total contained in the main totalizer may be depressed and that the other key is locked, angle levers 428, 429 are mounted on two pins 427 (Fig. 27) cooperating by lugs 430, 431 with circumferential portions of the differential disk 265' displaced by 90°. The angle levers 428, 429 are so connected by rods 432 and 433 in a manner not shown in detail, to the keys $+b$ and $-b$, that upon depressing one of these keys, the corresponding lug 430, 431 is moved towards the centre of the disk 265'. In Fig. 27 the disk 265' takes the position corresponding to a negative total of the main totalizer. The key $+b$ is therefore being locked by the angle lever 428 and the full portion of disk 265'.

In order to print the minus sign in addition to the amount, upon printing a negative amount, the following arrangement has been made.

The controlling slides 316 (Fig. 44) and 316' (Fig. 46) are provided with slots 434, 434' against the right-hand wall of which abut pins 435, 435' which are carried on arms 437, 437' fixed on a shaft 436. A lower arm 438 of the shaft 436 is pivoted to a rod 439 which is connected to the type wheel of the printing mechanism. By means of a roll 440 an arm 441 of the shaft 436 abuts, in the initial position of the parts, against the periphery of a cam disk 443 fixed on a shaft 442 (Fig. 27). In this position of said arm 441 the plus sign of the type wheel is in the printing position. During the operation of the machine an anti-clockwise rotation is imparted to the disk 443. At the moment the upper opening 444 of the curved groove 445 is opposite the roll 440, the driving movement for the controlling slides takes place. Upon one of the slides 316 or 316' herewith being moved to the left, which is the case in making a subtraction or taking a negative total, the corresponding pin 435, 435' is taken along, whereby the roll 440 enters the curved groove 445 and is kept during the printing time of the printing mechanism in a position, in which the minus sign of the type wheel is in the printing position.

11. The modes of record

Four different modes of record are capable of being executed by the machine:

- I. The ordinary record (record of first order);
- II. Recording the sub-total from the main totalizer (record of second order);
- III. Recording sub-totals and grand-totals from the controlling totalizers (record of third order);
- IV. Recording addenda (record of fourth order).

I. An ordinary record requires three different modes of operations of the machine viz: introduction of the old state of account, introduction of the amounts received or paid out, printing the new state of account. The introduction of the old state and the impression of the new state each requires an operation of the machine, but in introducing the amounts received and paid out a separate operation is required for recording each amount received or paid out.

The mode of operation of the main totalizer and the simultaneous throwing-in of a controlling totalizer of the group S (Fig. 2) is determined by the six upper keys $-B$, $+B$, Ab , Zu , $-b$, $+b$ (Fig. 1) of the row 11, said keys being denoted hereinafter the main keys. The by-keys 13 are able to be depressed upon introducing amounts received and paid out only. When this takes place they cause an account totalizer to be thrown-in also, to which the amount received or paid out, is transmitted additively. The account totalizers are subdivided into two groups, the group influenced by the by-keys 1 to 9 and 19 to 23 being allotted to the amounts received and the group influenced by the by-keys 10 to 18 and 24 to 27 to the amounts paid out.

In order to introduce the old state in the machine, after depressing the corresponding amount keys 10 and account keys 17 one of the keys $-B$ and $+B$ is depressed and, namely, the key $+B$ if it is a matter of a positive value, and the key $-B$ if it is a matter of a negative one. Hereby the motor key M is released and the operation of the machine is started by depressing this key, the set amount thus being transmitted to the main totalizer, the corresponding transaction totalizer $-B$ or $+B$ and to the printing and display mechanism. A transmission of the set amount to the auxiliary totalizer does not take place even in case the key HR is being depressed.

In order to introduce amounts received or paid out, after setting this amount by means of the amount keys 10, the by-key 13 determining the kind of said amount, the motor key M is released by depressing the main keys Zu or Ab , respectively. During the operation of the machine caused by the motor key M, the set amount is transmitted additively or subtractively to the main totalizer and additively to the transaction totalizer Zu or Ab , to the account totalizer thrown into operation and to the printing and display mechanism. In case the key HR is depressed, then at the same time the additive or subtractive transmission to the auxiliary totalizer takes place.

This operation of the machine may be followed by any required number of operations recording amounts received or paid out.

With the third mode of operation the total

contained in the main totalizer is taken. According to whether the total is a positive or a negative one, the main key $-b$ or $+b$ is locked. There are further provided means causing one of the keys $-b$ or $+b$ to be able to be depressed only if no amount key has been set. By depressing the key $-b$ or $+b$ the motor key M is released. During the operation now following the main totalizer is zeroized and the total contained therein is transmitted additively to the corresponding transaction totalizer $-b$ or $+b$ and the printing and display mechanism is positioned. A transmission to the auxiliary totalizer does not take place even in case the key HR is depressed.

While the amount keys 10, the main keys, the key RZ and the keys ZS, ES are released at the end of each operation of the machine, the keys HR (auxiliary totalizer) and N (addenda) permanently remain set. They are released by the keys L disposed below and above them, respectively. The account keys 17 set on the beginning of an ordinary transaction are released only at the end thereof, viz. after the new state of account has been printed.

II. As the main totalizer is zeroized at the end of any ordinary transaction, a sub-total is able to be taken from the main totalizer only after an amount received or paid out has been recorded. By depressing the key RZ (sub-total of the main totalizer) the motor key M is released, such depressing being possible only if no amount key is depressed. Upon starting the machine, the transmission of the sub-total from the main totalizer onto the printing and display mechanism takes place. In case this sub-total is a negative one, the machine adjusts itself automatically in the described manner for taking negative totals.

III. If the total is to be taken from one of the six transaction totalizers $-B$, $+B$, A_b , Z_u , $-b$, $+b$, from the auxiliary totalizer or from one of the account totalizers, one of the keys ZS (sub-totals) or ES (grand totals) is first depressed, this being possible only if none of the amount keys is depressed. By depressing the keys ES and ZS, the keys HR and the by-keys 13 which generally do not cause the release of the motor key M, become releasing keys for the motor key as is permanently the case with the main keys. If now one of the main keys is depressed, or one of the by-keys or the key HR, the motor key M is released. With the operation started by said key M, the sub-total or grand total is taken from the totalizer selected by depressing said main or by-key or the key HR.

IV. The key N (addenda) has to be depressed in case ordinary transactions are to be recorded as addenda, as hereinafter described in detail. With the addendum key N depressed, all the totalizers are thrown

out of operation except the main totalizer. The record of an ordinary transaction is therefore effected by the main totalizer although the main and by-keys are thrown-in when this takes place.

The depression of the addendum key N besides causes certain special operations to be effected, as hereinafter described. As to the rest, the mode of function of the machine is the same as in an ordinary transaction.

12. Mode of operation of the totalizer controlling mechanism

In order to allow the mode of operation of the totalizer controlling mechanism to be more readily understood, the proceedings taking place during the operations of the machine required for a record of first order will be described hereinafter.

It may be assumed that M 600.00 paid out are to be booked with an old state of account of M + 576.20. The operator reads off the old state from the account sheet and sets it by means of the keys 10 (Fig. 1). Then he depresses the key $+B$ whereupon the first operation may be released by depressing the key M. At the beginning of the operation the locking of all the keys takes place as well as the drive of the transaction totalizer (Fig. 25), as described hereinafter. While the differential member 252 for the case ZS, ES remains locked in its position of rest, the zero locking lever 62' for the differential member 251 of the keys 11 has been thrown-out by depressing the key $+B$ and the differential member 251 and the corresponding positioning member 82' will be adjusted to a position $+B$ two units distant from their position of rest. Hereby takes place, by means of the rack 278 in connection with the member 82' and of the spur wheel 277 (Fig. 24), the rotation of the differential shaft 274 by two angular units, whereby the second step of the step drum 272 for the group S of totalizers (Fig. 2) is positioned—causing the throwing-in of the transaction totalizer $+B$ —and the controlling disks of the differential shaft 274 will be positioned opposite the controlling slides, with their circumferential portions allotted to the operation $+B$.

At this operation the controlling disk 405 (Fig. 24) turns its full circumferential portion towards the controlling slide 322 connected with the member 318, whereby the auxiliary totalizer remains thrown-out, although the controlling disk 406 causes the shaft 311 to go over into adding position.

The controlling disk 407 turns to the slide 322' a recess, the member 318 therefore goes into the throw-in position, upon the driving movement of the controlling slides, and the shaft 311' remains in adding position, owing to the disk 408 presenting to the slide 316' a full circumferential portion.

The throw-in and -out motion proper, by

which the rider axles 161, 224, 224' are brought from their initial position into the engaging position and back again, now takes place, as described, by the motion of the fingers 295 connected to the arms 290, 298 and 300 (Fig. 27), said fingers being driven by means of the shaft 284 and the sleeve 299 from the controlling shafts 289 and 304 (Figs. 27, 39 to 41).

The controlling shafts 289 and 304 receive, in their turn, their rocking motion by the cam disks 331, 332, 333, to which they are coupled by the rocking frames 341, 342, 343 and rods 349 to 354. The mode of coupling is regulated by the controlling disks 372 to 377 (Figs. 42, 42a) of the shaft 274 and the controlling disks 378 to 383 of the shaft 370. This latter which is connected by the spur wheel 398 to the member 82' for the keys ES and ZS, remains locked in its initial position by the zero locking lever 62', as none of the said keys is depressed. The controlling disks 379, 381, 383, of the shaft 370, cooperating with the slides 364, 366, 368 for the shaft 304, are provided, in the zero zone, with a recess (Fig. 42a). But, of the disks 373, 375, 377, cooperating with the same slides, only the disk 377 presents a recess in the operating position, in the described angular position of the shaft 274. Upon the driving motion of the slides taking place, therefore the shaft 304 will be coupled with the rocking frame 343 for amount setting, by the slide 368 (Fig. 41) bringing the rod 354 into mesh with the rocking rod 348. Thereby the main totalizer has been adjusted to the operation "setting an amount". The shaft 289 for the auxiliary totalizer and the account and transaction totalizers are coupled likewise by means of the rocking frame 343 (setting an amount), by the two slides 363, 365 being retained by the disks 378, 380 and only the slide 367 being released for the coupling movement by the disks 376 and 382.

After the coupling of the shafts 289 and 304 with the rocking frame 343 has been effected and the differential members 65, 80 of the amount setting mechanism have completed, in the described manner, their differential motion, the rocking frame 343 is swung down by means of the cam disk 333 (Fig. 41), the rider axles 161 of the thrown-in group of transaction totalizers being brought into the position determined by the step drums 272 and the rider axle 224' of the main totalizer into the adding position. Upon the return motion, now following, of the displaced differential members 65, 80 of the amount setting mechanism the amount of 576.20 is transmitted onto the main totalizer and the totalizer +B in additive sense. When the return motion is accomplished, the cam disk 333 causes the rocking frame 343 to swing upwards and therewith the displaced rider axles to be returned into their initial

positions. Thereupon the driving shaft 386 (Fig. 41) of the controlling slides is swung back, the displaced controlling slides 367, 368, 322' thereby reaching again their right-hand initial positions and the rocking frame 343 being uncoupled from its rods 353, 354. The differential shaft 274 remains in its position till the next operation of the machine, where it will be displaced, like the display and type wheels, from the old position directly into a new one. At the end of the operation of the machine the depressed keys will be released in the described manner.

For the purpose of introducing the transaction the amount of 600.00 is set by means of the keys 10 and, since it is a matter of subtraction, the key Ab is to be depressed, whereby the operation is released. The locking of the keys and the positioning of the differential members for the transaction keys 11, 12, 13 takes place, the shaft 370 (Fig. 24) remaining in its position of rest and the differential shaft 274 being adjusted into its position corresponding to the operation Ab. In this position only the pairs of disks 376, 382 (Fig. 42a) and 377, 383, present recesses to their slides 367, 368, so that the two controlling shafts 289, 304 come to be coupled, upon the driving motion of the slides, with the rocking frame 343, for setting an amount.

The controlling disks 405 (Fig. 38) and 407 (Fig. 31) of the members 318, 318' of the auxiliary and main totalizer, respectively, present recesses to the corresponding slides 322, 322'. The two disks 406 (Fig. 44) and 408 (Fig. 46) likewise show recesses in the path of the corresponding slides 316, 316', so that the rider axles 224 and 224' will be adjusted in the subtracting position, upon the rocking frame 343 swinging downwardly which as in the operation +B, takes place before the beginning of the return movement of the differential members of the amount setting mechanism, while at the same time, the rider axle of the group S of transaction totalizers comes to be adjusted to the totalizer Ab and one of the three upper rider axles 161 to be adjusted to the account-totalizer selected by means of the keys 13, supposing that, in order to throw into operation the auxiliary totalizer too, the key HR had been depressed, whereby the high portion of the controlling disk 409 (Fig. 37a) is swung out of the path of the slide 322. The amount of 600.00 is added in the transaction totalizer Ab and in the account totalizer thrown-in, while it will be subtractively transmitted to the main and auxiliary totalizers. As the amount of 576.20 contained in the main totalizer is less than that to be subtracted, in this transmission a transfer from 0 to 9 takes place in the counting wheel of the highest numeral position, which is the result of the change of the positive amount contained in the main totalizer into a negative one. The same proceeding

takes place in the auxiliary totalizer. As described, a unit is transmitted subtractively into the units position and the differential disk 265' of the main totalizer moves from the position of Fig. 21 into that of Fig. 27. After the return motion of the amount differential members the return of the displaced rider axles 161, 224, 224' and of the slides 322, 322', 316, 316', 367, 368 into their initial position takes place.

The differential disk 265 effects, in its new position the locking of the key $+b$ by the angle lever 428 (Fig. 27). If in the next operation of the machine the total is to be taken from the main totalizer, only the key $-b$ is able to be depressed for releasing this operation. At the beginning of this operation of the machine the positioning of the differential shaft 274 into the position $-b$ takes place. The differential shaft 370 remains in position of rest, as none of the keys ZS and ES has been depressed. Only one of the controlling disks 373, 375, 377 (Fig. 42a) cooperating with the slides allotted to the main totalizer, namely the disk 373, presents a recess to its slide 364, so that the controlling shaft 304 comes to be coupled with the rocking frame for drawing grand-totals.

Two of the three controlling slides for the controlling shaft 289 are retained by the disks 378 and 380, namely those allotted to grand-totals and sub-totals. The slide 367, however, has been released by the controlling disks 382 and 376, for the coupling motion, so that the shaft 289 comes to be coupled with the rocking frame 341 for amount setting. The member 318 of the auxiliary totalizer is kept in the throw-out position by the disk 405 (Fig. 37a) and by the slide 322, so that the auxiliary totalizer remains thrown-out. The member 318' for the main totalizer, however, reaches, owing to the recess of the disk 407 (Fig. 32) being turned to the slide 322', its throw-in position. The disk 408 (Fig. 45) causes the shaft 311' for the main totalizer to be adjusted in the subtracting angular position.

Before the beginning of the positioning movement of the differential members of the amount setting mechanism the cam disk 331 (Fig. 39) causes the rider axle 224' of the main totalizer to be adjusted in the subtracting position and, after this motion has been finished, to be thrown-out. When this takes place, the subtracting wheels of the main totalizer are brought back into the position 9,999,999,999. This results in that the printing wheels come to be adjusted to the amount of the negative total of 23.80. The motion directed towards the left, of the slide 316' (Fig. 46) causes the shaft 436 to be rotated, whereby the roll 440 enters the curved groove 445 (Fig. 27) of the disk 443 and the printing of the minus sign is effected beside the amount. The subtracting wheels of the main

totalizer remain in the position 9,999,999,999 until, with one of the following operations of the machine, an amount is added. Then a transfer from 9 to 0 will take place in the highest counting wheel, which passage will automatically add to the units position the wanted unit and will position at the same time the differential disk 265' into the position of Fig. 21. During the return motion of the differential members of the amount setting mechanism the transaction totalizer $-b$ having been thrown-in, due to the cam disk 333, to this totalizer the amount of the negative total of 23.80 is additively transmitted.

13. The driving mechanism

At the right-hand side of the transaction totalizer is disposed the driving motor 455 of the machine (Figs. 25, 26, 48). The motor shaft is in connection with a spur wheel 460 mounted on a fixed tap 459 by means of a worm 456, worm wheel 457 and a spur wheel 458 (Figs. 25, 26) fixed to the latter. A coupling star 462 (Fig. 48) having three tangential surfaces 461 projects into the hollow space formed by the spur wheel 460, said coupling star being fixed by pins 463 (Fig. 50) on the hub 464 of a spur wheel 465 likewise mounted on the tap 459. Between the tangential surfaces 461 and the cylindrical hollow surface 466 of the spur wheel 460 there are arranged coupling rolls 467 (Figs. 48, 50) by means of which the wheel 465, upon rotation of the wheel 460, is taken along in an anti-clockwise direction by the coupling rolls 467 being pinched between the surfaces 461 and 466. Pins 454 engaging the rolls 467 are mounted on a coupling disk 453 which is loosely mounted with its hub 452 (Fig. 50) on the hub 464 and has a lateral lug 451. By spring-actuated bolts 450 (Fig. 48) mounted in the coupling star 462 the rolls 467 are pressed against one side of the pins 454.

The hub 452 of the coupling disk 453 has mounted on it a contact disk 468 positively connected by a spring 469 (Fig. 50) to a locking disk 470 fixed on the hub 464. Both the disks 468 and 470 have on their peripheries recesses 471 (Fig. 48) which are engaged in the position of rest of the disks by a roll 472 mounted on an angle lever 473. The lower arm of this lever cooperates with a contact spring 475 by means of a lateral lug 474. This spring 475 is conductively connected to the one wire, 476, of the electric circuit and is provided with a contact 477 cooperating with a contact 479 connected to the other wire 478.

The disks 468, 470 have lateral lugs 480, 481 (Figs. 48, 50). These lugs are situated, together with a lug 451 of the coupling disk 453, in the path of a lug 482 of a three-armed lever 484 mounted on the pin 483. In the position of rest of the machine said three

lugs 451, 480, 481 are held in a common line by the lug 482. When this is the case, the spring 469 of the disk 468 is being tensioned so that the disk 468 will rotate by a certain amount in anti-clockwise direction and press the roll 472 out of the recess 471, when the lug 480 of said disk 468 is released by the lug 482. An arm 485 (Fig. 48) extending towards the left, of the lever 484 has a recess 486 and, attached thereto on the right, a rest 487. A locking slide 489 is further mounted by means of two pins 488 and slots on the arm 485, said slide 489 having a recess 490 and, on the left thereof, a rest 491 and being drawn towards the right by a spring 492 arranged between it and the arm 485. In the position of rest of the machine the slide 489 however is hindered from moving to the right by the left-hand wall of its recess 490 abutting from the right against a lug 493 (Figs. 48, 49) of a lever 495 pivoted on a fixed pin 494. At the same time the three-armed lever 484 comes to abut, under the action of a spring 496, with the rest 487 against the lower surface of the lug 493. The lever 495 (Fig. 49) is rigidly connected to a lever 497 which is connected to a pin 506 fixed on the shaft 505 of the motor key M by means of a pin 498 and a double lever 500 mounted on a fixed pin 499.

The spur wheel 465 of the locking disk 470 is engaged on one side (Fig. 47) by a spur wheel 504 rigid on the main driving shaft 42, and on the other side by a spur wheel 507. This latter is in mesh with a wheel 508, this latter with a wheel 509 and this with a wheel 510. While the wheels 507, 508 are mounted on pins 511, 512 of the frame of the machine, the wheel 509 is mounted on the driving shaft 330 of the control mechanism and the wheel 510 is mounted on the shaft 442 (Fig. 27).

A cam disk 513 (Fig. 48) is connected to the wheel 510, the curved groove 514 of which disk is engaged by a roll mounted on an arm 515 rigid on the driving shaft 386 for the controlling slides. Upon rotation of the disk 513 the shaft 386 is oscillated as required for the motion of the controlling slide. The number of teeth of the different spur wheels has been so chosen that upon two revolutions of the wheel 465 the shafts 42, 330 and 442 will execute one revolution. The wheel 507 carries a pin 516 projecting into the path of a nose 517 of an arm 518, extending to the right, of the lever 484.

The described driving mechanism works as follows:

In the position of rest of the machine the parts assume the position shown in the drawings. When, after setting the amount and transaction keys as required for the transaction to be made and after releasing the motor key M in the manner described herein-
after, this motor key M is depressed, the arm

493 swings to the left (Fig. 48) taking along with it the locking slide 489. As soon as its right-hand edge has released the rest 487 the lever 484 swings upwardly under the action of the spring 496, locks the motor key M in the depressed position by the recess 486 engaging about the lug 493, and releases by its lug 482 the three lugs 451, 480 and 481. Then first the contact disk 468 rushes forward, acted upon by its spring 469, whereby the roll 472 is lifted from the recess 471 and the motor circuit is closed. The spur wheel 460 turned by the motor takes with it the rolls 467 which will be pinched between the cylindrical hollow surface 466 and the tangential surfaces 461 of the coupling star 462 and thereby effect the coupling of the wheel 465 with the wheel 460. The three disks: locking disk 470, contact disk 468, coupling disk 453 take part in the rotation of the wheel 460 until the pin 516 reaches the nose 517 of the arm 518 which will take place shortly before the operation of the machine is finished, that is, shortly before the second revolution of the wheel 465 is completed. By engaging the nose 517 the pin 516 pushes the three-armed lever 484 back into its initial position, the lug 482 again reaching the path of the three lugs 451, 580, 481. The lever 484 is swung back to such an extent that the locking slide 489 is released by the left-hand edge of the arm 493 and engages with its rest 491 below said arm so that if the motor key M is retained in depressed position, a new swinging motion of the lever 484 in order to initiate a new operation of the machine, is impossible. Only after the motor key M has gone back into its initial position (Fig. 48) and the rest 491 is on the left of the arm 493 and the rest 487 is below the latter, can a new operation of the machine be initiated and takes place in the manner hereinbefore described. The lateral lug 480 of the contact disk 468 first abuts against the lug 482, returned to initial position, of the lever 484. While said disk 468 is retained in initial position, the locking disk 470 moves by a small distance further whereby the spring 469 becomes tensioned again. In the meantime also the coupling disk 453 has been retained by its lug 451 whereby the coupling between the wheel 460 and the coupling star 462 has taken place by retaining the rolls 467 by means of the pins 454. When, finally, the locking disk 470 strikes the lug 482 by its lug 481 after precisely two revolutions, the recesses 471 are again opposite the roll 472. This latter engages said lugs whereby the angle lever 473 goes back into its initial position and the motor circuit is interrupted between the contacts 477, 479.

14. The type wheels of the printing mechanism

The printing types are rigidly mounted on type wheels which are mounted in two

groups coaxially with the shafts 520, 521 (Figs. 51, 61, 62). Each type wheel carries two rows of types, one row being arranged on the upper half of the wheel, and the other row on its lower half. By this means four printing places are formed in the printing mechanism each adapted to print a special document, viz. the record strip, the customer's ticket, the book and the account card.

The record strip receives all the transactions made by the machine and required for controlling the operations, the ticket serves for a single proof of the transaction, the book and the account card serve for collective proof of the transactions made in an account. While the book remains in the hand of the customer, the card remains in the office.

The rear four type wheels 522, 522' (Fig. 51) of each group of types are adapted to print the consecutive number and are actuated by means of a special mechanism described hereinafter and causing the wheels 522, 522' to be moved by one unit with each operation of the machine.

The next ten type wheels 523, 523' (Fig. 51) of each group are the amount type wheels. They are connected by tubular shafts 524, 524', surrounding each other, to spur wheels 525, 525' which, in their turn, are in mesh with racks 526 mounted for crosswise shifting in the frame of the machine. The racks 526 are guided in the frame by means of slots 556, 557 (Fig. 56) into which project bars 558, 559 mounted in the frame and carrying, between the racks 526, distance sleeves 560 (Fig. 51). Wheels 528 rigidly mounted on shafts 527 mounted in the frame, are in mesh with teeth 550 (Fig. 56) arranged on the upper surface of the racks 526. The shafts 527 carry at their rear ends spur wheels 529 (Figs. 51, 2) in mesh with the teeth 146 of the members 82 of the amount differential mechanism. As described, said members come to be positioned during the differential operation, to the set amount or to the total amounts of the selected totalizer.

The next six type wheels toward the front, 530 to 535 and 530' to 535', (Fig. 51) are allotted to the transaction totalizer. They are directly mounted loosely on the shafts 520, 521 and have rigidly mounted on them teeth 536 in mesh with toothed wheels 537, 537'. The outer wheels of these groups are rigidly connected to shafts 538, 539, respectively, the remaining wheels with tubular shafts 540 surrounding one another. The rear ends of the shafts 538, 539 and of the tubular shafts 540 carry spur wheels 541, 541' engaging racks 542 to 547. These racks have slots 557 (Fig. 56) and 548 (Fig. 57) by means of which they are guided so as to

be shifted crosswise on bars 560, 549 rigid on the frame.

The rack 542 (Fig. 51) connected to the type wheels 530, 530' has a lateral lug 561 which engages by teeth 562 a segment 565. This segment is mounted by means of pins on a carrier 564 of the frame 23 of the machine and has pivoted to it the rod 439 (Figs. 27, 51) which, as described, is connected to the setting device for the sign. The type wheels 530, 530' carry within their two printing zones the signs plus and minus. Upper teeth 566 (Fig. 57) of the racks 543 to 547 are in mesh each with a wheel 567 (Figs. 57, 26) fixed on a shaft 568 mounted in the frame. These shafts 568 carry on their rear ends wheels 569 (Fig. 26) which are in mesh with the positioning members 82' of the transaction totalizer. The described connections cause the type wheels 531, 531' to be positioned by the keys of row 11, the type wheels 532, 533, 534 and 532', 533', 534' by the keys of row 13, and the type wheels 535, 535' by the keys of row 12. The type wheels carry the types corresponding to the keys of said rows.

The following four type wheels toward the front, 570, 570', (Fig. 51) serve for printing the date. They carry teeth 571 engaged by wheels 572, 572' mounted coaxially with the shafts 538, 539. The wheels 572 are rigidly fixed on sleeves 573 which are provided at their front ends with setting wheels 574 (Figs. 51, 1) for setting the date. The wheels 572', loosely mounted on the shaft 539, are geared, by intermediate wheels 576 mounted on a shaft 575, to the wheels 572 so that the date type wheels 570, 570' are able to be set in accordance with each other by the setting wheels 574.

The foremost seven type wheels 577, 577' (Fig. 51), mounted for free rotation on the shafts 520, 521, are adapted to print the number of the account set by means of the keys 17 (Fig. 1). These wheels 577, 577' have fixed to them toothed wheels 578 in mesh with racks 579 (Figs. 66, 51) mounted for crosswise shifting motion in the frame by means of slots 580 and cross bars 581. At their right-hand ends these racks 579 are in mesh, by teeth 582, with toothed wheels 584 rigidly mounted on shafts 583. These shafts 583 are rotatably mounted on the frame and rigidly carry at their rear ends toothed wheels 585 (Fig. 27). These latter are in engagement with toothed wheels 586 (Figs. 27, 51) of differential shafts 587. The differential shafts 587 are rotatably mounted in the frame above the shafts 583 and carry stops 588 arranged in screw lines on their surface which cooperate with the ends of the shafts 589 of the keys 17 (Fig. 27). The toothed wheels 585, 586 and the stops 588 of neighboring numeral positions are staggered with respect to each other, as shown

in Fig. 51, in order to prevent a mutual interference.

The key shafts 589 carry pins 590 which cooperate, like the pins of the amount keys, with a locking bar 591 having hook-shaped portions and with a block bar 592 having V-shaped recesses. These two bars are shiftably mounted on cross bars 594, 595 by means of slots 593. The shafts 583 have loosely mounted on them toothed wheels 596 (Figs. 65, 51) which are connected impositively, by springs 597 (Fig. 51) to the shafts 583 and the lugs 598 of which (Fig. 65) abut against rigid stops 599 of the shafts 583.

The toothed wheels 596 are in mesh with a common rack 600 (Figs. 65, 51) which is guided by slots 605, 606 for crosswise shifting on bars 607, 608. A rod 609 connects the rack 600 to a lever 611 (Figs. 65, 52) mounted on a shaft 610. The lever 611 cooperates by means of rolls 612, 613 with two cam disks 614, 615 which are rigidly mounted on a shaft 616 forming the main driving shaft of the printing mechanism.

When the rack 600 is moved to the right by rotation of the disks 614, 615, a rotation is imparted to the toothed wheels 596 which rotation is taken part in by the shafts 583 owing to their being coupled by the springs 597 (Fig. 51), until one of the stops 588 of the corresponding shaft 587 strikes the foot of the depressed key 17. Hereby the type wheels 577, 577' belonging to the corresponding row of keys 17 have been set to the value of the depressed key. When in position of rest the type wheels 577, 577' are on zero. If no key 17 has been depressed in one of the rows, the corresponding type wheel has a full revolution imparted to it, said revolution being limited by a fixed stop 617 cooperating with the differential shaft 587. After the printing operation the differential shafts 587 and the type wheels 577, 577' are returned to their initial positions by the disks 614, 615.

15. The drive of the printing devices

The printing shaft 616 is connected to the main driving shaft 42 (Figs. 26, 27, 54) of the machine by a pair of bevel wheels 620, 621 and spur wheels 622, 623, 624. Upon each rotation of the shaft 42 a full revolution is imparted also to the shaft 616. As will be seen from the Figures 2 and 52, the shaft 616 carries, besides the disks 614, 615 a series of cam disks adapted to drive the other devices of the printing mechanism. To these devices belong the feeding mechanism for the control strip, for the ticket, for the account book, for the card, the cutting device for the ticket, the driving mechanisms for the printing plates and the ratchet device for the consecutive number.

The rear disk 626 (Fig. 52) is a groove disk in the curved groove 627 of which (Fig. 58)

engages a roll 628 of a rod 630 embracing with its forked end the shaft 616 and pivoted at its other end to an angle lever 629. The angle lever 629 is rigid on a shaft 631 mounted in the frame and having fixed on it a lever 632 (Fig. 52). The upper arm of the angle lever 629 and the arm 632 are connected by a rod 633 which projects through slots 634 (Figs. 60 to 64), concentric to the shaft 631, of seven arms 635 loosely mounted on the shaft 631. The rod 633 has, at a certain point, a bent-out portion, see Fig. 52, in order to not interfere with the movements of a toothed wheel 672 described hereinafter. These arms 635 are impositively connected to the rod 633 by springs 636 so that the upper wall of their slots 634 normally abuts against the rod 633. The left-hand ends of the arms 635 have pivoted on them, by pins 637, controlling slides 638 embracing with their fork-shaped lower ends a guiding rod 639 mounted in the frame of the machine. Each controlling slide 638 carries on its upper end a cross piece 640 having two lateral lugs 641, 642. While the cross pieces 640 of the fourth and fifth slides from the rear are pivotally connected by the pins 637 to said slides, the connection between the remaining slides and the cross pieces is a rigid one.

The lateral lugs 641, 642 of the controlling slides cooperate with fourteen controlling disks, in particular with controlling disks 643 to 649 (Fig. 52) rigidly fixed on a shaft 650 and with controlling disks 651 to 657, rigidly fixed on a shaft 658 (Figs. 56, 52). The latter carries a toothed wheel 659 geared, by means of a toothed wheel 661 loosely mounted on a shaft 660, to a toothed wheel 663 rigidly mounted on a shaft 662. This latter carries at its rear end a toothed wheel 664 (Fig. 51) engaged by the rack 547, the position of which is controlled by the member 82' allotted to the row of keys 12 (Fig. 1).

In a similar manner the shaft 650 is in connection with the rack 543, attached to the member 82' of the row of special keys 11, by means of toothed wheels 671, 672 (Fig. 56), 673 (Fig. 51), by a sleeve 674 (Fig. 51) surrounding the shaft 642 and a toothed wheel 675 fixed to the rear end of the sleeve 674.

As described in Chapter 10, the positioning member 82' of the row of keys 11 is in connection with the controlling shaft 274 and the positioning member of the row of keys 12 with the controlling shaft 370, so that in setting the transaction totalizer, the shaft 650 is positioned in correspondence with the controlling shaft 274 and the shaft 658 in correspondence with the controlling shaft 370.

The controlling slides 638 carry at their lower end pins 680 (Fig. 56) engaging slots 681 of rods 682 (Figs. 56, 59), 683 (Fig. 60), 684 (Fig. 62), 685 (Fig. 61), 686 (Fig. 63), 687 (Fig. 64) and 688 (Fig. 66). The curved groove 627 (Fig. 58) is of a shape such

as to cause the rocking frame 631, 633 to have imparted to it a rocking motion, after the shafts 650, 658 have been positioned from the transaction totalizer. Upon this rocking motion taking place, the controlling slides 638 are guided impositively with the lugs 641, 642 of their cross pieces 640 against the periphery of the disks 643 to 649 and 651 to 657 (Fig. 52). Those of the controlling slides 10 the lugs 641, 642 of which are, when this takes place, opposite to recesses of the controlling disks, are taken along downward and swing downwards the rods 682 to 688 engaged by their pins 680 and mounted on arms 15 690 of a shaft 689. In so doing, the rods 682 to 688 come to engage by recesses 691 a rod 692 (Figs. 60 to 64) and pins 693 (Fig. 59) or 694 respectively (Fig. 66) which are driven by the shaft 616 in a manner hereinafter described.

The rod 692 (Fig. 52) is carried by two arms 695 rigidly connected to one another by a sleeve 696. This sleeve 696 is mounted on a shaft 701 and is connected to arms 697, 25 698 (Fig. 60) carrying rolls 699, 700, cooperating with cam disks 705, 706 fixed on the shaft 616. With the rod 692 cooperate the five rods 683, 684, 685, 686, 687 (Figs. 60 to 64) which are adapted to drive the ticket cutting device, the printing plates for the book, the card, control strip and ticket.

The pin 693 (Fig. 59) is carried by one arm 707 of a three-armed lever 708 cooperating by rolls 709, 710 with cam disks 711, 712 35 rigid on the shaft 616. The pin 693 is adapted to engage the rod 682 for driving the feeding mechanism for the control strip.

The three-armed lever 708 is rigidly fixed on the shaft 701 which further has rigidly 40 mounted on it an arm 713 (Figs. 52, 65), said arm being connected by a rod 714, by an arm 715 loosely mounted on the shaft 689 and by a rod 716 pivoted to said arm 715, to the device for printing the consecutive number. The four type wheels 522, 522' (Figs. 51, 65) for the consecutive number carry on their peripheries two groups of types 0 to 9. By means of sleeves 717, 717' these type 50 wheels are loosely mounted on the tubes 524 and are driven by the oscillation of both 721, 722 which are rotatable around the sleeves 717, 717'.

The bow 721 (Fig. 65) is attached to the rod 716, the bow 722 is connected to the bow 55 721 by a longitudinal rod 723. Each bow has pivoted on it stepped pawls 724 engaging, in known manner, ratchet teeth 725, 725' of the type wheels, said wheels each having a deep groove and effecting the ratchet motion and the tens transfer of the type wheels. Spring-actuated pawls 728 mounted on cross 60 beams 726, 727 further engage the ratchet teeth 725, 725', said pawls yieldingly keeping the type wheels in every position. At all 65 the four printing places the same consecu-

tive number is in the printing position. The ratchet motion of the consecutive number does not depend, as evident, on the position of the controlling disks; this motion takes place with each operation of the machine. 70

The pin 694 (Fig. 66) is fixed on one arm 729 of a three-armed lever 730 cooperating by rolls 731 with cam disks 732, 733 rigid on the shaft 616. This pin 694 may be engaged by the rod 688 adapted to feed the tickets. An arm 734 is pivoted to the arm 75 690 (Fig. 66) connected to the rod 688, said arm 734 being connected by two rods 735, 736 to two arms 739, 740 rigid on eccentrically mounted bars 737, 738. These bars 80 carry loose rubber drums 741, 742 which by the arm 734 swinging in anti-clockwise direction are approached to engraving drums 743, 744. These engraving drums are rigidly mounted on shafts 745, 746 mounted in 85 the frame of the machine and carrying on their front ends toothed wheels 747, 748 (Fig. 55). The wheel 747 is in mesh with a wheel 749 which in its turn, is in mesh with a toothed wheel 750. 90

On the driving shaft 616 (Fig. 54) are arranged a toothed segment 755 to be engaged by the wheel 750, and a locking segment 756 cooperating with two pins 751 carried by the toothed wheel 750. Upon rotation of the 95 shaft 616 the wheel 750 has imparted to it by the segment 755 a stepwise motion during which the engraving drums have imparted to them a full revolution. As long as the segment 755 is not engaged by the wheel 750, 100 this latter is locked by the locking segment 756 and the pins 751. In the position of rest the engraving drums present to the rubber drums 741, 742 (Fig. 66) a flattened portion. Between this portion and the rubber 105 drums is introduced the ticket strip which comes from a supply drum 758 mounted on a shaft 757 (Fig. 54), and is fed by a guide 759 (Figs. 54, 66). For inking the engraving drums 743, 744 there are arranged ink drums 760, 761 mounted in the frame beside the first-named drums. When, upon a driving motion of the controlling slides, the rod 688 (Fig. 66) is brought into engagement 110 with the pin 694, the rubber drums 741, 742 are pressed against the engraving drums 743, 744. Upon the driving motion then following, of the engraving drums by the segment 755, the ticket strip is fed by the normal length of a ticket, the front and rear side 120 of the latter being printed at the same time by the engravings.

The arm 690 attached to the rod 687 (Figs. 64, 52) has pivoted to it, by means of a pin 762, a rod 763 and a rack 764. The rod 763 125 is connected to an arm 765 of a sleeve 767 (Fig. 52) rotatable on a shaft 766. On the front end of this sleeve 767 is rigidly fixed a frame 768 (Figs. 52, 64) which carries, by means of two arms a printing plate 769 ex- 130

tending crosswise below the type wheels arranged on the shaft 521. Upon each operation of the machine in which the rod 687 is in engagement with the rocking rod 692, this printing plate is pressed against the type wheels and causes the set types to be printed on the ticket.

The rack 764 is held in mesh, by a spring 770, with a ratchet wheel 771 mounted on a shaft 772. This latter carries, within the range of the ticket strip, a grooved drum 773 (Fig. 66) serving for spacing the lines on the ticket strip. This line spacing drum 773 cooperates with a rubbered counter drum 774 rotatably mounted in the frame of the machine. The feeding motion of the drum 773 takes place, as will be seen from the shape of the teeth of the rack 744 (Fig. 64), upon the return motion of the printing plate 769 into position of rest. When this takes place, the ticket strip is pressed by the high portion of the drum 773 against the counter drum and taken along for the space of a line.

To the left-hand end of the guide for the ticket strip is attached the cutting device 759 (Fig. 66) for said strip. This device consists of a plate 775 (Figs. 60, 66, 55) fixed to the frame, of a counter knife 776 screwed thereto and of a knife 777 (Fig. 60). The knife 777 is connected to the shaft 766 by two arms 778, said shaft carrying on its rear end a rigid arm 779 (Figs. 60, 52) attached to the arm 690, connected to the rod 683, by a rod 780. When the rod 683 is being coupled with the rocking rod 692, the knife 777 has imparted to it, simultaneously with the printing motion of the printing plate 769 (Fig. 64) a rocking motion whereby the ticket projecting to the left beyond the guide 759 is cut off and falls into a chamber 781 (Fig. 1) from which it may be removed.

In order to print the card, the same is introduced, through a slot 782 (Fig. 1) provided in the front wall of the casing, between the upper portion of the type wheels arranged on the shaft 521 and a printing plate 783 (Fig. 62). This plate is rigidly connected by arms 784 (Figs. 62, 52) to a shaft 785 mounted in the frame, said shaft carrying at its rear end an arm which is connected by a bent rod 787 to the arm 690 attached to the rod 684.

Like the card also the book is introduced, through a slot 795 (Fig. 1) of the front wall of the casing, between the lower part of the type wheels, and a printing plate 788 (Fig. 61). The printing plate 788 is rigidly connected by arms 789 (Figs. 61, 52) to a shaft 790 mounted in the frame, said shaft carrying at its rear end an arm 791 which is connected by a rod 792 to the arm 690 attached to the rod 685.

Pin wheels 793, 794 (Fig. 55) serve for spacing the lines on the book and the card, said pin wheels projecting with their pins

into the slots 782 and 795 (Fig. 1) and being mounted on slides 796, 797. These slides are adapted to vertically shift in guides 798 and are pressed upwardly by springs 799. Bent-over portions 800, 805 (Figs. 1, 55) of the slides 796, 797 projecting through the casing wall serve for depressing the pin wheels 793, 794, in order to clear the slots 782, 795 upon introducing the book and card, respectively.

The pin wheels are rigidly connected to ratchet wheels 806 (Fig. 55) which are engaged by pawls 803, 804, acted upon by springs 807, said pawls being mounted on arms 808, 809 rotatably mounted on the axles of the pin wheels. The arm 809 has attached to it a rod 810 the other end of which is connected to a double lever 812 pivoted on a fixed tap 811. The upper arm of this double lever is connected, by a rod 813, to a rod 814 which has the arm 808 pivoted to it.

The rod 814 is connected at its right-hand end to a double lever 815 mounted on the shaft 701 (Figs. 54, 52), the lower end of this double lever being connected to a rod 816 which is guided by its forked end on the shaft 616. By means of a roll 817 this rod 816 engages the curved groove of a cam disk 818 (Fig. 52) rigid on the driving shaft 616. Upon rotating the shaft 616 the pawls 803, 804 (Fig. 55) receive a to and fro motion by means of the rods 814, 813, 810 so that the book and the card when being introduced, are fed with each operation of the machine by the space of a line.

The arm 690 connected to the rod 686 (Fig. 63) has pivoted to it a rod 819 which is attached to an arm 821 rigid on a shaft 820. Another arm 823 of said shaft 820 is connected, by a rod 822, to a rocking frame 825 (Figs. 63, 52) mounted on a shaft 824 and carrying the printing drum 826 for printing the control strip. This drum 826 is arranged opposite the upper part of the type wheels of the shaft 520.

As described hereabove, the rod 682 (Fig. 59) is coupled to the pin 693 for actuating the control strip feeding device. A rod 827 is attached to the left-hand end of the rod 682, said rod 827 being connected to an angle lever 828 rotatable on the shaft 820, and, by means of rod 829, 830, to an angle lever 832 mounted on a shaft 731, and to a lever 834 mounted on a shaft 833.

The control strip 835 (Fig. 55) is fed from a magazine drum 836 between cross ribs 837, 838 over a fixed guide roll 839, the printing drum 826, a feeding roll 840 to the rewinding drum 802 loosely mounted on the shaft 833. The magazine drum 836 (Fig. 53) is mounted on a sleeve 853 connected to the hub 843 and surrounding the shaft 831. The sleeve 853 has a slot 852 and fixes the magazine drum by friction in every position of rotation. The cross rib 838 is carried by two arms 841 (Figs. 53, 52) the rear of which is rigidly connected

to the hub 843, projecting through the casing wall 842, of the angle lever 832. The rib 837 is carried by arms 844 loosely mounted on the shaft 831 and so in impositive connection by a spring 845 with the rib 838 that both said ribs are pressed against one another and the control strip 835 is clamped between them.

The feeding roll 840 (Figs. 55, 53) is fixed on a segment 846 rigidly connected to the hub 847 of the arm 834 loosely mounted on the shaft 833. The segment 846 has further mounted on it by means of a pin 847 a clamping piece 848 having a wedge surface 849 (Fig. 55) which is curved eccentrically relative to the pin 847. Said wedge surface cooperates with a wedge groove 850 (Fig. 53) of a disk 855 which is rigidly connected to the rewinding drum 802, said wedge surface being pressed into said groove by a spring 856. Another clamping piece 857 (Fig. 55) engages the wedge groove 850 of the disk 855 by means of a wedge surface 854 and acted upon by a spring 858, this piece 857 being mounted by a pin 859, on a segment 860 loosely arranged on the shaft 833. The segment 860 has a recess limited by two curved surfaces 861, 862. A laterally bent lug 863 of a lever 865 loosely mounted on a fixed pin 864, projects into said recess. The lever 865 is connected by a sleeve 866 (Fig. 53) to two arms 867 carrying a feeling roll 868 abutting under the action of a spring 869 (Fig. 55) against the periphery of the rewinding control strip. It is attained hereby that the lug 863 is at a distance away from the shaft 833 depending on the radius of the rewound control strip. When a new strip is to be put on, the feeling roll 868 may be lifted, against the action of the spring 869, from the rewound drum.

The upper surface of the control strip is situated below a display hole 871 (Fig. 55) of the plate 872 of the casing, through which opening the last printed lines may be read off. The feeding device for the control strip works so that in the position of rest of the machine the last line is at the place denoted by 873 (Fig. 55) of the printing drum 826 where this line may be read-off through the display hole 871. Shortly before a new line is printed, this printing taking place in the printing path 874, the last line comes to be fed into the place denoted by 875 where this line is distant from the printing path by the space of one line. When the new line has been printed this line passes on to the place 873. These operations take place in the following manner:

If the rod 682 (Fig. 59) is being coupled with the pin 693, the levers 832, 834 and therewith the ribs 837, 838 (Fig. 55) and the segment 846 with the clamping piece have imparted to them a rocking motion on their axes in clockwise direction. This taking place, the control strip 835 is taken along by

means of said two ribs 837, 838. This causes the rewinding drum 802 to turn in clockwise direction whereby the strip is wound back a certain distance from the rewinding drum. Together with said drum 802 the grooved disk 855 will move also, taking with it by clamping action the clamping piece 857 and thus the segment 860. Now the curved surface 862 is so shaped that, in the different radial positions of the feeling roll 868 it will strike the lug 863 and stop the magazine drum and the control strip at that moment when the last printed line has reached the place 875. The arms 837, 838 and the segment 846 move still a little farther, the control strip 835 gliding through between the ribs 837, 838. If the strip had not been stopped by the surface 862 abutting against the lug 863, the last line would have reached again the place 874. When the last line has reached the place 875, the printing of the new line takes place at the place denoted by 874 of the control strip. Thereupon the segment 846 and the ribs 837, 838 are swung back by the actuation of the rod 682. Upon this return motion the segment 846 is rigidly connected by the action of the clamping piece 848, to the rewinding drum 802. As the whole forward swinging motion of the segment 846 corresponded to a feeding motion of the strip from place 873 to place 874, the strip will be fed, in the return motion of the segment 846 causing the strip to be rewound on the drum 802, so far that the new line travels from place 874 to place 873 where it may be read-off through the display hole 871. Upon the anti-clockwise rotation of the rewinding drum caused by the return motion of the segment 846, also the segment 860 is taken along by the clamping piece 857 by friction generated by the action of the spring 858, until the surface 861 of the segment 860 abuts against the lug 836. After this all parts of the feeding mechanism assume again their initial positions and are ready for feeding new lines.

The ink ribbon 876 (Fig. 66) is an endless one. It goes from an ink roll 877 serving at the same time for driving the ribbon, over a tension roll 878, guide rolls 879, 880 and a guide rail 881 back to the ink roll 877. It supplies both the two sets of type wheels and the racks 579 for the type wheels of the consecutive numbers of the accounts.

The impression on the card (Fig. 67), the book (Fig. 68), the ticket (Figs. 69 and 70) and the control strip (Fig. 71) consists of seven columns, according to the different kinds of printing wheels. The column 882 (Figs. 67, 68) comprises seven numeral positions for the consecutive number of the account, column 883 comprises four positions for the date, column 884 one position for the sign N, ZS, ES of the row of keys 12, column 885 has three positions for the rows of keys

13, column 886 has one position for the signs B to HR of the row of keys 12, column 887 comprises one position for the signs plus or minus, column 888 comprises ten positions for the amount, and column 889 has four positions for the consecutive number of transaction.

16. Mode of operation of the printing mechanism

As will be seen from the Figures 67 and 68, the card and the book of a customer will always get the same account number. The date is that of the day of the transaction. The last transaction booked on a certain day always represents a new state of account ($\bar{b}$). The column 884 shows none of the signs ZS, ES; it will be seen therefrom that grand-totals (ES) and sub-totals (ZS) do not come to be printed on the card and the book. The sign N in column 884 refers to addenda to be made sometimes. In case the book is not present when a transaction is to be made, for instance when money is to be received on account by an order to the booking office, as it may be assumed with the transaction No. 0210 of 10.1.24, this transaction is recorded in the usual way on the control strip, ticket and card, but not in the book. This transaction, not recorded in the book, of 10.1.24 is entered upon the next presentation of the book, for instance on 20.2.24 by the transaction No. 0486. The depressing of the key N causes in this case the addendum transaction to be printed in the book only and the several control totalizers to remain unacted upon. The recordings in the column 885 denote the account totalizers thrown into operation too with the transaction by the keys 13 according to the kind of the item in question. From the column 886 it is to be seen that only "received" (Zu), "paid out" (A $\bar{b}$) and the new state of account ($\bar{b}$) come to be recorded in the book and card; all the remaining keys of the row 11 do not influence the printing plates 788, 783 (Figs. 61, 62) for the book and the card. The sign of column 887 is printed with each item. The feeding of the consecutive number of transaction, column 889, takes place at every operation of the machine. When the number 9999 has been reached, a new series of numbers will begin from 0000. Only with a ticket (Fig. 69) the numbers will be consecutives, while with the book, the card and the control strip the numeral denomination is an interrupted one since not all the single sections of a transaction are recorded thereon.

The ticket (Fig. 69) contains the complete statement of a record of first order, that is the old state of account B, the amount received or paid out Zu or A $\bar{b}$, and the new state of the account, $\bar{b}$. After each taking of a total, $\bar{b}$, from the main totalizer or after taking a total (ES and ZS) from one of the

controlling totalizers the ticket cutting device comes to operate. The great ticket feeding action with printing the engraving takes place in case one of the keys B, ZS or ES has been depressed. Fig. 70 shows a ticket indicating the grand-total of the control totalizer A $\bar{b}$.

The control strip (Fig. 71) records all the items except the old state B and the new state, $\bar{b}$, of an ordinary transaction. The item denoted by consecutive number 0544 is a grand-total from the transaction totalizer $-\bar{b}$. The items 0528 and 0535 denote grand-totals from the auxiliary totalizer, the items 0542 and 0543 denote sub-total and grand-total from the account totalizer 15. The item 0548 is a sub-total from the main totalizer.

The recording of the grand and sub-totals on the ticket and the control strip has the object of ascertaining the state of the totalizers when the machine is to be delivered to another operator.

The different printing effects at the several printing places are attained by the shape of the controlling disks, the disks 643 to 649 (Fig. 52) being set by the keys 11 and the disks 651 and 657 being set by the keys 12.

The disks 643 and 651 (Fig. 66) serve for controlling the great ticket feeding action and of the engraving print. The disk 643 has a recess reaching into the range of the lug 642 of the allotted control slide when the key $-B$ or $+B$ is being set. The disk 651 has a recess which reaches the range of the lug 641 when the key ES or ZS is depressed. As the cross piece 640 is pivotally mounted on the controlling slide 638, the rod 688 is coupled with the pin 694, in order to initiate the great ticket feeding action, always when one of the keys $+B$, $-B$, ES, ZS is being set, that is when in an ordinary transaction the old state is recorded or when the total is taken from one of the control totalizers.

The disks 649, 657 (Fig. 60) controlling the actuation of the ticket cutting device have recesses corresponding to the keys $-\bar{b}$, $+\bar{b}$ and ES, ZS. The cutting of the ticket therefore takes place always at the end of that operation in which one of these keys is set, that is when the new state ($-\bar{b}$, $+\bar{b}$) is printed or when a total is taken from one of the control totalizers.

The control of the printing motion of the printing plate 769 for the ticket and, at the same time the line spacing action for the ticket is done by the control disks 648, 656 (Fig. 64). These disks have recesses corresponding to the keys $+B$, $-B$, Zu, A $\bar{b}$, $+\bar{b}$, $-\bar{b}$ and ES, ZS. Since the cross piece 640 is pivotally connected to its control slide 638 also in this case, the rod 687 is coupled, upon setting one of said keys, with the rocking rod 692, whereby the printing of the old state, of the amounts received and paid out, of the new

state or of a total from one of the control totalizers is effected on the ticket. As the printing plate 769 returns the rack 764 effects the line feeding in the above-described manner.

The control of the printing motion of the printing roll 826 (Fig. 63) for the control strip is done by the control disks 647, 655. These disks have recesses corresponding to the keys Ab , Zu , RZ , HR and ES , ZS . The cross piece 640 is pivotally connected to its slide 638. Upon depressing one of these keys a print therefore is made on the control strip, that is the amounts received and paid out, the sub-totals of the main totalizer (RZ) and the totals from the control totalizers are recorded on the control strip.

The control of the control strip drive is done by the disks 644, 652 (Fig. 59). These disks have, in accordance with the disks 647, 655 (Fig. 63), recesses corresponding to the keys Ab , Zu , RZ , HR and ES , ZS and effect the coupling of the rod 682 (Fig. 59) with the pin 693. This latter executes its swinging motion after the printing motion of the roll 826 (Fig. 63) has been completed. The control strip is therefore fed by the space of a line after each printing motion of the roll 826.

The control of the printing motion of the plates 788 (Fig. 61) for the book and 783 (Fig. 62) for the card is effected by the control disks 646, 654 (Fig. 61) and 645, 653 (Fig. 62). These disks present recesses corresponding to the keys Ab , Zu , $-b$, $+b$. Besides, the disks 653, 654 allotted to the keys 12, have recesses which are, in the zero position, opposite to the lateral lugs 641; the disk 654, further, has a recess corresponding to the key N . The cross pieces 640 are rigid to their slides 638 so that a coupling of the rods 684, 685 can take place only if at the same time recesses of both the disks are opposite the lugs of the cross piece 640. This is the case if none of the keys 12 and one of the keys Ab , Zu , $-b$, $+b$ of the row 11 is being depressed or if in the row 12 the key N and in the row 11 one of the keys Ab , Zu , $-b$, $+b$ is being depressed. Therefore only the received and paid out amounts and the new states of account come to be recorded on the card and the book.

The line feeding device for the book and the card (Fig. 55) is operated, as described, directly from the main shaft 616. A special control mechanism for this device is not required, as the book and the card are introduced in the machine only for the duration of the printing operations allotted to them.

The described arrangements of the printing mechanism enable the different booking operations in the different impression carriers (book, card, ticket, control strip) to be recorded in the following manner:

1. Printing the old state of account ($-B$, $+B$) on the ticket only;

2. Printing the amounts received and paid out (Ab , Zu) in the book, on the card, the ticket and the control strip;

3. Printing the new state of account ($+b$, $-b$) on the card, in the book and on the ticket;

4. Printing a sub-total (RZ) from the main totalizer on the control strip only;

5. Printing sub-totals and grand-totals (ES , ZS) from a control totalizer on the control strip and the ticket;

6. Printing addenda only in the book.

17. The key blocking means

Blocking means are provided between the keys 10, 11, 12, 13, 17 and M (Fig. 1) compelling the operator to make all the setting operations belonging to a transaction, before the operation of the machine is released and preventing him from making other setting operations than those belonging to this transaction. These means further cause the different records of an ordinary transaction to be made in the prescribed succession only, they have the further effect that during an ordinary transaction only the records of second and forth order can be made and that amounts to be set and occurring again in succeeding records of the machine, need to be set one time only.

The whole means serving for the above-mentioned purposes are of the following four kinds: Means for releasing the keys, means for mutually blocking the keys, means for determining the setting succession in one operation of the machine and means for determining the setting succession of the different records of a transaction.

18. The key releasing means

The release of the amount keys 10, of the main keys, of the key RZ , of the by-keys 13, of the keys ZS , ES takes place at the end of each operation of the machine. All the above-named keys cooperate with locking bars which engage, in the manner described with the amount keys, by hook-shaped portions 31 (Fig. 2) over pins 30 of the depressed keys. To release the keys the locking bars are pushed upwardly by releasing bows, the key pins 30 being disengaged by the hook portions 31 of the said bars and the keys rushing back by spring action, into their positions of rest. As to the amount keys, the releasing bow 39 rocking about the shaft 38 (Figs. 2, 77) effects the releasing motion of the locking bars 28 (Fig. 2) in the manner described in chapter 2.

The shaft 38 (Figs. 77, 25) extends to the right up to below the key boards of the transaction keys and has there loosely mounted on it a releasing bow 891 engaging by a roll 892 (Fig. 25) a cam disk 893 (Figs. 25, 130

77) fixed to the driving shaft 42. The bow 891 cooperates with lower prolongations 40 of a locking bar 901 (Fig. 88) for the keys -B to RZ of the row 12 and of locking bars 894 (Fig. 89), 895 (Fig. 90), 896 (Fig. 92) for the by-keys 13 and with a locking bar 898 (Fig. 95) for the keys ES, ZS. The disk 893 (Figs. 25, 77) is of a shape like that of the disk 43 (Fig. 2) so that the release of said amount and transaction keys takes place at the same time, at the end of each operation. As in the amount setting mechanism the said locking bars are guided by end slots on rolls and bars 26, 27. Springs 899 (Figs. 89, 92) cause them to yieldingly abut on said rolls and bars.

The release of the keys HR and N does not take place by means of the driving mechanism, but by means of special releasing keys L. The keys HR and L of the row 11 cooperate with a locking bar 900 (Fig. 86) acted upon by a spring 899. As this bar 900 does not have the lower prolongation 40; it is not influenced by the releasing bow 891. Upon the key HR being depressed, the bar 900 engages with its hook portion 56 over a bar 905 connected as hereinafter described to the key HR, and locks the same in its set position until the key L is depressed. This key L cooperates, by a bar 905, with a tapered surface 907 of the locking bar 900 and takes the hook portion 56 out of the path of the bar 905 of the key HR, the latter thus rushing back into its position of rest. If the key L is released after the key HR has been released, it returns by spring action to its position of rest.

In a similar manner the keys N and L cooperate with a locking bar 908 (Fig. 95). The locking bars 591 (Figs. 27, 79) for the account keys cooperate, by prolongations 909, with a releasing bow 910 (Figs. 79, 78, 77) which is fastened on a shaft 911 supported on the key frame. The shaft 911 is capable of being shifted axially and is normally held by a spring 912 in its left-hand end position (Fig. 77). In this position an arm 913 of said shaft 911 so cooperates with an arm 914 (Figs. 77, 79) of the releasing bow 891 that on every releasing motion of said bow the bow 910 likewise receives a releasing motion and releases the set account keys 17.

As in an ordinary transaction the account number remains the same during the different operations of the machine, its release takes place, in order to obviate a repeated setting thereof, only at the end of the whole transaction viz. after the impression of the new state of account effected by depressing the keys +b, -b has been made. At the beginning of the first operation of a record of first order the frame formed by the shaft 911 and the bow 910 is laterally shifted by means hereinafter described, so that the arm 913 of the shaft 911 comes out of the path of the arm

914 of the bow 891 and a release of the account keys is prevented. Only after depressing one of the keys -b, +b the said frame is again brought back into its normal position by means hereinafter described whereby the arm 914 is capable of transmitting its releasing motion to the arm 913.

As described in chapter 2, amount keys 10 of one row can be released by depressing another key of the same row. This is the case also with the account keys 17. Wrongly depressed amount keys can be released before starting the operation of the machine, by the general releasing key 44 (Fig. 1), denoted by L, while wrongly depressed account keys 17 can be released by the general releasing key 18 (Fig. 1). The key 18 cooperates by its shaft 915 (Figs. 77, 78) with a prolongation 916 of the releasing bow 910.

19. The mutual blocking of the keys of a row.

The rows of the transaction keys are provided with detent devices which cause generally one key only of a row to be able to be depressed. These detent devices are formed, in a well-known manner, by detent disks 917 (Fig. 88) which are mounted on two supports 918 (Figs. 72, 74) arranged on the left-hand side of the rows of keys, and cooperate with pins 902 of the shafts of the keys. The whole space between said disks 917 is so chosen that one of the pins 902 only is capable of entering between the disks so that a simultaneous depression of two or more keys is rendered impossible.

In the row of keys 11 said pins 902 are not fixed on the keys 11 themselves but on blind keys 920 (Figs. 72, 74, 79) which are guided like the keys 11 in partitions 921 of the key frame and possess neither the head nor cooperate by their feet with differential members of the transaction totalizer.

The blind keys 920 are connected to the keys 11 by means of a frame which is formed by a bow 922 (Figs. 72, 79) rotatably mounted by pins 923 (Fig. 79) on the partitions 921, and by the bar 905 rigidly connected to said bow. The bar 905 engages by both ends slots 925 of the keys 11 and of the blind keys 920, as illustrated with one blind key in Fig. 74. By the described connection the blind keys 920 are compelled to take part in all movements of the keys 11 so that the detent device 917, 918 arranged on the left-hand side of the blind keys is operative also for the keys 11.

As it will be seen from Figures 88 and 72, the keys HR and L of the row 11 are not subject to the detent action of the device 917, 918. As the key HR has to cause the auxiliary totalizer also to be thrown-in for desired number of transactions, this key must be able to be depressed together with another key 11. The detent disks are therefor arranged between the upper seven keys only.

As to the row 12, the detent device 917, 918 (Fig. 72) works between the keys N, ZS, ES so that if the key N is being depressed, no totals can be taken from the control totalizers and, if one of the total keys ZS, ES is being depressed, no addenda can be recorded.

20. Locking the keys during operation of the machine

By depressing the motor key M (Fig. 96) all the keys are locked, the circuit for the driving motor is clausued and the operation of the machine is initiated.

The shaft 505 (Fig. 96) of the motor key M has mounted on it a pin 926 which engages a slot 927 of an arm 929 fixed on the bow 928. The bow 928 which is loosely mounted on the rod 483 extends to the left up to the right-hand side of the amount keys (Fig. 11) and has there a downwardly directed arm 931 to which is articulated a thrust bar 930 (Figs. 11, 96) cooperating with the cam disk 47 of the locking bow 46 (Figs. 11 and 2) for the amount keys. The disk 47 is mounted for limited rotation on the shaft 42 by means of a slot 932 (Fig. 11) provided on its hub and a pin 933 fixed in the shaft 42. Another pin 934 (Figs. 11, 96) arranged on the right-hand side of said disk 47 is able to cooperate with the end of the thrust bar 931. This bar is laterally held by a disk 935 fixed on the hub of the disk 47.

The bow 928 has on its right-hand end (Fig. 25) an arm 936 corresponding to the arm 930 and having pivoted to it a thrust bar 937 (Figs. 77, 96). This latter cooperates with a pin 938 (Fig. 96) of a disk 939 formed like the disk 47 and mounted for limited rotation on the shaft 42 by means of a slot and pin connection 940, 941 (Fig. 25). The bar 937 is laterally guided by means of a disk 942. A roll 943 (Figs. 96, 77) of a locking bow 944, for the transaction keys, loosely mounted on the shaft 38 cooperates with said disk 939. The bow 944 is acted upon in clockwise direction by a spring 945 (Figs. 25, 89) and is able to cooperate with lugs 946 of the locking bar 901 (Fig. 88) for the keys -B to RZ, of locking bar 900 (Fig. 86) for the key HR, of locking bars 894 (Fig. 89), 895 (Fig. 90) and 896 (Fig. 92) for the by-keys 13, and 898, 908 (Fig. 95) for the keys 12.

When the machine is in position of rest, the rolls 45 and 943 (Fig. 96) are located in the deep portions of the disks 47 and 939, whereby the lugs 48 (Fig. 2) and 946 (Figs. 89 to 92) and therewith the corresponding keys are released by the locking bows 46 and 944. If now the motor key M is depressed, the bow 928 (Fig. 96) rotates in clockwise direction, the thrust bars 931, 937 move forwards (Fig. 96) and impart a partial rotation to the disks 47, 939 in anti-clockwise direction so that the rolls 45, 943 come oppo-

site the full circumferential portion of said disks, the locking bows 46, 944 engage the lugs 48 (Fig. 2), 946 (Fig. 89) of the locking bars and all the amount and transaction keys are locked in their respective positions. During the operation of the machine the keys remain locked, as the shaft 42 upon its rotation takes along with it the disks 47, 939 by means of the pins 933 (Fig. 11) and 941 (Fig. 25) and the disks turn, during their rotation, their full portion to the rolls 45, 943. At the end of the operation of the machine, shortly before the releasing motion of the releasing bows 39 (Fig. 2) and 891 (Fig. 95), the deep portion of the disks arrives below the rolls 45, 943 (Fig. 96). This portion is engaged by the rolls of the locking bows under the action of their springs so that the key locking bars are released. As soon as the ascending section of the deep circumferential portion of the disks reaches the rolls, this being the case shortly before the revolution of the shaft 42 is completed and when the disks have reached their initial position, said disks are stopped.

The locking bars 591 (Fig. 79) of the account keys have lugs 947 which cooperate with a locking bow 950 fixed on the frame by means of arms 948 (Figs. 79, 77) and a shaft 949. The right-hand arm 948 has a rearward prolongation 955 having a pin 956. On this pin rests one arm of an angle lever 958 loosely mounted on the shaft 957 (Figs. 77, 79). The upper arm of said angle lever 958 abuts against a projection 959 of the locking bow 944 of the transaction keys. It is evident that upon each locking motion of the bow 944 the bow 950 is likewise turned into locking position by the angle lever 958 so that also the account keys 17 are locked when the motor key M is depressed and the machine operates.

A two-armed lever 954 mounted on the shaft 38 further cooperates with the pin 956 (Fig. 79) of the bow 950 for the account keys, said lever 954 being influenced in the manner described hereinafter by the keys -B, +B and -b, +b for the purpose of keeping the account keys locked also during the periods of rest arising between the single operations of a record of first order. The right-hand arm 948 of the bow 950 has a bent-portion 960 (Figs. 79, 78) on which abuts the upper arm of an angle lever 962 mounted in the frame by a pin 961. The lower arm of said angle lever acts upon the right-hand arm (Fig. 77) of the releasing frame 910, 911 (Fig. 78). When the bow 950 (Fig. 79) is rocked upwardly into locking position, the angle lever 962 effects the lateral shifting of the releasing frame 910, 911 (Fig. 78) against the action of the spring 912, the arm 913 (Fig. 77) of the shaft 911 coming out of the path of the arm 914 of the releasing bow 891 for the transaction

keys. The releasing frame 910, 911 therefore cannot be actuated as long as the account keys are locked.

21. Arrangement of the block bars and block bows

The different mutual blocking operations of the keys are substantially caused by block bars arranged beside the keys, said bars co-operating with block bows mounted on the block shaft 49 (Figs. 2, 72) situated above the setting mechanisms. The disposition of said bars is illustrated in Figures 74 and 72. The block bars are provided like the described lock bars, at their extremities with slots by means of which they are guided on rolls and rods 26, 27 respectively. They yieldingly abut against the lower rolls and rods 26 respectively. On the one hand the block bars cooperate with the key pins 30, 902 of the keys 12 and 13 and with the rods 905 (Fig. 74) of the keys 11 respectively, and, on the other hand, in the manner hereinafter described, with prolongations of the block bows or with special barring means.

Referring to Fig. 74, on the left are arranged the item counters 16 for the main keys, then follows to the right the detent device 917, 918 cooperating with the pins 902 of the blind keys 920.

Nine block bars cooperate with the rod 905 arranged between the blind keys 920 and the keys 11, viz. The block bars 963 (Fig. 79), 964 (Fig. 80), 965 (Fig. 81), 966 (Fig. 82), 967 (Fig. 83), 968 (Fig. 84), 969 (Fig. 85), 900 (Fig. 86), 970 (Fig. 87), the bar 900 (Fig. 86) serving, as above described, for blocking and releasing the key HR. On the right-hand side (Fig. 74) of the key row 11 is arranged the bar 901 (Fig. 88) cooperating in the above described manner with the key pins 30. On the left-hand side of the rows 13 are situated the item counters 15 and the detent devices 917, 918 cooperating with the pins 902 of the keys 13. Beside the left-hand row of keys 13 for recording amounts received, there is arranged, besides the described locking bar 894 (Fig. 89) a block bar 971 (Fig. 89); in the row of keys 13 recording the amounts paid out, there is arranged, besides the described locking bar 895 (Fig. 90) a block bar 972 (Fig. 90). Beside the row of keys 13 recording amounts received and paid out are, arranged besides the described locking bar 896 (Fig. 92) two block bars 973 (Fig. 91) and 974 (Fig. 92). The first-named bar 973 cooperates with the pins 30 of the "received"-keys 19 to 23 and the bar 974 cooperates with the pins of the "paid out"-by-keys 24 to 27.

The row of keys 12 has no item counter. On its left-hand side is the described detent device 917, 918 (Fig. 74) cooperating with the key pins 902, while on its right-hand side are arranged, besides the described two

locking and releasing bars, viz. 898 (Fig. 95) for the keys ZS and ES and 908 for the key N (Fig. 94), a block bar 975 (Fig. 93) for said key N and a block bar 976 (Fig. 94) for the keys ZS, ES.

As will be seen from Fig. 76, five auxiliary slides 977 (Fig. 80), 978 (Fig. 81), 979 (Fig. 82), 980 (Fig. 84), 981 (Fig. 87) are arranged between the keys 11 and the blind keys 920, besides the block bars 963 to 970 and 900. These auxiliary slides are guided by means of upper and lower slots 982 and 983 on cross bars 984, 985 respectively. These bars are mounted in a box-shaped casing 986, the side walls 987, 988 of which (Figs. 76, 86) are suspended by arms 989, 990 from the rods 26, 27 which guide the block bars. Springs 993 yieldingly act in upward direction on the auxiliary slides 974 to 980, said springs being attached to the upper end of a cross bar 994. The slides are further laterally guided by rear extensions 995 (Fig. 82) projecting through corresponding slots of the casing 986.

In the front and rear wall of the casing 986 (Fig. 83) are shiftably guided three locking cones 996 (Figs. 76, 83), 997 (Figs. 76, 79), 998 (Figs. 76, 83). These cones present a frontal abutting surface 999 by which they cooperate each with two of the bars 905 of the main keys, and are pressed forward by springs 1000. This forward action is limited by pins 1005 fixed on said cones and abutting against the casing 986. By a bent-portion 1006 (Fig. 76) the cone 996 cooperates with a lug 1007 (Fig. 82) of the auxiliary slide 979. The cone 998 (Figs. 76, 83) has a bent-portion 1008 cooperating with a lug 1009 (Fig. 84) of the auxiliary slide 980. A bent-portion 1010 (Figs. 76, 79) of the cone 997 cooperates with a lug 1011 (Fig. 80) of the auxiliary slide 977.

The block bows (Figs. 72, 73) mounted on the shaft 49 are partly rigid partly rotatable or shiftable thereon, when rotatable, they rotate partly in one, partly in both directions.

22. Mutually locking the keys -b and +b.

The shaft 49 has loosely mounted on its left-hand side (Figs. 72, 73) two bows 1012 and 1013 the left arms 1014, 1015 of which engage, by slots, pins 1016, 1017 (Figs. 72, 27a) of two-armed levers 1018, 1019 (Fig. 27a). These levers are pivoted on a pin 1020 of the frame and are in connection, as described in chapter 10, by thrust bars 432, 433 (Fig. 27), with the angle levers 428, 429 cooperating with the differential disk 265' for the main totalizer. Springs 1021 (Figs. 72, 27a) cause the arms 1014, 1015 to normally abut against a pin 1022 (Figs. 72, 73), the lugs 430, 431 (Fig. 27) of the angle levers 428, 429 being kept out of the recesses of the disk 265'.

The right-hand arms of the bows 1012, 1013 (Fig. 72) project with downwardly directed extensions 1023, 1024 (Figs. 72, 73) into the path of rear claws 1025 (Figs. 83, 84) provided on the upper ends of the block bars 967, 968. The latter have tapered surfaces 1026 (Fig. 83) and 1027 (Fig. 84) co-operating with the rods 905 for the keys $+b$, $-b$.

Upon depressing the key $-b$ or $+b$, the corresponding bar 905 acts upon the tapered surface 1026 or 1027 and tends to lift the block bar 967 or 968, respectively. The latter engages, in its turn, the claw 1024 or 1025 respectively and tends to turn the bow 1012 and 1013, respectively, in anti-clockwise direction. According to whether a recess of the disk 265' is opposite to the lug 430 and 431, respectively (Fig. 27) of the angle lever 428 and 429, respectively, or not, this rotation and therewith the depression of the key in question can take place or not. In the position shown in Fig. 27, of the disk 265' which corresponds to a negative total contained in the main totalizer, the key $-b$ is released, the key $+b$, however, is locked by means of the members 430, 428, 432, 1018, 1016, 1012, 1023, 968. In case a positive total is contained in the main totalizer the disk 265' presents to the angle lever 428 a recess. In this case the key $+b$ is free and the key $-b$ is locked.

23. Mutually locking the amount keys and total keys

The block shaft 49 has rigid arms 55 (Figs. 2, 11) cooperating with slots 1028 of the upper ends of the block bars 29 (Fig. 27) for the amount keys, said bars having V-shaped recesses. Within the range of the transaction keys the block shaft 49 is provided with three rigid arms 1029, 1030, 1031 (Figs. 72, 73). The arm 1029 (Fig. 79) presents a tapered surface to the frontal claw 1032 of the forked upper end of the block bar 963. This bar has a tapered surface 1033 which cooperates with the bar 905 allotted to the key RZ. The arm 1030 is opposite the claw 1032 (Fig. 80) of the block bar 964 which cooperates by tapered surfaces 1034 and 1035 with the bars 905 allotted to the keys $-b$, $+b$. The third arm 1031 of the shaft 49 (Fig. 94) is opposite a bent-portion 1036 of the claw 1032 of the block bar 976. The latter has tapered surfaces 1037, 1038 co-operating with the pins 30 of the keys ZS, ES.

If one of the amount keys 10 (Fig. 2) is depressed, the corresponding bar 29 is shifted upward, the slot 1028 thereof embracing the corresponding arm 55 of the shaft 49 and locking this shaft. Herewith also the arms 1029, 1030 and 1031 (Fig. 72) are fixed and the block bars 963 (Fig. 79), 964 (Fig. 80) and 976 (Fig. 94) cannot be lifted, that is to

say, the total keys $-b$, $+b$, RZ, ZS, ES are locked. A total key therefore cannot be depressed before the amount keys have been released. Inversely, no amount key can be depressed when one of the total keys has been set. Upon depressing one of the above-named total keys, the arm 1029, 1030 or 1031 in question, of the shaft 49, is engaged by the claw 1032 of the lifted block bar 963 (Fig. 79), 964 (Fig. 80) or 976 (Fig. 94). When this takes place, the shaft 49 (Fig. 2) has imparted to it a partial rotation in clockwise direction whereby the lower arms 55 reach over the frontal claw 50 (Fig. 2) of the block bar 29 for the amount keys and lock it against being lifted and therewith said keys 10 against being depressed.

24. Releasing the transaction differential members

Each key of a row of keys releases, when depressed, the corresponding differential member which is, in the position of rest of the machine, locked in zero position.

In the amount setting mechanism the pins 64 (Fig. 2) of the differential members 65, 80 are released, as described in chapter 2, by the zero locking levers 62, the bar 29 being shifted upward upon depressing a key of the row in consideration, and the lever 62 having imparted to it, by means of the lever 59, a rocking motion towards the left. As to the transaction differential mechanism, the pins 64' of the differential members 251 for the key row 11, pins 64' of the differential members 253 for the row 13 and pins 64' of the differential members 252 for the row 12 are released in a similar manner by the zero locking levers 62'.

For the row of keys 11 there is arranged, instead of the sub-lever 59 (Fig. 2) a bow 1039 (Fig. 74), which is loosely mounted on a bar 1040 connecting the walls 987, 988 of the casing. This bow 1039 engages behind lugs 1041, 1042, 1043, 1044 of the block bars 963 (Fig. 79), 964 (Fig. 80), 969 (Fig. 85) and 970 (Fig. 87). The right-hand arm 1045 (Fig. 74) of the bow 1039 is prolonged to the rear and cooperates with the pin 60' of the lever 62' for the differential member 251. The block bar 969 (Fig. 85) has a tapered surface 1046 which is influenced by the bar 905 belonging to the key HR. A lever 1052 cooperates with the lug 1043 of the bar 969 (Figs. 85, 74), the other end of which lever 1052 engages by a slot 1053 the pin 426 (Fig. 37a) of the control disk 409 which serves for throwing in and out the auxiliary totalizer. The bar 970 (Fig. 87) has six lugs 1047 which cooperate with the bars 905 for the six main keys. Upon depressing one of said six main keys, the corresponding bar 905 engages a lug 1047 of the bar 970 and lifts it, the lug 1047 taking with it the bow 1039, the arm 1045 of

which moves the zero locking lever 62' for the differential member 251 of the keys 11 into releasing position. In the same manner the differential member 251 is released by depressing the key HR by means of the bar 969 (Fig. 85) and by depressing the key RZ by means of the bar 963 (Fig. 79).

The sub-levers 59' (Fig. 74) for the rows 13, mounted on pivots 1051 of the partitions 921, have lateral lugs 1048 which cooperate in the left-hand row with a lug 1049 (Figs. 74, 89) of the bar 971, in the middle row with a lug 1050 (Fig. 74) of the bar 972 and in the right-hand row with lugs 1055 (Figs. 74, 91) and 1056 (Figs. 74, 92) of the bars 973 and 974. The bars 971 (Fig. 89) and 972 (Fig. 90) are provided with lugs 1057 for all the keys of the row belonging to it. The bar 973 (Fig. 91) has only lugs 1057 for the five upper keys 19 to 23, the bar 974 (Fig. 92) has lugs for the four lower keys 24 to 27. The zero locking lever 62' (Fig. 74) for the row 12 is provided, instead of with a pin 60' with a pin 1058 acted upon on one side by a sub-lever 1059 (Figs. 74, 93) and on the other side by a sub-lever 1060 (Figs. 74, 94). The sub-lever 1059 (Fig. 93) cooperates with a lug 1061 of the block bar 975 which is provided with an oblique slot 1062 acted upon by the pin 30 of the key N. The sub-lever 1060 abuts by its front end against a lug 1063 of the block bar 976. If a key ZS or ES is depressed, the lever 62' is brought into releasing position by means of the bar 976 and the sub-lever 1060. Upon depressing the key N, the rotation of the lever 62' takes place by means of the block bar 975 and the sub-lever 1059.

25. Releasing the amount differential members upon taking totals

The amount differential members 65, 80 (Fig. 2) are released, as described in chapter 2, by a bow 67 extending along the lower prolongations 52 of the zero locking levers 62 being rocked in anti-clockwise direction, upon depressing a total key. The connection of said bow with the total keys $-b, +b, RZ, ZS$ and ES is effected by the arms 1064, 1065 (Fig. 74) situated on the right-hand portion of the bow and carrying pins 1066, 1067. With the pin 1066 cooperates a double lever 1068 mounted on the bar 1040 (Fig. 74) and engaging with a lateral lug 1069 behind the lug 1041 (Fig. 79) of the bar 963 and behind the lug 1042 (Fig. 80) of the bar 964.

The pin 1067 (Fig. 74) is acted upon by a lateral lug 1070 of the sub-lever 1060. This lever cooperates with the block bar 976 (Fig. 94). As described, the block bar 963 (Fig. 79) is lifted by depressing the key RZ, the bar 964 (Fig. 80) by depressing the keys $-b, +b$ and the bar 976 (Fig. 94) by depressing the key ZS or ES. Upon one of these bars being lifted, the bow 67 is swung by inter-

mediary of the sub-lever 1068 or 1060 in anti-clockwise direction whereby the amount differential members are released.

26. The mutual locking of the by-keys and the keys $-b, +b, -B, +B, RZ$

The simultaneous throwing-in of the account totalizers takes place only during the record of amounts received or paid out. The keys 13 must therefore be set only together with the keys Ab and Zu , but not simultaneously with the keys $-b, +b, -B, +B$, and RZ . For the purpose of mutually locking the above-named keys there is rotatably but non-displaceably mounted on the block shaft 49 (Figs. 72, 73) a bow 1070 which is held by a spring 1071 (Fig. 72) in contact with a pin 1072 (Fig. 72) fixed on the frame of the machine. On the left the bow 1070 has two arms 1073, 1074, one of which, 1073 (Fig. 79) cooperates with the rear claw 1075 of the forked upper end of the block bar 963 while the arm 1074 cooperates by an enlarged foot 1076 (Figs. 72, 80, 81) with the claws 1075 of the block bars 964 (Fig. 80) and 965 (Fig. 81). The bars 964 and 963 are acted upon by the keys $-b, +b$ and RZ . The block bar 965 has lugs 1077, 1078 located in the path of the bar 905 allotted to the keys $-B, +B$. The bow 1070, further, presents in the range of the by-keys 13, four arms 1079, 1080, 1081, 1082 (Fig. 72), the downwardly directed lugs of which each cooperate with the frontal laterally bent claws 1083 of the forked upper end of the block bars 971 (Fig. 89), 972 (Fig. 90), 973 (Fig. 91), 974 (Fig. 92) for the by-keys.

When one of the by-keys is depressed the lateral lug 1083 of the lifted block bar engages the lug of the corresponding arm 1079, 1080, 1081 or 1082 (Figs. 89 to 92) and imparts to the bow 1070 a clockwise rocking motion, so that the arms 1073 (Figs. 79), 1074 (Figs. 80, 81) engage over the claws 1075 of the block bars 963, 964, 965 (Figs. 79, 80, 81) and lock the keys $-b, +b, -B, +B, RZ$. If, however, one of these latter keys is depressed, the claw 1075 of the moved block bar 963, 964 or 965 projects in front of the arm 1073 and 1074, respectively, and prevents the bow 1070 from rocking clockwise, whereby all by-keys are locked.

27. Mutually locking the by-keys and keys Ab and Zu

An arrangement has been provided by means of which the key Ab is locked in case one of the "received" by-keys 1 to 9 and 19 to 23 has been depressed, and by means of which the key Zu is locked in case another by-key has been depressed. This arrangement further causes the two kinds of "received" and "paid out" by-keys to lock each other mutually.

On the block shaft 49 (Fig. 72) is rotatably but not shiftably mounted a block bow 1084

(Figs. 72, 73) to the left-hand arm 1085 of which (Figs. 72, 87) is pivoted at 1086 (Figs. 76, 87) the auxiliary slide 981. This slide has a projection 1087 (Fig. 87) adapted to co-operate with the bars 905 allotted to the keys *Ab* and *Zu*. The bow 1084 possesses, in the range of the by-keys, four arms 1088, 1089, 1090, 1091 (Fig. 72), the arms 1088 (Fig. 89) and 1090 (Fig. 91) being forwardly directed and being opposite oblique faces of the lateral lugs 1083 on the block bars 971 and 973, respectively. The arms 1089 (Fig. 90) and 1091 (Fig. 92) are rearwardly directed and are opposite oblique faces of the lateral lugs 1092, on the rear claws of the forked ends of the block bars 972 and 974 respectively. The block bow 1084 is yieldingly held, by means of a special adjusting device, in a determined middle position, in which its arms and the auxiliary bar 981 take the position shown in the drawings. To this end the arm 1090 (Fig. 72) of the bow 1084 has a pin 1093 (Fig. 91) engaged by two levers 1095, 1096 loosely mounted on a bar 1094. These two levers are connected by a spring keeping them from either side in contact with the shaft 49 and keeping the pin 1093 and thus the bow 1084 in a determined middle position yielding from both sides.

Upon depressing one of the by-keys 1 to 9 and 19 to 22, the block bar 971 (Fig. 89) or 973 (Fig. 91), respectively, is lifted and imparts by means of the forward arm 1088 or 1090 to the bow 1084 a clockwise rocking motion. This causes an upward motion of the auxiliary slide 981 (Fig. 87) the lug 1087 of which moves below the bar 905 allotted to the key *Ab*. At the same time the rear arms 1089 (Fig. 90) and 1091 (Fig. 92) move over the lugs 1092 of the block bars 972 and 974 and lock them against an upward motion. By depressing one of the "received" by-keys 13 thus the paid out by-keys and the key *Ab* are locked. Upon depressing one of the by-keys 10 to 18 and 24 to 27, the bow 1084 has imparted to it an anti-clockwise rocking motion whereby the auxiliary slide 981 (Fig. 87) is lowered and its lug locks the key *Zu* and thereby the forward arms 1088 (Fig. 89), 1090 (Fig. 91) lock the "received" by-keys, by means of the block bars 971 and 973.

28. Mutually locking the keys *ZS*, *ES* and *RZ*

No transaction totalizer of the group *S* (Fig. 2) is allotted to the key *RZ*, from which totalizer the total might be taken after depressing the keys *ZS*, *ES*, as is possible with the totalizers allotted to the main keys. A simultaneous depression of the key *RZ* and of one of the keys *ZS*, *ES* is therefore prevented by a special arrangement.

The block shaft 49 (Fig. 72) carries a bow 1098 which is held in contact with the pin 1072 by a spring 1099 (Fig. 79). This bow

1098 has on the left a downwardly directed arm 1100 (Figs. 72, 79) cooperating with a slot 1105 (Fig. 79) of the upper end of the bar 963 which may be acted upon by the key *RZ*, and has on the right an arm 1106 (Figs. 72, 94) the lower oblique face of which is located in the path of the lug 1036 of the bar 976 acted upon by the keys *ZS*, *ES*. If the key *RZ* is depressed, the bar 963 moves with its slot 1105 over the arm 1100 and locks the bow 1098 against rotation so that no key *ZS* or *ES* can be depressed. If, however, a key *ZS*, *ES* is depressed, then, upon upward motion of the bar 976 (Fig. 94), the bow 1098 has imparted to it, by means of the lug 1036 and of the arm 1106 a clockwise rocking motion, the arm 1100 moving over the claw 1052 (Fig. 79) of the bar 963 and locking the key *RZ*.

29. Mutually locking the main keys, key *HR* and by-keys

If the total is to be taken from one of the account or transaction totalizers of the groups *N*₁, *N*₂, *N*₃ and *S* or from the auxiliary totalizer, the main or by-key in question or the key *HR* must be depressed, after depressing the key *ZS* or *ES*. The operation of taking a total can be taken part in by a single totalizer only, according to the construction of the machine; means are therefore provided which so block the main and by-keys and the key *HR* upon depressing the key *ZS* or *ES*, that one of these keys only is able to be depressed. As described in chapter 19, detent disks 917, 918 (Fig. 72) are arranged between the six main keys and between the by-keys of each row so that only one of the six main keys or one key of each row 13 can be depressed in every case. In chapter 27 is further described a mechanism for mutually locking the two kinds of by-keys and the keys *Ab* and *Zu*. All these locking mechanisms are not able, however, to prevent that besides a main key the key *HR* and a by-key is also depressed and that two by-keys of the same kind in two different rows are set. In order to exclude these possibilities but not to interfere with the mutual relations of the keys in question in case no total is to be taken, the block means above-mentioned are normally out of working readiness and are brought into readiness only by depressing one of the keys *ZS* or *ES*.

The block shaft 49 (Fig. 72) has mounted on it for loose rotation and shifting motion, the two bows 1107 and 1108. The bow 1107 has the arms 1109 to 1115. A sleeve 1116 is attached on the right to the arm 1115, in the annular groove of which sleeve engages the forked end 1117 (Figs. 72, 92, 94) of an angle lever 1120 pivoted at 1118 on a bent-portion 1119 (Fig. 72) of the key partition. The other arm 1121 of said angle lever rests on a lug 1122 (Fig. 94) of the block bar 976, to which lug it is brought in contact by a spring 130

1123 (Fig. 72) arranged between the bow 1107 and a pin 1124 and normally holding the bow 1107 in its right-hand end position. Upon depressing one of the keys ZS, ES, the bow 1107 (Fig. 72) is shifted towards the left into working position, by intermediary of the block bar 976 (Fig. 94) and the angle lever 1120. Upon releasing the key in consideration, the bow automatically returns into its position of rest under the action of the spring 1123.

The bow 1108 has eight arms 1125 to 1132 (Figs. 72, 73). The arms 1131 and 1132 (Fig. 72) are embraced by the arms 1114 and 1115 of the bow 1107 so that the bow 1108 is enforced to take part in the lateral movement of the bow 1107. The bow 1108 has at its left-hand end, a prolongation 1133 (Figs. 72, 73) projecting beyond the arm 1125 and abutting against the arm 1023 of the bow 1012 which effects together with the bow 1013 the mutual locking of the keys $-b$, $+b$ by the disk 265' (Fig. 27). Between the arm 1023 and the arm 1024 of the bow 1013 is inserted a sleeve 1101 (Fig. 72) and the arm 1109 of the bow 1107 abuts from the left on the arm 1024. In this manner the bows 1012, 1013 also are enforced to take part in the lateral motion of the bow 1107.

By means of special adjusting devices the bows 1107 and 1108 are yieldingly held in both directions of rotation in a determined position, these devices being of the same construction as that employed for the bow 1084 (Figs. 91, 72) and consisting of the levers 1095 and 1096. Two levers 1136, 1137 connected by a spring 1135 cooperate with a pin 1134 of the bow 1107 (Figs. 72, 90), and two levers 1140, 1141 connected by a spring 1139 cooperate with a pin 1138 of the bow 1108 (Figs. 72, 89).

The arms 1110 (Fig. 72) of the bow 1107 and the arms 1125 of the bow 1108 cooperate, by lower oblique faces, with claws 1142 and 1143 (Fig. 85) of the block bar 969 for the key HR, the arm 1110 being directed to the rear, while the arm 1125 is directed forward. The arms 1111 (Fig. 72) of the bow 1107 and the arm 1126 of the bow 1108 cooperate with claws 1144, 1145 (Fig. 87), bent to the right, of the block bar 970 for the six main keys, the arm 1111 being directed to the rear while the arm 1126 is directed forward. With the bows in working position, upon depressing one of the main keys or the key HR, the bow 1108 has thus imparted to it a clockwise rotation and the bow 1107 a rotation in opposite sense.

With each of the four block bars 971, 972, 973, 974 (Fig. 72) of the by-keys 13 cooperate two parallel arms of each of the bows 1107 and 1108, by means of lower oblique faces. The rear arms 1112, 1129 come into alternate action with the block bar 971 (Figs. 89, 72), the same is the case with the block bar 972 (Figs. 90, 72) and the rear arms 1113, 1130, with the block bar 973 (Figs. 91, 72) and the

forward arms 1114, 1131, with the block bar 974 (Figs. 92, 72) and the forward arms 1115, 1132, of the bows 1107, 1108. The directions of said arms is, as evident, opposite to each other with the two rows of by-keys for "received" (Figs. 89, 91) and with the two rows of by-keys for "paid out" (Figs. 90, 92).

Upon depressing a main key or the key HR the bows 1107 and 1108 rock in opposite sense and the arms 1129 (Fig. 89) and 1130 (Fig. 90) of the bow 1108 lock the block bars 971, 972, and the arms 1114 (Fig. 91) and 1115 (Fig. 92) of the bow 1107 lock the block bars 973, 974. By depressing one of the main keys or the key HR thus all by-keys are locked.

Upon depressing one of the by-keys of the left-hand or middle row 13, both bows rock anti-clockwise and the arms 1125 (Fig. 85) and 1126 (Fig. 87) of the bow 1108 lock the block bars 969, 970. Upon depressing one of the by-keys of the right-hand row 13, both bows rock clockwise and the arms 1110 (Fig. 85) and 1111 (Fig. 87) lock the block bars 969, 970. As the mutual blocking action of the by-keys for "received" and "paid out" is effected separately, as described in chapter 27, by the bow 1084, all remaining by-keys, the main keys and the key HR are locked upon depressing a by-key.

30. Mutually locking the main keys and key HR

There is still the possibility, required for a record of first order, of depressing the key HR together with a main key. In order to obviate this possibility also when setting the key ZS, ES, a bow is loosely mounted on the shaft 49, this bow consisting of two arms 1146, 1147 and a bar 1148 and being arranged between the arm 1110 (Fig. 72) of the bow 1107 and the arm 1126 of the bow 1108, and taking part in the lateral motion of the bows 1107 and 1108. Said bow is yieldingly held in a determined position by an adjusting device 1149, 1150, 1155 (Fig. 86) attached to its bar 1148 (Figs. 86, 72). The arm 1146 is directed forward and turns to the claw 1142 of the block bar 969 (Fig. 85) a lower oblique face, while the rear arm 1147 is opposite the claw 1145 of the block bar 970 (Fig. 87).

If a main key is depressed after the arms 1146, 1147 (Fig. 72) have reached the range of the bars 969, 970 by depression of a key ZS, ES, the key HR is locked by the arm 1146 (Fig. 85) engaging over the claw 1142 of the bar 969. If the key HR is depressed, the main keys are locked by the arm 1147 (Fig. 87) engaging over the claw 1145 of the bar 970.

31. Release of the mutual locking of the keys $-b$, $+b$

As described in chapter 22, one of the keys $-b$, $+b$ is always locked by the disk 265' (Fig. 27). This locked state must be released

by depressing the key ZS or ES in case the total is to be taken from the transaction totalizer allotted to said locked key. The bows 1012, 1013 (Fig. 72) mediating the locking of the keys $-b$, $+b$, are shifted to the left, as described, upon depressing a key ZS, ES, by the bows 1107, 1108. When this takes place, their arm 1023, 1024 come out of the planes of the bars 967, 968, whereby the locking action of the disk 265' (Fig. 27) on the keys $-b$, $+b$ is annulled while a key ZS, ES is set.

32. Releasing the motor key

The different operations of the machine are initiated by depressing the motor key M. This key can be depressed only if the other setting operations required for the operation of the machine have been made before. The succession in depressing the keys, with the records of first order is the following: Amount keys, account keys, by-keys, main key in consideration, motor key. The account keys need to be depressed only in case the old state is to be recorded, and the by-keys only in case amounts received or paid out are to be recorded. As the amount zero is also able to be recorded, for instance in recording the state $+b=0$, the depression of the account keys and the following keys is not made dependent on the prior depression of an amount key. Upon taking a sub-total from the main totalizer the key RZ and the motor key M is depressed, upon taking the total from a control totalizer the key ZS or ES, one of the control totalizer keys and the motor key M are depressed. The motor key is thus usually released by the main keys and by the key RZ only, if, however, a key ZS or ES has been depressed, the release of the motor key is effected, not only by the main keys and the key RZ, but by the key HR and the by-keys.

The shaft 505 (Fig. 96) of the motor key M has fixed on it a pin 1156 cooperating with the upper end, having an oblique face 1157, of a slide 1161. This slide is acted upon by a spring 1158 and is guided, by pins 1159 and slots 1160 about vertically relative to said key shaft. The slide 1161 is in connection, by means of a pin 1162 engaging a slotted arm 1163, with a shaft 1164 mounted in the frame.

This shaft has, in the range of the row of keys 11, a rigid arm 1165 (Fig. 87) abutting with its upper end against a pin 1166 of the block bar 970. When said bar is lifted by depressing one of the main keys, the shaft 1164 has imparted to it, by means of the arm 1165, a rotation whereby the slide 1161 (Fig. 96) is moved out of the path of the pin 1156 of the motor key and the latter is released. When the slide 1161 has snapped upward again after the depressed main key has been released, it is pushed downward, when the

motor key returns to rest position, by the pin 1156 engaging the surface 1157, and snaps up again to lock the motor key, when the pin 1156 arrives at its left-hand side.

The pin 30 of the key RZ (Fig. 88) cooperates with a projection 1167 of a double lever 1169 pivoted at 1168 on the partition. This double lever 1169 is connected to the shaft 1164 by a sub-lever 1170 engaging by slots over a pin 1171 of the said double lever 1169, and by a pin 1172 of an arm 1173. Upon depressing the key RZ the shaft 1164 is rotated in the same manner as when a main key is depressed, and the motor key is released.

The double lever 1169 (Fig. 88) engages by a pin 1174 a slot of a lever 1175 loosely mounted on the shaft 49, the upper end of which lever is intended to cooperate with a pin 1177 fixed on an arm 1176 of the bow 1070. The lever 1175 is embraced by the arms 1127, 1128 of the bow 1108 (Fig. 72) and is thus enforced to take part in the lateral shifting motion of the bow 1108. This lever 1175 normally lies out of the path of the pin 1177. If, however, the bow 1108 is shifted to the left by depressing a key ZS, ES, it arrives behind the pin 1177. As described in chapter 26, the bow 1070 has imparted to it a clockwise rotation upon depressing a by-key. This rotation causes—if a key ZS or ES has been depressed before—the shaft 1164 (Fig. 88) to have imparted to it, by means of the pin 1177, levers 1175, 1169 and 1170, the motion required for releasing the motor key M.

The arm 1128 (Figs. 72, 88) of the bow 1108 has a bent portion 1178 engaging over the lever 1175. As described, the bow 1108 is provided with a forwardly directed arm 1125 (Fig. 85) which, upon depressing the key ZS or ES enters the path of the block bar 969 and effects a clockwise rotation of the bow 1108, upon depressing the key HR. This rotation is transmitted by said bent portion 1178 (Fig. 88) to the lever 1175 and therewith to the shaft 1164 releasing the motor key M. In this way the motor key is released, after foregoing depression of the key ZS, ES, also directly by the key HR.

If the key HR is set, the keys ZS, ES cannot be depressed, as upon shifting the bow 1108 the arm 1125 would laterally strike the lifted claw 1142 (Fig. 85). The key HR must therefore be released by its releasing key L before a key ZS, ES is depressed and must be set anew, after depressing a key ZS, ES, if the total is to be taken from the auxiliary totalizer.

33. Releasing the main keys and key RZ

While the key HR is not locked before the beginning of a record in order to be able to effect the simultaneous throwing-in of the auxiliary totalizer if desired, the main keys and the key RZ are locked at this time and

are released only when an account key or a key ZS, ES is depressed. The shaft 957 (Figs. 72, 77, 79) mounted for rotation in the frame, has rigidly fixed to it a bow 1179 extending along upper prolongations 1180 (Fig. 79) of the block bars 592 (Fig. 77), said prolongations cooperating by V-shaped recesses with the pins 590 of the account keys 17. On the right-hand end of the shaft 957 is rigidly fixed an arm 1182 (Figs. 72, 77, 94) the upper bent extremity 1183 of which cooperates with an oblique face 1184 of the block bar 976 for the keys ZS, ES. A bow 1185 likewise rigidly fixed on the shaft 957 (Figs. 72, 77) engages over lugs 1186 (Fig. 72) of the block bars 963 (Fig. 79) for the key RZ, 964 (Fig. 80) for the keys $-b$, $+b$, 965 (Fig. 81) for the keys $-B$, $+B$ and 966 (Fig. 82) for the keys Ab , Zu . A spring 1187 (Fig. 94) attached to the lever 1182 (Fig. 94) normally keeps the shaft 957 in the illustrated position in which the main keys and the key RZ are locked by the bow 1185. Upon depressing an account key 17 or a key ZS, ES, the release of the main keys and of the key RZ takes place by the shaft 957 having imparted to it the rotation required for releasing the projections 1186 by the bow 1185, either from the block bar 592 (Fig. 77) of the account keys and the bow 1179 or from the lever 1182 (Fig. 94). The keys $-b$, $+b$, Ab , Zu can be locked, however, still by other means in a record of first order, as hereinafter described.

34. Releasing the keys Ab , Zu by the by-keys and the keys ZS, ES

In recording amounts received and paid out in a record of first order, account totalizers of the groups N_1 , N_2 , N_3 are to be thrown into operation simultaneously. For this purpose an arrangement is provided enabling, in a record of first order, the depression of a key Ab and Zu only when a by-key has been depressed before. The rear claw 1025 (Fig. 82) of the block bar 966 for the keys Ab and Zu is normally opposite the lower end 1188 of a lever 1189 loosely mounted on the shaft 49, so that the keys Ab and Zu normally are locked, by means of tapered faces 1153, 1154 provided on the block bar 966. The lever 1189 is held by a spring 1190 (Fig. 82) in contact with a lug 1191 of an arm 1192 which is rigidly connected to the shaft 49. The upper end of said lever engages behind a pin 1193 fixed on the arm 1074 of the bow 1070. This bow has, as described in chapter 26, forwardly directed arms 1079 to 1082 (Figs. 72, 89 to 92) cooperating with the block bars of the by-keys so that upon depressing a by-key, the bow 1070 and, by intermediary of the pin 1193, the lever 1189 (Fig. 82) have imparted to them a clockwise rotation. Thereby the foot 1188 comes out of the path

of the claw 1025 and releases the keys Ab and Zu .

The locked state of the keys Ab and Zu must, further, be released also by depressing the keys ZS, ES in order to enable the total to be taken from the transaction totalizers recording the amounts received and paid out. This is made in the following manner: If a key ZS, ES is depressed, the block shaft 49 has imparted to it, by the arm 1031 cooperating with the block bar 976 (Figs. 72, 94) and rigidly connected to the shaft 49, a clockwise rotation. This rotation has, as described in chapter 23, the first object of locking the amount keys when a total key is to be depressed but causes further in this case the lever 1189 (Fig. 82) to be taken along by the lug 1191, exactly as upon depressing a by-key, in clockwise direction and to release the locked state of the keys Ab and Zu .

35. Normal state of the machine

The last-described blocking arrangements are of a character such as to have the object of enforcing a determined setting succession of the keys in one and the same operation of the machine. The blocking arrangements described hereinafter, however, relate to the mutual condition of the single records of a transaction or to the transactions themselves. The machine is so arranged that after a transaction has been finished, the four different records I to IV may be initiated as desired. When, however, one of these records has been started, the machine is enforced to execute all operations to be done in this record in a determined succession, and no following record can be started before these operations have been completed.

The state assumed by the machine and its members after finishing any transaction, is always the same, it may be denoted by "normal state".

The auxiliary slides 977 to 981 (Fig. 76) are decisive as to the state of the machine relating to the setting succession of the operations. The auxiliary slide 981 takes, in normal state, the position illustrated in which its lug 1087 is out of the path of the bars 905 allotted to the keys Ab and Zu .

The auxiliary slide 980 (Fig. 84) takes its upper position in which two lugs 1194, 1195 arranged on it lock the keys Ab and Zu , in which, further, two oblique faces 1196, 1197 lie in the path of the bars 905 of the keys $-B$, $+B$ and the rear face of the lug 922 keeps down the locking cone 998 by means of its lug 908.

The auxiliary slide 979 (Fig. 82) is held, against the action of the spring 993, in its lower position by the lug 1006 of the forwardly spring-actuated locking cone 996 (Fig. 83), said lug 1006 engaging before the upper face of the lug 1007 (Fig. 82). In this lower position of the slide 979 two projec-

tions 1198, 1199 are out of the path of the bars 905 of the keys $-B$, $+B$ so that the latter are not locked by the auxiliary slide 979. Two oblique faces 1200, 1205 cooperating with the bars 905 of the keys Ab and Zu , are likewise out of the path of said bars.

The auxiliary slide 978 (Fig. 76) engaging by a rod 1206 projecting on both sides, over the ends of the auxiliary slides 977 and 980, is in its upper position (Fig. 81) in which it is kept by the spring 999.

The auxiliary slide 977 (Fig. 80) takes its upper position, in which it engages by projections 1207, 1208, below the bars 905 of the keys $-b$, $+b$ and locks them, in which further, its faces 1209, 1210 lie in the path of the bars 905 of the keys Ab , Zu and the rear face of its lug 1011 retains the locking cone 997 by the lug 1010 provided on this latter.

36. The setting succession in records of first order

As described in chapter 35, among the main keys those locked by the auxiliary slides in the normal state of the machine are the keys Ab , Zu , $-b$, $+b$, so that upon initiating a record of first order by depressing amount and account keys, the bow 1185 (Fig. 72) releases the keys $-B$, $+B$ only. The setting of the keys $-B$, $+B$ must cause these keys themselves to be locked after the first record has been finished, and the keys Ab and Zu to be released.

Upon depressing a key $-B$, $+B$, the auxiliary slide 980 is shifted downward by the faces 1196, 1197 (Fig. 84) so that its lugs 1194, 1195 release the keys Ab and Zu . The lug 1008 engages over the lug 1009 of the auxiliary slide 980 thus keeping the latter in its lower position until the locking cone 998 is again moved rearward. This takes place only if a key $-b$ or $+b$ is depressed, by its bar 905 engaging the frontal face 999 of said locking cone. Any desired number of records may thus be executed for recording amounts received and paid out.

Upon depressing a key $-B$, $+B$ the locking cone 996 (Fig. 83) is pushed to the rear by the corresponding bar 905 so that its lug 1006 (Fig. 82) releases the auxiliary slide 979, this latter moving upward, under the action of the spring 993, and, particularly, at first so far as to cause the lug 1198 or 1199 to abut by its front face against the returned bar 905. In this position of the auxiliary slide 979 the rear face of its lug 1007 has already moved in front of the lug 1006 of the locking cone 996 (Fig. 83) so that said cone is retained in its rear position upon the key $-B$, $+B$, respectively, being released at the end of the record. When the key $-B$ or $+B$ returns the auxiliary slide 979 is able to accomplish its upward motion and engages with its projections 1198, 1199 below the bar

905 of the keys $-B$, $+B$ whereby the latter are locked until the auxiliary slide is again moved downward.

When for starting the second record, a key Ab , Zu is depressed, the keys $-b$, $+b$, still locked, must thereby be released but the locking of the keys Ab and Zu for the following record must be prepared. Upon depressing a key Ab , Zu the auxiliary slide 977 is shifted downward and is held in this lower position by the lug 1010 of the cone 997 which has snapped forward, in which lower position the lugs 1207, 1208 of said slide release the keys $-b$, $+b$. Any desired number of records may now be initiated by depressing the keys Ab , Zu without the position of the auxiliary slide being altered in any way.

Upon initiating the last section of a record, by depressing the one of the keys $-b$ or $+b$ which has been released by the disk 265' (Fig. 27), it must be attained that at the end of this section the keys $-B$, $+B$ are in released state and that the key $-b$, $+b$ which was depressed and released again in the meantime, and the keys Ab , Zu are in locked state. Upon depressing a key $-b$, $+b$ the auxiliary slide 979 (Fig. 82) is moved downward by the bars 905 cooperating with the faces 1200, 1205, and is held in this lower position by the lug 1006 of the locking cone 996 which has snapped forward, in which lower position the lugs 1198, 1199 of said slide 979 release the keys $-B$, $+B$. The depression of a key $-b$, $+b$ further causes the locking cones 997 (Fig. 80), 998 (Fig. 84) to be pushed back so that the two auxiliary slides 977, 980 which are retained by said cones, snap upward. When this takes place, the auxiliary slide 980 (Fig. 84) engages with its projections 1194, 1195 below the bars 905 of the keys Ab , Zu and locks them. After the key $-b$ or $+b$, has been released, the auxiliary slide 977 (Fig. 80) engages with its projections 1207, 1208 below the bar 905 of the keys $-b$, $+b$ and locks them also, so that after the last section of the record of first order, all the auxiliary slides are brought back into normal state.

The account number is the same for the duration of an ordinary transaction. In order that it may be necessary to set it one time only, and in particular before depressing the key $-B$ or $+B$, the depression of a key $-B$, $+B$ causes the account keys 17 to be locked and to be released only after the operation initiated by depressing a key $-b$, $+b$ has been accomplished.

On the pin 1212 of the key partition is pivoted a double-armed lever 1213. The front end of this lever rests on an abutting face 1211 (Fig. 81) of the block bar 965 for the keys $-B$, $+B$, while its rear end is in contact with a pin 1214 of a thrust bar 1215. This bar is guided, by means of a slot 1216 on the cross bar 985 and embraces by a slot

1217 of its lower end a pin 1218 fixed on the double lever 954 rigid on the shaft 38 (Figs. 79, 77) which pin abuts against a pin 956 of the locking bow 950 for the account keys. A spring 1219 (Fig. 79) normally keeps the thrust bar 1215 in its upper position in which the front face of a nose 1220 (Fig. 79) of a locking piece 1221 abuts against the rear face of the upper end of the bar 1215. Said locking piece is pivoted on a pin 1222 fixed in the wall 987 (Fig. 76). It has an abutting face 1223 for the rods 905 of the keys $-b$, $+b$, extending in parallel to the frontal face of the locking cone 997, and is acted upon in clockwise direction by a spring.

When a key $-B$, $+B$ is depressed, the block bar 965 (Fig. 81) is shifted upward and the bar 1215, is shifted downward, by the intermediary of the double lever 1213, whereby the lever 954 (Fig. 79) has imparted to it a clockwise rotation and the locking bow 950 an opposite rotation. The bow 950 engages behind the lugs 947 of the locking bars 591 of the account keys thus causing the latter to be locked. At the same time the drive for the release of the account keys is interrupted by the releasing bow 910 being shifted by means of the angle lever 962.

Upon the thrust bar 1215 moving down the locking piece 1221 is released, it snaps forward so that its lower face will engage with its nose 1220 over the upper end of said bar 1215 and lock the latter, the locking bow 950 and the releasing bow 910 by the described connections in their displaced position until a key $-b$, $+b$ is depressed. When a key $-b$, $+b$ is depressed, the rod 905 engaging the abutting face 1223 of the locking piece 1221 (Fig. 79) returns said piece again whereafter the thrust bar 1215, the locking bow 950 and the releasing bow 910 return to their initial positions by the action of their springs.

37. Setting succession in records of second order

In order to release the operation of the machine for taking a sub-total from the main totalizer, the key RZ and the motor key must be depressed. A sub-total from the main totalizer is able to be taken only with a record of first order and, particularly, before the last section thereof which is caused by depressing a key $-b$, $+b$. The locking of the key RZ in the normal state of the machine and in taking totals from the control totalizers is effected by the blocking operation between the account keys and the key RZ, as described in chapter 33. As long as account keys are depressed, the key RZ is in released state and this is the case, as described in chapter 36, during a record of first order. The sub-totals from the main totalizer may thus be taken before or after any desired op-

eration of the machine has been initiated by the key Ab or Zu.

38. Setting succession in records of third order

For taking a sub-total or grand total from one of the control totalizers a key ZS, ES of the corresponding control totalizer key and the motor key must be depressed. As described in chapter 32, the key HR, if set, must be released before a key ZS, ES can be depressed. Further, due to the detent devices 917, 918 (Fig. 72) existing between the keys 12 the key N, if set, must be released before depressing a key ZS, ES. In order to render impossible the depression of a key ES for the duration of a record of first order, these keys are locked for this time. The right-hand end of the shaft 38 (Fig. 94) carries a rigid arm 1228 having a nose 1229. This latter cooperates with a lug 1230 of the block bar 976 for the keys ZS, ES. As described in chapter 36, the shaft 38 has been rocked clockwise, for the duration of a record of first order, in order to lock the account keys 17, by the double lever 954 (Fig. 79). Owing to this rocked state the nose 1229 engages over the lug 1230 and locks the keys ZS, ES against being depressed, for the duration of a record of first order. As described in chapter 33, the bow 1185 (Fig. 72) locking the main keys releases the block bars of these keys upon depressing a key ZS, ES. Now, by depressing a key ZS, ES, the locking of main keys $-b$, $+b$, Ab, Zu must be interrupted for the duration of a record of third order, this release being effected by the auxiliary slides 977 (Fig. 80), 980 (Fig. 84), as described in chapter 35. This interruption is caused by the auxiliary slide 978 (Figs. 76, 81) which engages by the rod 1206 over the ends of the auxiliary slides 977, 980 (Fig. 76). The upper end 1224 of the auxiliary slide 978 cooperates with a lug 1225 of the arm 1192 rigid on the shaft 49 (Fig. 76). The shaft 49 has imparted to it, upon depressing a key ZS, ES, a clockwise rotation by intermediary of the block bar 976 (Fig. 94) and the forwardly directed arm rigid thereon. This rotation causes the lug 1225 (Fig. 81), connected to the shaft 49, to shift down the auxiliary slide 978 and, by the intermediary of the cross bar 1206 also the two auxiliary slides 977 (Fig. 80) and 980 (Fig. 84). The amplitude of this shifting motion is so chosen that the projections of the slides 977 (Fig. 80) and 980 (Fig. 84) will release the keys $-b$, $+b$ and Ab, Zu, but not the corresponding locking cones 997 (Fig. 80), 998 (Fig. 84). Upon releasing the keys ZS and ES, respectively, the shifted auxiliary slides 977, 978, 980 (Fig. 76) return again into normal position.

By depressing a key $-B$, $+B$ the locking of the account keys is interrupted for the

duration of a record of first order by the locking piece 1221 (Fig. 79) engaging by the nose 1220 over the upper end of the thrust bar 1215 and maintaining it in its lower position.

In order to prevent the depression of a key -B, +B taking place in taking a total from the transaction totalizers -B, +B, from effecting the described locking of the account keys, the locking piece 1221 (Fig. 79) is provided with a pin 1226 (Figs. 79, 76) cooperating with a lug 1227 (Figs. 76, 80) of the auxiliary slide 977. Upon depressing a key ZS, ES, the auxiliary slide 977 is moved down also, by intermediary of the shaft 49, the auxiliary slide 978 (Fig. 76) and the bars 1206. In consequence thereof the lug 1227 engages, as long as a key ZS, ES is set, over the pin 1226 and prevents the locking piece 1221 from snapping forward, upon depressing a key -B, +B, and effecting the locking of the account keys for the following operations of the machine.

39. Setting succession in records of fourth order

The recording of addenda can only be made in common with a record of first order. The key N cannot be depressed together with a key ZS, ES, owing to the action of the detent device 917, 918 (Fig. 72) interposed between these keys. In order to prevent the key N, during a record of first order, from being either depressed or released, the rigid arm 1228 mounted on the right-hand end of the shaft 38 (Fig. 93) cooperates by its nose 1229 with a lug 1231 of the block bar 975 for the key N. The rocked state of the shaft 38 existing during a record of first order, as described in chapter 36, causes the nose 1229 (Fig. 93) to engage over the lug 1230 when the key N is not depressed, and to engage below it when the key N is in depressed state. In the first-mentioned case the key N is locked against being depressed by means of its pin 30 and slot 1062, in the second case it is locked against being released. Upon rocking the shaft 38 back into its initial position, after a record of first order has been completed, the nose 1229 releases the lug 1230 of the block bar 975 and the key N is able to be depressed and released again. As will be seen, the key N must be depressed before the key -B or +B has been set.

The connection of the key N with the totalizer control mechanism, to throw them out, is effected by the double lever 397 (Fig. 93) engaging by its pin 1231 and slot the block bar 975.

40. The item counter

The item counters serve for recording the number of depressions of the main and by-keys. This record is to be made with records of first order only. Special means are there-

fore provided which interrupt the driving mechanism of the item counters during the other records.

The item counters 15 and 16 each consist of three counting wheels 1234 (Fig. 98) the figures of which may be read through holes in the casing and these wheels are connected to one another by a suitable tens transfer mechanism. The counting wheels 1234 are mounted on shafts 1235 rigidly mounted in a frame which is formed by two plates 1236, 1237 and bolts 1238 connecting them (Figs. 72, 74, 97). Four of these frames in all, are arranged in the machine. The left-hand frame (Fig. 72) carries six item counters for the main keys, the three right-hand frames each have nine item counters allotted to the by-keys. The plates 1236 (Fig. 97) of each frame possess two slots 1239, 1240 engaged by pins 1241, 1242 rigidly fixed on the key partitions 921. A third pin 1244 rigid on the partition 921 abuts from the rear on a lower prolongation 1243 of the plate 1236. Owing to the above-described guiding means the frame is able to execute, together with the item counters, a small down and up motion. A spring 1245 attached between the frame and the partition 921, tends to keep the frame in its upper position. A rod 1247, passing through a prolongation 1246 of each plate 1236 and connecting all the frames to each other, engages in slots 1248 of two eccentric members 1249 surrounding two eccentrics 1250 (Figs. 97, 72) rigid on the shaft 42. A lever 1255 mounted on the eccentric member 1249 (Figs. 97, 93, 94) is normally held in engagement with the rod 1247 by its upper hook-shaped portion 1256, so that the rod 1247 and therewith the item counters are enforced to take part in the down and up movement of the eccentric member 1249. Lugs 1258 (Figs. 93, 94) of the levers 1255 cooperate with the lower ends of two levers 1260 rigid on a shaft 1259. The right-hand ends of these levers 1260 (Figs. 93, 94) carry a roll 1261 which cooperates with a tapered face 1262 (Fig. 93) of the block bar 975 influenced by the key N, and with a tapered face 1263 (Fig. 94) of the block bar 976 influenced by the keys ZS, ES.

At the right-hand side of each units wheel of the item counters there is mounted for rotation on the shafts 1235 a pawl carrier 1264 (Figs. 98, 97) normally abutting under the action of a spring 1265 by a lug 1266 against a tongue 1267 of the plate 1236. The pawl carrier 1264 carries by means of a pin 1268 (Fig. 98) a spring-actuated pawl 1269 engaging the teeth of the units wheel and causes the item counter to be fed. A counter-pawl 1270 prevents the counting wheels from returning. The lugs 1266 (Figs. 98, 97, 72, 74) are such as to strike, upon the downward motion of the frame, the pins 902 of the depressed keys. If, therefore, one of the main or by-keys has been depressed and its pin 902

has been brought into the path of the lug 1266, the pawl carrier 1264 is stopped upon the downward motion of the whole frame, effected by the eccentric drive 1250, 1249 (Fig. 97), during the operation of the machine. This causes a rotation of the carrier 1264 (Fig. 98) on the shaft 1235 of such an amount such as to cause the units wheel to be fed by one unit by the pawl 1269. As will be seen, two or more item counters can be fed at the same time.

The hook-shaped lever 1255, 1256 (Fig. 97) has the object of interrupting the drive of the item counters in records of third and fourth order. In records of second order no feeding motion of item counters takes place as the key RZ has no item counter allotted to it. Upon depressing a key N, ZS or ES, the upward motion of the tapered faces 1262 (Fig. 93) or 1263 (Fig. 94) causes the levers 1260 to rock, said levers displacing the levers 1255 to the rear, by means of the lugs 1258, so that their hooks 1256 come out of engagement with the rod 1247. During the next operation of the machine no down and up motion of the item counter frame takes place whereby the feeding motion of the item counters allotted to the depressed main and by-keys is left undone.

41. Mode of operation

In the following will be described, in bold outline, the operation of the machine with the four different records. In order to avoid the repeated description of the different modes of operation of the different mechanisms of the machine, reference is made to the foregoing corresponding chapters.

In the normal state of the machine the main totalizer is at zero (+0), if the last taken grand total (b) was positive; it is at 9,999,999,999 (-0), if said total was negative (chapters 9 and 12). The auxiliary totalizer is on -0 or +0 or contains a positive or negative value according to whether the arithmetic total of the amounts received and paid out is positive or negative in the bookkeeping period just passed which the auxiliary totalizer may be imagined to have been engaged in. The transaction and account totalizers are on zero or contain positive amounts arising from the transactions of the foregoing operations.

The type wheels of the printing mechanism (Fig. 51) and the display wheels 144 (Fig. 2) take the positions corresponding to the set amounts of the foregoing operation, see chapter 4. The differential members 65, 80 (Fig. 2) of the amount differential mechanism, chapter 3, and the differential members 251, 80', 252, 80' and 253, 80' (Fig. 25, chapter 10) of the transaction differential mechanism take their upper extreme positions in which they are locked by the zero locking levers 62 (Fig. 2) and 62' (Fig. 25). The last line

printed on the control strip can be read-off through the display hole 871 (Fig. 55). As to the keys, the six main keys, the key RZ and the motor key M are in locked state, all remaining keys are released (chapter 35). The operator has therefore free choice of initiating, by depressing amount and account keys, a record of first order or, by depressing one of the keys ZS, ES, a record of third order or, by depressing the key N, a record of fourth order.

Record of first order. Introduction of the old state

It may be assumed that the customer having the account No. 1,225 appears in the office to take from his account or pay in thereon an amount. The operator reads off on the card numbered 1225 (Fig. 67) or on the book (Fig. 68), respectively, the amount of the old state denoted by the consecutive number 128 (Fig. 67) and showing the sum of M + 2435.00 and sets this amount by means of the amount keys 10. The depression of the amount keys causes the corresponding amount differential members 65, 80 (Fig. 2) to be released by the zero locking levers 62 (chapter 2) and all the total keys to be blocked (chapter 32) which are not yet in blocked state (chapter 23).

The depression of the account keys causing the account number 1,225 to be set, produces the release of the main keys and of the key RZ by the bow 1185 (Figs. 72, 77; chapter 33). The keys Ab, Zu, -b, +b, however, still remain locked by the auxiliary slides 980 (Fig. 84) and 977 (Fig. 80; chapter 35), so that the keys -B, +B and RZ only have been released. According to the positive sign of the set old state, the key +B must be depressed.

The depression of the key +B causes to be blocked: the other main keys and the key RZ (chapter 19) as far as this latter has not yet been blocked, as well as the by-keys (chapter 26), so that account totalizers will not be able to be thrown-in with this operation. The depression of the key +B further causes: the transaction differential member 251, 80' (Figs. 75, 25; chapter 24) to be released, the keys Ab and Zu to be released by their auxiliary slide 980 (Fig. 84; chapter 36), the account keys to be locked and their release to be put off till the end of an operation started by one of the keys -b, +b (chapter 36), the locking of the keys -B, +B (chapter 36), taking place at the end of the present operation, to be prepared, the key N to be locked against depression and release during the record of first order (chapter 39), the keys ZS, ES to be locked against being depressed during the record of first order (chapter 38) and the motor key M to be released by the slide 1161 (Fig. 96; chapter 32).

By depressing the motor key all keys are blocked by means of the bow 928 (Fig. 96), the bars 931, 937 and the bows 46, 944, as far as they have not yet been blocked (chapter 20) and the operation of the machine is initiated (chapter 13). All keys remain blocked during the operation (chapter 20). The motor key blocks itself. If the motor key is kept depressed, any new operation of the machine cannot be initiated (chapter 13).

At the beginning of the operation the actuation of the transaction totalizer takes place in which only the differential member 251, 80' (Fig. 25) is lowered into the position corresponding to the key +B (chapter 10). The actuation, now following, of the cross head 115' (Fig. 25) of the transaction totalizer moves the differential shafts 274 (Fig. 24) of the totalizer control mechanism and the shaft 650 (Fig. 52) for the printing mechanism, and the corresponding display and type wheel into the position corresponding to the key +B (chapters 10 and 15). The shafts 370 (Fig. 24) and 658 (Fig. 52) and the shafts 273 (Fig. 24) for the step drums of the groups of account totalizers N_1 , N_2 , N_3 remain in their positions of rest, as the transaction differential members 252, 80' and 253, 80' (Fig. 25) are held in their upper end positions by the zero locking levers 62'.

The selecting motion, effected by the shaft 386 (Fig. 39), of the control slides for the totalizer control mechanism causes, according to the recesses provided on the control disks: the control shafts 289 and 304 (Fig. 27) to be coupled with the rocking frame 343 (Fig. 41) for "setting amounts" (chapters 10 and 12), the throw-out member 318' (Fig. 24) for the main totalizer to be positioned into throw-in position, the throw-out member 318 for the auxiliary totalizer to be brought into throw-out position and the shaft 311' for the main totalizer to remain in adding position (chapter 12).

In the printing mechanism the selecting motion of the control slides caused by the shaft 631 (Fig. 52) rocking, effects, according to the recesses provided on the control disks of the printing mechanism, the coupling of the thrust bar 687 (Fig. 64) of the print drive for the ticket with the bar 692 and of the bar 688 (Fig. 66) for the drive of the great ticket feeding motion, with the pin 694 (chapter 15).

The actuation of the amount differential mechanism now takes place, whereby the amount differential members are moved down to strike the set amount keys and are locked in this position (chapter 3). The downward motion of the cross head 115 (Fig. 2) of the amount differential mechanism now causes the printing and display wheels allotted to the amount in consideration, to be positioned to the set amount of 2435.00 (chapter 4). In the meantime the feeding motion

of the consecutive number from 528 to 529 (chapter 15) took place as well as the positioning of the type wheels 577, 577' (Fig. 51) to the account number 1,225 (chapter 14) and the great ticket feeding motion in which the ticket received at both sides an impression (chapter 15). While the amount differential members 65, 80 (Fig. 2) remain in their locked position, the printing motion of the printing plates takes place whereby the set item No. 529 (Fig. 69) containing the account number, the date, the sign B, the sign + or -, the value of the amount and the consecutive number, is printed on the ticket. Upon the return motion of the printing plate 769 (Fig. 64) for the ticket the feeding motion of the ticket strip takes place by the space of a line (chapter 15). The printing motion of the printing mechanism is followed by the downward motion of the rocking frame 343 (Fig. 41) by which motion the rider axles are brought over into their axial position corresponding to the set position of the keys, and whereby the totalizers are coupled with the amount setting members. When this takes place the transaction totalizer +B and the adding wheels of the main totalizer come to engage the amount differential members. Upon the return movement now taking place, of the amount differential members the set amount is transmitted additively to the transaction totalizer +B and to the main totalizer (chapter 3). At the same time the return of the positioned transaction differential member 251, 80' (Fig. 25) to its upper extreme position takes place (chapter 10). The printing and display wheels, except the type wheels for the account numbers which return to their initial position, remain in their set position till the following operation of the machine.

The control slides of the totalizer control mechanism and printing mechanism are returned again whereby the couplings of the rocking frames and different printing devices, respectively, are released again. The item counter drive causes the item counter for the key +B to be fed by one unit (chapter 40). At the end of the operation of the machine all keys are unlocked by the locking bows 46, 944 (Fig. 96; chapter 20) and the set keys return to unset position, except the key HR (chapter 18). When this takes place, the zero locking levers 62, 62' (Figs. 2, 25) reach again their locking position in which they lock the returned differential members. After the released motor key M has reached its position of rest, it is locked anew by the slide 1161 (Fig. 96, chapter 32). The key +B is locked too, after having reached its position of rest (chapter 36). The keys Ab and Zu which had been released, by depression of account keys 17, from the bow 1185 (Figs. 72, 77; chapter 33), have been released, further, from the correspond-

ing detent device 917, 918 by the key +B returning, these keys are however still blocked by the lever 1189 (Fig. 82, chapter 34). The keys N, ZS, ES are blocked by the arm 1228 (Figs. 93, 94) so that at the end of the first operation of the machine the amount and by-keys and the key RZ have been released, besides the key HR.

10 *Record of first order. Introduction of amounts received and paid out*

To continue the record, the card and the book are introduced in the machine, the slots (782 and 795, Fig. 1) being rendered free by means of the lateral lugs 800, 805, from the pin wheels 793, 794, until the holes of the book and card have engaged said pin wheels. When the key HR has been set, the high portion of the control disk 409 (Fig. 37a) has been rocked out of the path of its control slide 322, by means of the lever 1052, so that in recording amounts received or paid out (chapter 10), the auxiliary totalizer is thrown-in. The amount of transaction stated by the customer of account No. 1,225, and which may be assumed to be an amount of M 250.00 to be paid in, according to the item 530, (Figs. 67, 68, 69, 71), is now set by means of the amount keys. By depressing these keys the corresponding amount differential members are released (chapter 2) and total keys are locked, as far as they have not yet been locked (chapter 23). Thereupon the by-key 5 is depressed which, as assumed, may be allotted to the kind of the receipt. By depressing the by-key 5 the transaction differential members 253, 80' of the left-hand key row 13 is released (chapter 24) and the by-keys 10 to 18 and 24 to 27 allotted to amounts to be paid out, and the key Ab are locked (chapter 27), while the key Zu is released.

The depression of the key Zu causes the keys -b, +b to be released from the auxiliary slide 977 (Fig. 90, chapter 36). The keys -b, +b remain, however, locked till the end of the operation of the machine, by the detent devices 917, 918 (chapter 19). The depression of key Zu causes further the transaction differential members 251, 80' and the motor key M to be released (chapters 24, 32).

To initiate the operation the motor key M is depressed (chapter 13) whereby all keys are blocked (chapter 20). At the commencement of the operation the transaction differential mechanism is actuated, the transaction differential members 251, 80' and 253, 80' being locked in their positions corresponding to the keys Zu and 5 (chapter 10). The actuation, now following, of the cross head 115' (Fig. 25) moves the differential shaft 274, the lower shaft 273 (Fig. 24) of the totalizer control mechanism and the display and printing wheels in consideration into the position corresponding to the keys Zu and 5 (chapter 10) as well as the shaft 650 (Fig. 52) of the

printing mechanism in the position corresponding to the key Zu (chapter 15).

The selecting motion of the control slides for the totalizer control mechanism causes, as in the foregoing operation, the control shafts 289 and 304 (Fig. 27) to be coupled with the rocking frame 343 (Fig. 41) for "setting amount" (chapters 10 and 12). It causes further the throw-out members 318 and 318' (Fig. 24) for main and auxiliary totalizer, to move into throw-in angular position and the shafts 311 and 311' to remain in adding rotary position (chapter 12).

In the printing mechanism the selecting motion of the control slides causes the thrust bars 687 (Fig. 64) of the ticket printing drive 686 (Fig. 63) of the control strip printing drive, 652 (Fig. 59) of the control strip transport, 684, 685 (Figs. 61, 62) of the printing drive for book and card, to be coupled with the bar 692 and with the pin 693, respectively (chapter 16).

In the meantime the tens transfer parts which happen to have been displaced in the preceding operation, have returned (chapter 6). Now the actuation of the amount differential members takes place which members are moved down until they strike the set keys, and are locked in this position (chapter 3). The downward motion of the cross head 115 (Fig. 2) causes the printing and display wheels allotted to the amounts, to go over to the amount of M 250.00. In the meantime the feeding motion took place from No. 529 to consecutive number 530 (chapter 15) and the positioning of the type wheels 577, 577' (Fig. 51), by means of the account keys, remained set, to the account number 1,225 (chapter 15) as well as the transport of the last printed line showing the consecutive number 528, of the control strip (Fig. 71) from place 873 (Fig. 55) to place 875. By the printing motion of the printing plates, the set item 530 is printed at the four printing places, that is on the ticket (Fig. 69), the control strip (Fig. 71), the card (Fig. 67) and in the book. This operation is followed by the line feeding motion for the ticket, the book and card and the displacement of the lines printed on the control strip from the place 874 (Fig. 55) to place 873 where this line may be read-off through the display hole 871. Furthermore the type wheels 577, 577' are brought back into initial position. The remaining printing and display wheels remain set to the amount 215.00 and to the signs Zu, 5 (chapters 14, 15) till the next operation.

The printing motion of the printing mechanism is followed by the downward motion of the rocking frame 343 (Fig. 41) whereby the adding wheels of the main and auxiliary totalizer, of the transaction totalizer Zu and account totalizer 5 are coupled with the amount differential members. Upon the return motion now taking place, of the amount

differential members into their upper extreme position the amount of M 250.00 is transmitted additively onto the said totalizers (chapter 3). At the same time also the return motion of the positioned transaction differential members takes place (chapter 10). The drive of the item counters effects the feeding motion of the item totalizer allotted to the keys *Zu* and 5, by one unit (chapter 40). At the end of the operation all keys are released from the locking bows 46, 944 (Fig. 96, chapter 20) and the set keys are returned except the account keys (chapter 36) and the key *HR* (chapter 19), the returned differential members being locked again by their zero locking levers. At the end of the operation the amount keys, the by-keys, the keys *HR*, *RZ* and $-b$, $+b$ have been released as well as the corresponding releasing keys, but all remaining keys are locked. The operator is thus free to record still further amounts received or paid out, to take the subtotal from the main totalizer or to record the new state b .

According to Fig. 69 the record of a further receipt (item 532) and the record of two amounts paid out (items 531 and 533) is assumed. The three operations of the machine required for these records take place in the manner described with the operation for item 530. Upon depressing the by-keys 14 (item 531) and 26 (item 533) allotted to drafts, the key *Zu* and the by-keys allotted to the receipts are, however, locked (chapter 27) and upon the selecting motion of the control slides the preparation for positioning the minus-sign takes place by the cam disk 443 (Fig. 27; chapter 10) and the positioning of the shafts 311, 311' (Fig. 24; chapter 10) of the auxiliary totalizer and main totalizer into subtracting position whereby the amounts in question are transmitted subtractively to the auxiliary totalizer and main totalizer. The transmission to the account and transaction totalizers take place additively as in the operation for the receipts.

Record of first order. Printing the new state of account

After the operation recording the item 533 the main totalizer contains the total +2735.00, the auxiliary totalizer contains the total +300.00 representing the arithmetic sum of the items 530 to 533. As to the keys, they all are blocked except the keys $-b$, $+b$, the amount and by-keys, the keys *RZ*, *HR* and the corresponding releasing keys.

To initiate the last operation of the record of first order serving for taking the total from the main totalizer, one of the keys $-b$, $+b$ has to be depressed. As the main totalizer contains a positive total, the key $-b$ is in locked state (chapter 22). The depression of the key $+b$ causes the amount and by-keys to be locked (chapters 23, 26), the

key *RZ* to be locked by detent device 917, 918 of the key row 11 (chapter 19) and causes further the release of the amount differential members 65, 80 (Fig. 2) from their zero locking levers (chapter 25) and the release of the motor key (chapter 32). By depressing the key $+b$ the locking of the account keys 17 and the delay of their release is annulled (chapter 36). At the same time the release of the keys *N*, *ES*, *ZS* by the shaft 61 takes place (Figs. 93, 94; chapters 38, 39). The auxiliary slides 979, 997, 998 (Figs. 80, 82, 84 are so influenced as to lock the keys *Ab* and *Zu* and to prepare the locking of the keys $-b$, $+b$ and the release of the keys $-B$, $+B$ (chapter 36).

Upon depressing the motor key, the locking of all keys hitherto still unlocked, takes place (chapter 20) as well as the start of the operation (chapter 13). At the commencement thereof the transaction differential mechanism is actuated, the differential member 251, 80' being lowered into the position corresponding to the key $+b$ (chapter 10). The actuation, now following, of the cross head 115' (Fig. 25) of the transaction differential mechanism moves the differential shafts 274 (Fig. 24) and 650 (Fig. 52) for the totalizer control mechanism and printing mechanism and for the corresponding display and type wheel into the position corresponding to the position of the key $+b$ (chapters 10 and 15). The shafts 273 for the account totalizers and the differential shaft 370 and shaft 658 (Fig. 52) of the printing mechanism stay in their position of rest as none of the keys 12 and 13 has been depressed. The selecting movement of the control slides causes, in the totalizer control mechanism, the rocking frame 343 (Fig. 41) for "setting amounts" to be coupled with the control shaft 289 and the rocking frame 341 (Fig. 39), for taking grand totals, to be coupled with the control shaft 304. It further causes the shaft 311 (Fig. 24) and the throw-out member 318' for the main totalizer to be positioned for addition and for throwing-in, respectively, and the throw-out member 318 for the auxiliary totalizer to be positioned for throwing-out (chapters 10 and 12).

In the printing mechanism the selecting movement of the control slides causes the thrust bar 687 (Fig. 64) of the printing-drive for the ticket, the bars 684, 685 (Figs. 61, 62) of the print drive for book and card and the bar 683 (Fig. 60) of the drive of the cutting device to be coupled with the rocking bar 692 (chapter 16).

In the meantime the tens transfer parts which happen to have been displaced in the preceding operation, have been returned (chapter 6). By the downward motion of the rocking frame 341 (Fig. 39) the adding wheels 219' (Fig. 16) of the main totalizer are coupled with the amount differential

members 65, 80 (Fig. 2; chapters 8, 12). Thereupon the amount differential members released from their zero locking levers 62 (Fig. 2) are moved downward until the tens teeth 231' of the adding wheels 219' (Fig. 16) strike the zero stop teeth 233' whereby the differential members 65, 80 are uncoupled from their actuating members and are locked in their positions, and whereby the main totalizer is zeroized (chapter 7).

The downward motion of the cross head 115 of the amount differential mechanism causes the printing and display wheels to be positioned to the total of the main totalizer according to the position of the amount differential members 65, 80 (chapter 4). In the meantime the feeding of the consecutive number from 533 to 534 took place as well as the positioning of the type wheels 577, 577' (Fig. 51) to the account number set by the keys 17 (chapters 14, 15).

The actuation of the printing mechanism effects the simultaneous impression of the total of the main totalizer, +2735.00 on the card, ticket and book (item 534, Figs. 67, 68, 69) and the ticket is cut off (chapters 15, 16). The cut-off ticket falls into the chamber 781 (Fig. 1) and can be taken therefrom. Then follow the line feeding motions for book, card and ticket strip, motions which, however, are not, of any importance as to the book and card, as these latter are taken out of the machine after the printing operation has been completed.

After the printing motion the rider axle 224' of the main totalizer is brought back into its initial position by the rocking frame 341 (Fig. 39) as well as the control shaft 304, whereby the adding wheels 219' are uncoupled from the amount differential members 65, 80. Besides, the rocking frame 343 (Fig. 41) and the control shaft 289 move the rider axle 161 for the group of transaction totalizers S axially whereby the totalizer +b engages the amount differential members 65, 80. Upon the return movement now following of the amount differential members into their upper extreme positions the total amount of 2735.00 is additively transmitted to the transaction totalizer +b. When arrived in the upper extreme position, the amount differential members are uncoupled from the totalizer +b by the rider axle 161 of the group S of totalizers being returned into idle position by the rocking frame 343. The actuation of the item counter causes the item counter (chapter 40) allotted to key +b to be fed. At the end of the operation of the machine all keys are unlocked from the blocking bows 46, 944 (Fig. 96; chapter 20) and the set amount and account keys and the key +b are released (chapters 18 and 36). The returned differential members are locked anew by their zero locking levers 62 and 62', respectively (Figs. 2, 25; chapters 2,

24, 25). After the operation of the machine has been completed, the machine is in normal state (chapter 35) in which the amount keys, account and by-keys and the keys HR, N, ES, ZS and the corresponding releasing keys are in released state, while the remaining keys are in locked state.

Record of second order

In order to be able to inform the customer, during the course of a series of Zu- and Ab-records, about the intermediate state of account just existing, the sub-total can be taken from the main totalizer. In the normal state of the machine the key RZ is locked and is released only after an account key is depressed (chapter 33), but is locked again by depressing an amount key (chapter 33) so that this key is in the released state only in the intervals before and after the operations of an ordinary record for introducing Zu- and Ab-amounts.

If the key RZ is depressed in these intervals, to take a sub-total from the main totalizer, this depression causes the amount keys to be locked (chapter 23), none of these keys being allowed to be set upon depressing the key RZ, and causes, further, the by-keys to be locked (chapter 26). The keys N, ZS, ES and the account keys 17 already are locked in their setting positions (chapters 36, 38, 39). The depression of the key RZ further causes the transaction differential member 251, 80' (Fig. 25), the amount differential members 65, 80 and the motor key M to be released (chapters 24, 25, 32).

The depression of the motor key causes the keys RZ and HR (chapter 20), still unlocked, to be locked and the operation of the machine to be started (chapter 13). At the beginning of the operation the transaction differential mechanism is actuated, the differential member 251, 80' (Fig. 25) being lowered into the position corresponding to the key RZ (chapter 10). The actuation of the cross head 115', now following (Fig. 25), of the transaction differential mechanism causes the differential shafts 274 (Fig. 24) and 650 (Fig. 52) for the totalizer control mechanism, printing mechanism and for the corresponding display and type wheel, to take the position according to the key RZ (chapters 10, 14). The shafts 273 (Fig. 24) for the account totalizers and the differential shaft 370 as well as shaft 658 (Fig. 52) of the printing mechanism remain in their positions of rest, since none of the keys 12 and 13 has been depressed. Upon the shaft 274 rotating, the nose 417' (Figs. 45, 45a) engages the pin 418 of the bow 419' cooperating by the bar 421' with the differential disk 265' for the main totalizer. If the main totalizer contains a positive total, a recess will be opposite to the pin 423', as described in chapters 9 and 10, the recess RZ of the

control disk 408 remaining covered by the auxiliary disk 411. If the total contained in the main totalizer is a negative one, a full portion of the disk 265' will be opposite to said pin 423', the recess RZ of the control disk thus being free. In the first-mentioned case the shaft 311' is turned, upon the control slide 316' operating it, into adding position, in the second case, to be assumed here, into subtracting position.

In the totalizer control mechanism, by the selecting motion of the control slides, according to the recesses of the control disks in consideration, of the shafts 274 and 370 (Fig. 24), the rocking frame 342 (Fig. 40) is coupled for taking sub-totals, with the control shaft 304; said selecting motion further causes the throw-out member 318' to move into the throw-in angular position and the shaft 311' to move into subtracting angular position. It causes, further, the throw-out member 318 for the auxiliary totalizer to move into throw-out angular position. The control shaft 289 is coupled to no rocking frame, as the key RZ has no transaction totalizer allotted to it and account totalizers do not take part in the operation RZ.

In the printing mechanism the selecting motion of the control slides causes the bars 686 (Fig. 63) of the printing drive mechanism for the control strip to be coupled with the rod 692, and the bar 682 (Fig. 59) for the control strip drive to be coupled with the pin 693. The other controllable members of the printing mechanism are not coupled with the drive, as the sub-total from the main totalizer is printed on the control strip only (chapters 15, 16). In the meantime the tens transfer members which happen to have been displaced in the preceding operation, have returned (chapter 6). By the downward motion of the rocking frame 342 (Fig. 40) the subtracting wheels 220 (Fig. 16) of the main totalizer are coupled with the amount differential members 65, 80 (Fig. 2; chapters 8 and 12) whereupon the amount differential members, released from their zero locking levers 62 (Fig. 2), are moved down until the tens teeth 232' of the subtracting wheels 220' (Fig. 16) strike the zero stop teeth 233'. When this takes place, the amount differential members are uncoupled from their driving members and locked in the set position (chapter 7). The adding wheels 219 of the main totalizer are set, in this case, to 9,999,999,999, and not, as in taking a positive total, to zero, since the negative total has a supplementary subtractive tens transfer mechanism, as described in chapter. The amount differential members 65, 80 take the position according to the absolute value of the negative total.

The downward motion of the cross head 115 of the amount differential mechanism causes

the printing and display wheels to be set to the absolute value of the negative total of the main totalizer according to the position of the amount differential members (chapter 4). In the meantime the following has taken place: the feeding motion of the consecutive number (chapter 15), the motion of the last printed line of the control strip from place 873 (Fig. 55) to place 875 (chapter 15), the positioning of the minus sign (chapter 10) and the positioning of the type wheels 577, 577' for the account numbers according to the account keys 17 kept locked (chapter 14). The printing motion of the roll 829 (Fig. 63) causes the sub-total from the main totalizer, the account number, the date, the minus or plus sign, sign of work and consecutive number to be printed on the control strip; this is illustrated for a positive sub-total by item 548 (Fig. 71). The new printed line is fed to place 873 (Fig. 55) where it can be read-off through the display hole 871, the type wheels for the account number return to their initial position, book and card are fed by the space of a line (chapters 14 and 15).

The amount differential members remain engaging the main totalizer; after the impression has been finished, they are returned to their upper initial position whereby the counting wheels of the main totalizer are returned to the position they assumed before the operation started. When arrived in the upper initial position, the amount differential members 65, 80 are uncoupled from the main totalizer by the rider axle 224' being brought back to its idle position by the rocking frame 342 (Fig. 40). Then all keys are unlocked from the locking bows 46, 944 (Fig. 96, chapter 20) and the key RZ is released, whereby, after the operation has been completed and the motor key has been locked again (chapters 13, 32), all parts of the machine, except the control strip, take exactly the same position as at the beginning of the operation so that the record of first order may be continued. The actuation of the item counters had not been influenced, as no item counter is allotted to the key RZ.

Record of third order

The record of third order has for its purpose to take a sub- or grand total from one of the control totalizers, that is from one of the account or transaction totalizers or from the auxiliary totalizer.

The record of third order is initiated by depression of a key ZS, ES. If the key HR was set, it must be released (chapter 32). The same applies to the key N (chapter 19). Upon depressing a key ZS, ES the other keys of the row 12 are locked (chapter 19) as well as the amount keys (chapter 23), while the amount differential members are released (chapter 25). The said depression further causes: the key RZ to be locked (chapter 28),

the mutual locking of the keys $-b$, $+b$ to be annulled (chapter 31), the keys Ab and Zu to be released (chapter 34), the transaction differential member 252, 80' to be released (chapter 24), the main keys to be released from the bow 1185 (chapter 33), the keys $-b$, $+b$, Ab , Zu to be released from their auxiliary slides 977 (Fig. 80) and 980 (Fig. 84; chapter 38), the locking device, dependent on the keys b and B , for the account keys to become inoperative, the main and by-keys and the key HR to mutually lock themselves (chapter 29), the item counter drive to be thrown-out (chapter 40) and the by-keys and the key HR to become releasing keys for the motor key M (chapter 32).

All control totalizer keys are thus released and so blocked that one of them only can be depressed, all the other keys being locked. By depressing one of the control totalizer keys the corresponding transaction differential member and the motor key is released (chapters 32, 24).

It may be assumed that a grand-total is to be taken from the totalizer Ab . By depressing the key Ab the differential member 251, 80' (Fig. 25) and the motor key is released. By depressing the latter all keys are locked and the operation of the machine is released (chapter 20, 13). In the course of this operation the totalizer Ab is thrown in during the downward motion of the amount differential members (chapter 7). The shaft 304 (Figs. 39 to 41) is out of engagement with the rocking frames so that the main totalizer remains out of operation. The control disk 408 (Fig. 46) presents a recess Ab to the control slide 316' whereby the minus-sign is positioned (chapter 10). After the total has been transmitted to the printing and display mechanism, the zeroized transaction totalizer Ab is uncoupled from the amount differential members.

In the printing mechanism by the selecting motion of the control slides, the printing drive for control strip and ticket, the great ticket transport, the control strip transport and the ticket cutting device transport are thrown-in. The ticket taken from the machine (Fig. 70) contains, besides the bi-lateral impression of the engraving, a single printed line only, representing the total of the control totalizer (chapters 15, 16) and showing, besides the totalizer sign Ab , the mode of operation sign ES .

Upon the release of the key ES taking place at the end of the operation, the blocking operations caused by the depressing of this key, are annulled (chapters 29, 38). After the operation of the machine has been finished, the machine takes again the normal state (chapter 35). The line on the control strip may be read-off through the display hole 871 (Fig. 55).

If the key ZS had been depressed, the

amount differential members remain coupled with the thrown-in totalizer even during the return into their upper extreme position. In other respects the mode of operation in record of third order is the same as the hereinbefore described.

In taking totals from the auxiliary totalizer, wherein after depressing the key ES or ZS the key HR is set, the machine throws itself over, in case the auxiliary totalizer contains a negative total, into the state for taking negative totals in the same manner as described with records of second order. Positive grand totals from the auxiliary totalizer are illustrated by the items 528 and 535 (Fig. 71).

Records of fourth order

These records serve for recording in the book a record made in an account in absence of the book. No action of the control totalizers takes place. The main totalizer only enters into action to calculate the new state and to obviate the separate setting thereof which could be made from the statements given by the card. The record of fourth order thus takes place like that of first order in which all control totalizers are at rest and the impression is made in the book only: The amounts received and paid out only and the new state of account will be printed with the sign N , as show items 486, 487 (Fig. 68).

To initiate a record of fourth order the key N is depressed, this being possible in the normal state of the machine only (chapters 39, 19). This depression causes the bow 392 (Fig. 42) to be swung by means of the double lever 397 (Figs. 93, 41) whereby the transaction control disks 391 (Fig. 42a) come into the path of the control slides allotted to the control totalizers and prevent the control shaft 289 from being coupled with the rocking frames. The control totalizers hereby remain thrown out for the time the key N is being set (chapter 10). The depressing of the key N causes further the item counter drive to be thrown out (chapter 40) and the transaction differential member 252, 80' (Fig. 25) to be released, said member having the task of positioning the type N in the printing mechanism (chapter 14).

Upon initiating the first operation of the record by depressing one of the keys $-B$, $+B$ the key N is locked. This locked state is annulled only during the last operation of the record by depressing a key $-b$ or $+b$ (chapter 39). During the first operation the old state is transmitted to the main totalizer, and no impression takes place. In the operations for recording amounts received and paid out these amounts are transmitted additively or subtractively to the main totalizer and are printed on the control strip together with the type N . A transmission of said amounts to the account totalizers does

not take place although by-keys have been set. During the last operation the impression of the positive or negative new state is made on the control strip, the main totalizer being at the same time zeroized.

While the form of mechanism herein shown and described is admirably adapted to fulfill the objects primarily stated, it is to be understood that it is not intended to confine the invention to the one form of embodiment herein shown and described, as it is susceptible of embodiment in various forms, all coming within the scope of the claims which follow.

What is claimed is:

1. In a machine of the class described the combination of a main totalizer, an auxiliary totalizer, a plurality of differentially movable actuators for said totalizers, a totalizer governing mechanism, an auxiliary totalizer key for throwing-in said auxiliary totalizer with determined operations of said main totalizer, and means adapted to interrupt the connection existing between said actuators and said main totalizer and for engaging said auxiliary totalizer with said actuators when the main totalizer is inactive.

2. In a machine of the class described the combination of a main totalizer for additions and subtractions, a plurality of controlling totalizers, a plurality of differentially movable actuators for entering amounts and taking totals, means for throwing-in said controlling totalizers, a driving mechanism, means for coupling said driving mechanism with said throwing-in means, a totalizer governing mechanism, manipulative means for said controlling totalizers causing said controlling totalizers to be engaged with said actuators in dependence on the operation of the main totalizer, special manipulative means, slides in said governing mechanism acting upon said coupling means, and governing members influenced by said special manipulative means adapted to block said slides, whereby the coupling between said driving mechanism and said means for throwing-in said controlling totalizers is annulled.

3. In a machine according to claim 42, a driving mechanism, connections between said mechanism and said driving member, adjusting means for said abutting means operated from said driving mechanism, and manipulative means for limiting the differential movement of said abutting means generated by said driving mechanism.

4. In a machine according to claim 42, a driving mechanism, connections between said mechanism and said driving member, adjusting means for said abutting means operated from said driving mechanism, manipulative means for determining the differential movement of said abutting means generated by said driving mechanism, means for in-

terrupting said connection between said adjusting means and said abutting means, whereby the abutting means, in the position of rest of the machine, maintains its adjusted position and is directly moved at every operation of the machine from the old into the new position.

5. A machine according to claim 42, wherein said abutting means is in the form of a rotatable and shiftable step drum, and manipulative means for adjusting said step drum in a determined angular position.

6. A machine according to claim 42, wherein said abutting means is in the form of a rotatable and shiftable step drum, manipulative means for adjusting said step drum in a determined angular position, the steps on said drum being of equal thickness, a stop fixed on the frame of the machine and arranged at one side of said steps, a lug on said driving member at the other side of said steps.

7. A machine according to claim 42, wherein said abutting means is in the form of a rotatable and shiftable step drum, manipulative means for adjusting said step drum in a determined angular position, the steps on said drum being of equal thickness, a stop fixed on the frame of the machine and arranged at one side of said steps, a lug on said driving member at the other side of said steps, a flange on said step drum cooperating with said lug and arranged so as to cause the step drum, upon the return motion of said driving member, to be returned into initial position.

8. In a machine according to claim 42, a totalizer controlling mechanism, and connections between said mechanism and said driving member whereby said driving member is driven in dependence on said totalizer controlling mechanism.

9. In a machine of the class described the combination of a totalizer for additions and subtractions, differential actuators therefor, means for selectively positioning said totalizer for addition or subtraction and containing a selecting member, means for throwing in and out said totalizer and containing a throw-out member, controlling disks having notches, means for controlling said disks, a controlling slide connected to said selecting member, a second controlling slide connected to said throw-out member, driving means for said slides, driving means for said disks adapted to set them according to said controlling means and to retain said disks in the set position while the machine is at rest.

10. In a machine of the class described the combination of a totalizer, differential actuators therefor adapted for entering amounts and taking totals, means for coupling said totalizer with said actuators, rods connected to said means, three rocking frames, adapted respectively for entering amounts, taking

sub-totals and grand-totals, cam disks adapted to rock said rocking frames, and manipulative means for selectively engaging said rods with said rocking frames.

5 11. A machine according to claim 10, in which said manipulative means comprises controlling slides movable perpendicularly with respect to said rods and engaging them, controlling disks having notches and adapted
10 to be differentially positioned, driving arms, and springs between the latter and said controlling slides yieldingly moving said control slides against said disks in order to perform said coupling if a notch of said disks
15 is opposite to them.

12. In a machine of the class described the combination of a main totalizer, a plurality of transaction totalizers, differential actuators for entering amounts and taking totals,
20 main keys adapted to simultaneously control an operation of the main totalizer and the throwing-in of one of said transaction totalizers, total keys adapted to control a total taking operation from the transaction totalizers, the mechanism whereby the operations controlled by said keys are carried out comprising a special differential actuator controlled by said main keys, a set of controlling disks connected to said special actuator, a
25 second special differential actuator controlled by said total keys, a second set of controlling disks connected to said second special actuator, means for coupling said totalizers with said first-named actuators, controlling slides
30 connected to said means, two lugs on each slide co-operating each with one controlling disk in each of said two sets of disks, and driving means for said controlling slides.

13. In a machine according to claim 12, notches on determined disks of said second set of controlling disks and arranged so as to be opposite to said controlling slides in the initial position of their set of disks, whereby said controlling slides can be released by depressing the main keys only.
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14. In a machine according to claim 12, notches on determined disks of said first set of controlling disks and arranged so as to be opposite to said controlling slides in the initial position of said set of disks, so that the machine can be set, by depressing a total key, for total taking operations independently of the depression of a main key.
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15. In a machine according to claim 12, a selecting member in said means for coupling said totalizers with said actuators, connections between said selecting member and said special actuator for the main keys adapted to differentially position said selecting member for the different coupling of said transaction totalizers.
60

16. In a machine of the class described, the combination of a main totalizer and an auxiliary totalizer, differentially movable
65 actuators for said totalizers, an amount set-

ting mechanism cooperating with said actuators, control mechanism for governing the cooperation of said actuators with said totalizers, manipulative means for setting said control mechanism to couple said main totalizer to said actuators for several kinds of operation, said control mechanism including means set by said manipulative means for effecting the coupling of said auxiliary totalizer to said actuators for certain kinds of operation of said main totalizer, an auxiliary totalizer key, and connections between said key and said control mechanism so constructed and so adjusted in the position of rest of said key as to render ineffective the means for coupling said auxiliary totalizer to said actuators.
70 75 80

17. A machine according to claim 16 in which said manipulative means comprises a plurality of main keys arranged in a row with said auxiliary totalizer key, a differentially movable actuator cooperating with said main keys and said auxiliary totalizer key, and connections between said last named actuator and said control mechanism.
85 90

18. In a machine of the class described, two totalizers, differentially movable actuators for said totalizers, common manipulative means for simultaneously controlling the coupling of said actuators with each of said totalizers, and manipulative means for modifying the control of said common manipulative means with respect to one of said totalizers.
95

19. In a machine of the class described, two totalizers, differentially movable actuators for said totalizers, setting devices determining the coupling of said actuators to each of said totalizers, a row of keys, a differential setting member controlled by said keys and constituting a common adjusting member for said setting devices, and means controlled by the key permitting the greatest movement of said differential setting member for modifying the adjustments of said setting devices effected by other keys of the row.
100 105 110

20. In a machine of the class described, a main totalizer adapted for addition and subtraction, two transaction totalizers, a total taking mechanism, means controlled by said main totalizer in accordance with the sign of the total contained therein for adjusting said total taking mechanism with respect to said main totalizer so as to take positive or negative totals, and means for coupling one or the other of said transaction totalizers to said total taking mechanism according to whether the total is positive or negative.
115 120

21. A machine in accordance with claim 20 in which said coupling means is controlled by the means for adjusting said total taking mechanism.
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22. In a machine of the class described, a main totalizer, a plurality of control totalizers, differential actuators for said totalizers,
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- mechanism including manipulative means for coupling said main totalizer to said actuators in accordance with different kinds of operations, and means for selectively coupling said control totalizers to said actuators comprising a setting device, means for setting said setting device in accordance with the control totalizer to be coupled, a shifting member cooperating with said setting device to cause the relative shifting of said control totalizers and their actuators by which the selection is effected, and means operated by the manipulative means for the main totalizer controlling said shifting member.
23. In a machine of the class described, a main totalizer, a plurality of control totalizers, differential actuators for said totalizers, mechanism including manipulative means for coupling said main totalizer to said actuators in accordance with different kinds of operations, and means for selectively coupling said control totalizers to said actuators comprising a setting device, means for setting said setting device in accordance with the control totalizer to be coupled, a shifting member for relatively shifting said control totalizers and their actuators to effect the selection, said shifting device acting through the intermediary of said setting device, and means operated by the manipulative means for the main totalizer controlling said shifting member.
24. A machine in accordance with claim 23 in which said setting device comprises a rotatable drum having helically arranged abutting surfaces adapted to be engaged by said shifting member, said drum being mounted for longitudinal shifting movement under the action of said shifting member.
25. In a machine of the class described, a main totalizer, a plurality of control totalizers, differential actuators for said totalizers, manipulative means for coupling said main totalizer to said actuators in accordance with different kinds of operations, means actuated by said manipulative means for selectively coupling said control totalizers to said actuators, said coupling means having disengageable connections and special manipulative means for controlling the engagement of said connections.
26. In a machine of the class described, a main totalizer, a plurality of control totalizers, differentially movable actuators for said totalizers, manipulative means for coupling said main totalizer to said actuators, means for selectively throwing said control totalizers into engagement with said actuators, a driving mechanism, disengageable connections between said throwing means and said driving mechanism, and means set by said manipulative means for controlling said connections.
27. In a machine of the class described, a main totalizer, a plurality of control totalizers, differentially movable total taking devices, means for coupling said main totalizer to said total taking devices, means for coupling said control totalizers to said total taking devices, a driving mechanism, manipulative means for selectively connecting said main or control totalizer coupling means to said driving mechanism, and manipulative means for modifying the action of said control totalizer coupling means to effect the coupling of a particular control totalizer.
28. In a machine of the class described, a main totalizer, a control totalizer, differentially movable actuators for entering amounts into and taking totals from said totalizers, manipulative means for simultaneously coupling said main totalizer and said control totalizer to said actuators for entering amounts, total keys, and connections between said total keys and said manipulative means adapted to modify said manipulative means so that the manipulation thereof causes the coupling of said control totalizer alone to said actuators for total taking.
29. In a machine of the class described, a main totalizer, a control totalizer, differentially movable actuators for entering amounts into and taking totals from said totalizers, separate mechanisms for coupling said main totalizer and said control totalizer to said actuators, a driving mechanism, separate mechanisms for connecting said coupling mechanisms to said driving mechanism, a dual control for each of said connecting mechanisms, and manipulative means for each element of said dual control, the operation of said connecting mechanisms being determined by the combined effect of the elements of said dual control.
30. In a machine of the class described, a main totalizer, a control totalizer, differentially movable actuators for entering amounts into and taking totals from said totalizers, separate mechanisms for coupling said main totalizer and said control totalizer to said actuators, a plurality of driving elements having driving motions differently timed with respect to the operation of the machine, separate mechanisms for connecting each of said coupling mechanisms to each of said driving elements, a dual control for each of said connecting mechanisms and manipulative means for each element of said dual control means, the operation of said connecting mechanisms being determined by the combined effect of the elements of said dual control.
31. In a totalizing mechanism for addition and subtraction, an adding wheel, a subtracting wheel coaxial therewith, a reversing gear between said adding and subtracting wheels, a differential wheel journaled coaxially with said adding and subtracting wheels, means

for selectively coupling said differential wheel to said adding or subtracting wheel, and a differential actuator for said differential wheel.

32. In a machine according to claim 31, a hub rigidly connected to said differential wheel and having rotatably mounted on it said adding and subtracting wheels.

33. In a machine according to claim 31, a hub rigidly connected to said differential wheel and having rotatably mounted on it said adding and subtracting wheels, said hub having a longitudinal slot, a series of teeth on the inside of said counting wheels, and a coupling member shiftably mounted in said slot and adapted to be selectively engaged with the teeth of said counting wheels.

34. In a machine according to claim 31, a hub rigidly connected to said differential wheel and having rotatably mounted on it said adding and subtracting wheels, said hub having a longitudinal slot, a series of teeth on the inside of said counting wheels, an axle mounted coaxially with said differential and counting wheels, a coupling member rotatably but not axially shiftable on said axle projecting from said slot, said axle being shiftable relative to said wheels to effect the coupling of the counting and differential wheels.

35. In a machine according to claim 31, a hub rigidly connected to said differential wheel and having rotatably mounted on it said adding and subtracting wheels, said hub having a longitudinal slot, a series of teeth on the inside of said counting wheels, an axle mounted coaxially with said differential and counting wheels, a coupling member rotatably but not axially shiftable on said axle projecting from said slot, and means for selectively shifting said axle to couple either the adding or the subtracting wheel to said differential wheel.

36. In a machine according to claim 31, a hub rigidly connected to said differential wheel and having rotatably mounted on it said adding and subtracting wheels, said hub having a longitudinal slot, a series of teeth on the inside of said counting wheels, an axle mounted coaxially with said differential and counting wheels, a coupling member rotatably but not axially shiftable on said axle projecting from said slot, said slot being of sufficient length to permit said coupling member to be engaged with either counting wheel or to be disengaged from both, and means for selectively shifting said axle to place said coupling member in either of said positions.

37. In a totalizing mechanism adapted for addition and subtraction, an adding wheel, a subtracting wheel, a tubular member upon which said wheels are mounted, differential mechanism, means within said tubular member for selectively coupling said differential mechanism to either of said wheels, bevel

gears rigidly connected to said adding and subtracting wheels, a reversing bevel pinion interposed between said bevel gears, a journal for said bevel pinion, a fixed rod arranged in parallel with the axis of the totalizer, and means for mounting said journal on said rod.

38. In a totalizing mechanism adapted for addition and subtraction, means for materially embodying the sign of the total contained in said totalizing mechanism comprising a member adapted to be adjusted in different positions corresponding respectively to positive and negative totals, driving means for imparting movements of adjustment to said member, control means for said driving means in the highest order of the totalizing mechanism adapted to initiate a driving movement of said driving means upon a passage in the highest order from 9 to 0 or from 0 to 9, and stops limiting the motion of said member to prevent more than one movement of adjustment initiated by successive passages in a positive or in a negative direction.

39. A totalizing mechanism in accordance with claim 38 in which said member adapted to be adjusted in different positions corresponding respectively to positive and negative totals comprises a disk having notches, and a feeling member cooperating with said disk.

40. In a totalizing mechanism adapted for addition and subtraction, an adding wheel, a subtracting wheel, a reversing gear interposed between said wheels, a differential actuator for said wheels, shiftable means for selectively coupling said actuator to said wheels, means for materially embodying the sign of the total contained in said totalizing mechanism comprising a member adapted to be adjusted in different positions corresponding respectively to positive and negative totals, driving means for imparting movements of adjustment to said member, control means for said driving means in the highest order of the totalizing mechanism adapted to initiate a driving movement of said driving means upon a passage in the highest order from 9 to 0 or from 0 to 9, a stop member positively connected to said first mentioned member to be adjusted therewith, said stop member having stops arranged alternately in two planes, and a stop arm cooperating with said stops and connected to said shiftable means so as to be positioned in the path of the stops in one plane or the other according to the wheel being actuated.

41. In a totalizing mechanism adapted for addition and subtraction, an adding wheel, a subtracting wheel, a reversing gear interposed between said wheels, a differential actuator for said wheels, shiftable means for selectively coupling said actuator to said wheels, means for materially embodying the sign of the total contained in said totalizing

mechanism comprising a member adapted to be adjusted in different positions corresponding respectively to positive and negative totals, driving means for imparting movements of adjustment to said member, control means for said driving means comprising a lug on each of said wheels, a projecting member in said driving means adapted to be engaged by said lugs and adjustable to cooperate with the wheel which is being actuated, said projecting member being adapted to initiate a driving motion when struck by one of said lugs, a stop member positively connected to said first mentioned member to be adjusted therewith, said stop member having stops arranged alternately in two planes, and a stop arm cooperating with said stops and connected to said shiftable means so as to be positioned in the path of the stops in one plane or the other according to the wheel being actuated.

42. In a machine of the class described, a multiple totalizer, differential actuators for said totalizer, shiftable means for selectively coupling said actuators to the individual totalizers, a driving member having a uniform extent of travel, and differentially adjustable abutting means between said driving member and said shiftable means.

43. A machine according to claim 42, wherein said driving member comprises a rod shiftable mounted in the frame of the machine and having a lug cooperating with said adjustable abutting means, a shaft mounted for rotation in the frame of the machine, an arm rigid on said shaft, and a connection between said arm and said rod.

44. In a machine of the class described, a totalizer adapted for addition and subtraction comprising an adding wheel, a subtracting wheel, and a reversing gear between said wheels, a differential actuator for said totalizer, shiftable means for selectively coupling said actuator to said adding wheel or said subtracting wheel, a driving member having a uniform extent of travel, and differentially adjustable abutting means between said driving member and said shiftable means.

45. In a machine according to claim 44, a totalizer governing mechanism, and operative connections between said mechanism and said abutting means.

46. In a machine according to claim 44, a driving mechanism for the machine, connections between said mechanism and said driving member, actuating means connected to said driving mechanism for adjusting said abutting means, and manipulative means for regulating the motion of said actuating means.

47. In a machine of the class described, a totalizer adapted for addition and subtraction comprising an adding wheel, a subtracting wheel, and a reversing gear between

said wheels, a differential actuator for said totalizer, shiftable means for selectively coupling said actuator to said adding wheel or said subtracting wheel, a driving member having a uniform extent of travel, steps on said shiftable means, and manipulative means for selectively positioning said steps in the path of said driving member.

48. In a machine of the class described, a totalizer adapted for addition and subtraction comprising an adding wheel, a subtracting wheel, and a reversing gear between said wheels, a differential actuator for said totalizer, shiftable means for selectively coupling said actuator to said adding wheel or said subtracting wheel, a driving member having a uniform extent of travel, steps on said shiftable member, manipulative means for selectively adjusting said steps in the path of said driving member, and a fixed stop on the frame of the machine against which the selected step is adapted to be moved by said driving member.

49. In a machine of the class described, a totalizer adapted for addition and subtraction comprising an adding wheel, a subtracting wheel, and a reversing gear between said wheels, a differential actuator for said totalizer, shiftable means for selectively coupling said actuator to said adding wheel or said subtracting wheel, a driving member having a uniform extent of travel, said shiftable means comprising two sections joined to permit relative rotation, steps on one of said sections, and manipulative means for differentially rotating said step bearing section to position different steps in the path of said driving member.

50. In a machine according to claim 47, an adjustable throw-in, throw-out member comprising an abutting member adapted to be interposed between said driving member and said steps, a stop adapted to be positioned behind said steps, said stop and abutting member being so connected that only one will be in operative position at a time, and means for adjusting said throw-in, throw-out member.

51. In a machine of the class described, a totalizer adapted for addition and subtraction comprising an adding wheel, a subtracting wheel, and a reversing gear between said wheels, a differential actuator for said totalizer, shiftable means for selectively coupling said actuator to said adding wheel or said subtracting wheel, a driving member having a uniform extent of travel, a fixed stop in line with the path of movement of said driving member, steps on said shiftable means, means for selectively bringing said steps between said driving member and said fixed stop, an adjustable throw-in, throw-out member having abutting members adapted to be selectively brought into the line between said driving member and said fixed stop, one of

said abutting members being adapted to be interposed between said fixed stop and the step nearest thereto, the others being wholly on the side of said steps toward said driving member, the total thickness of the steps and abutting members in operative position being substantially equal in all positions of adjustment.

52. In a machine according to claim 47 an adjustable throw-in, throw-out member comprising an abutting member adapted to be interposed between said driving member and said steps, a stop adapted to be positioned behind said steps, said stop and abutting member being so connected that only one will be in operative position at a time, means for adjusting said throw-in, throw-out member, a flange on said throw-in, throw-out member adapted to be engaged by said driving member on its return movement, and a lost motion connection between said shiftable member and said throw-in, throw-out member.

53. In a machine according to claim 47 an adjustable throw-in, throw-out member comprising an abutting member adapted to be interposed between said driving member and said steps, a stop adapted to be positioned behind said steps, said stops being so connected that only one will be in operative position at a time, means for adjusting said throw-in, throw-out member, a controlling slide connected to said throw-in, throw-out member, a driving arm, a spring between said slide and said arm, a controlling member having notches, said slide being yieldably moved against said holding member by said spring and arm, and manipulative means for adjusting said controlling member.

54. In a machine of the class described, a totalizer adapted for addition and subtraction comprising an adding wheel, a subtracting wheel, and a reversing gear between said wheels, a differential actuator for said totalizer, shiftable means for selectively coupling said actuator to said adding wheel or said subtracting wheel, a driving member having a uniform extent of travel, differentially adjustable abutting means between said driving member and said shiftable means, a set of keys, a differential member controlled by said keys, a shaft connected to said differential member so as to be angularly adjusted thereby, a controlling disk having notches rigid on said shaft, a slide controlling said abutting means, a driving member connected to said slide by a spring, whereby said slide is yieldingly moved against said disk.

55. In a machine of the class described, a totalizer adapted for addition and subtraction, means for adjusting said totalizer for addition or subtraction comprising a selecting member, means for materially embodying the sign of the total contained in said totalizer comprising a setting member having dif-

ferent positions of adjustment corresponding respectively to positive and negative totals, a feeling member cooperating with said setting member, a notched controlling disk cooperating with said feeling member, a controlling slide connected to said selecting member, means for yieldingly moving said slide against said disk, and connections between said feeling member and said controlling disk whereby the contour of said disk is modified in one position of said setting member.

56. In a machine of the class described, a totalizer adapted for addition or subtraction, means for selectively adjusting said totalizer for addition or subtraction, means for materially embodying the sign of the total contained in said totalizer comprising a setting member having different positions of adjustment corresponding to positive and negative totals, and means operated by said totalizer upon a passage from a positive to a negative total for adjusting said setting disk into a different position, a feeling member cooperating with said setting member, a key, a controlling disk adjusted by said key, a second controlling disk arranged beside and limitedly rotatable with respect to said first named disk, a controlling slide cooperating with said controlling disks and connected to said selective means, a notch in said first named disk normally covered by said second disk, and connections between said feeling member and said second controlling disk for freeing said notch in dependence upon the position of said setting member.

57. A machine according to claim 56 in which the means for freeing said notch comprise a spring between said two controlling disks, a second spring on said feeling member weaker than said first named spring and withholding said feeling member from said setting disk, a lug on said second disk engaging said feeling member upon the positioning of said first disk by said key, whereby said second disk is stopped and uncovers said notch if said setting member is so positioned as to prevent said feeling member from yielding.

58. In a machine of the class described, a totalizer adapted for additions and subtractions, differential actuators for said totalizer, means for materially embodying the sign of the total in said totalizer comprising a setting member adapted to be adjusted in different positions corresponding respectively to positive and negative totals, and means operated by the totalizer upon a passage from a positive to a negative total or vice versa for adjusting said setting member in a different position, control means adapted to adjust the machine for taking totals, and means controlled in common by said control means and said setting member for relatively adjusting said actuators and said totalizer for taking positive or negative totals.

59. In a machine of the class described, a totalizer adapted for addition and subtraction, total taking mechanism cooperating therewith, means comprising two keys for
 5 adjusting said total taking mechanism for taking positive or negative totals from said totalizer, means for materially embodying the sign of the total contained in said totalizer comprising a setting member having different positions of adjustment corresponding
 10 respectively to positive and negative totals, means operated by the totalizer upon a passage from a positive to a negative total, or vice versa, for adjusting said setting member in a different position, and connections
 15 between said setting member and said keys whereby one of said keys is locked and the other released in one position of said setting member, while in the other position thereof
 20 the second mentioned key is locked and the other released.
60. A machine according to claim 59 in which said setting member comprises a notched disk and said connections comprise
 25 feeling members positively connected with each key and cooperating with said disk, the notches being so arranged that the key corresponding to the sign of the total is released and the other is locked.
- 30 61. A machine according to claim 59 in which said setting member comprises a disk having equidistant notches in its periphery and said connections comprise feeling members so cooperating with said periphery that
 35 one of said feeling members is always opposite a notch and the other is opposite a full portion of said periphery.
62. In a machine of the class described, a main totalizer, an auxiliary totalizer, differential actuators for said totalizers, manipulative means for coupling said main totalizer
 40 to said actuators for various kinds of operations and for coupling said auxiliary totalizer for certain of said kinds of operations, said manipulative means comprising a
 45 notched controlling disk, means for differentially adjusting said disk, a control slide adapted to effect the coupling of the auxiliary totalizer, and a driving member adapted to yieldingly press said slide against said
 50 disk.
63. In a machine of the class described, a totalizer, differential actuators for said totalizer, means for selectively coupling said totalizer to said actuators, driving means for
 55 said coupling means and a controlling mechanism for said driving means comprising a plurality of sets of controlling disks, a plurality of manipulative means corresponding
 60 in number to said sets of controlling disks and connected to said disks so as to adjust the same, and members in said driving means each controlled by a group consisting of a controlling disk of each set of disks.
64. In a machine of the class described, a
 65 main totalizer adapted for addition and subtraction, transaction totalizers adapted for addition only and comprising a positive total totalizer and a negative total totalizer, differential actuators for taking positive and
 70 negative totals from said main totalizer, manipulative means for setting said actuators to take a positive or a negative total, and connections between said manipulative means and said transaction totalizers adapted to
 75 couple either the positive total or negative total totalizer to said actuators in dependence upon the key depressed.
65. In a machine of the class described, the combination with a key bank, of item counters allotted to said keys, operating means for
 80 each item counter, a main frame upon which all of said item counters are mounted, guide means on the machine frame adapted to guide said main frame in a plane extending substantially perpendicularly with respect to
 85 the key stems, driving means for reciprocating said main frame, and a device on each key stem adapted to be moved by depression of the key to which it is appurtenant into
 90 position to engage the corresponding item counter operating means during the reciprocation of said main frame.
66. In a machine according to claim 65, a lever pivoted beside each units wheel of
 95 said item counters, a spring between said lever and said frame, a bent portion on said lever, a pin on each key entering the path of said bent portion when the key is set, and a pawl mounted on said lever and engaging said
 100 units wheel.
67. A machine according to claim 65, in which said driving means comprises a shaft, two eccentric disks rigid on said shaft, two eccentric straps surrounding said disks, pins
 105 on said main frame, said eccentric straps having slots engaged by said pins, hooks pivoted on said eccentric straps, springs so normally acting upon said hooks that the latter are engaged over said pins, and means for
 110 disengaging said hooks from said pins.
68. A machine according to claim 65 in which said driving means comprises a shaft, two eccentric disks rigid on said shaft, two eccentric straps surrounding said disks, pins
 115 on said main frame, said eccentric straps having slots engaged by said pins, hooks pivoted on said eccentric straps, springs so normally acting upon said hooks that the latter are engaged over said pins, means for disengaging said hooks from said pins, bent portions on said hooks, a rocking lever connected to certain setting keys, and means on said lever adapted to engage said bent portions
 120 when the key is set to uncouple said hooks from said pins.
69. In a machine of the class described, the combination of a main totalizer and an auxiliary totalizer, differentially movable actuators for said totalizers, an amount setting
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mechanism cooperating with said actuators, manipulative means, control mechanism adapted to be set thereby for governing the cooperation of said main totalizer with said
 5 actuators, control mechanism adapted to be set by said manipulative means for governing the cooperation of said auxiliary totalizer with said actuators, means for rendering
 10 said last mentioned control mechanism ineffective, and manipulative means controlling said last mentioned means.

70. In a machine of the class described, a main totalizer, a plurality of control totalizers, differential actuators for said totalizers,
 15 a plurality of driving cams for effecting the coupling of said main totalizer during different stages in the operation of the machine, mechanism including disengageable connections for selectively coupling said control
 20 totalizers to said actuators, manipulative means for controlling the coupling of said main totalizer by said cams, and means operated by said manipulative means for controlling said disengageable connections.

25 71. In a machine of the class described, a plurality of totalizers comprising counting wheels, said counting wheels being arranged in groups each composed of counting wheels from the same order of all said totalizers,
 30 the counting wheels of each group being coaxial, a differential wheel for each group mounted coaxially with the counting wheels of its group, differentially movable actuators permanently connected with said differential
 35 wheels, and means for selectively coupling said differential wheels with the counting wheels of their respective groups.

72. In a machine as specified in claim 71 a hub on each differential wheel on which its
 40 appurtenant counting wheels are rotatably mounted.

73. In a machine of the class described, a plurality of totalizers consisting of counting wheels, a plurality of differential wheels
 45 for different orders, an extended longitudinally slotted hub on each differential wheel, said counting wheels being arranged in groups composed of counting wheels of the same order of all said totalizers, each group
 50 of counting wheels being mounted upon the hub of the differential wheel of the same order, a series of teeth on the inside of each counting wheel, axles within said hubs, coupling means on said axles mounted so as to
 55 to be rotatable but not longitudinally shiftable upon said axles, said coupling means extending through said slots into the pitch circles of the teeth within their corresponding groups of counting wheels, and means for
 60 shifting said axles to selectively aline said coupling means with the counting wheels of their respective groups.

74. In a totalizer, counting wheels and a differential wheel axially alined, an actuator
 65 engaging said differential wheel, means

for selectively coupling said differential wheel to said counting wheels, notches in the peripheries of said counting wheels, said differential wheel having teeth omitted to provide notches corresponding to the notches of
 70 said counting wheels, and alining means adapted to engage said notches.

75. In a device of the class described, a group of coaxial counting wheels, each having a toothed axial bore and a toothed periphery, a differential wheel coaxial with said
 75 counting wheels and having likewise an axial bore, a shaft slidable within said axial bores, means for selectively coupling said counting wheels to said differential wheel comprising a coupling member on said shaft adapted to engage the toothed bore of a counting wheel and to be moved from one counting wheel to another by sliding said shaft, a rod rigidly connected with said shaft and parallel
 85 therewith, said rod engaging the peripheral teeth of said counting wheels and having a lateral slot opposite said coupling member adapted to free the coupled counting wheel for rotation, said differential wheel being of smaller diameter than said counting wheels and not engaged by said rod.

76. In a totalizing mechanism comprising adding and subtracting wheels coupled to rotate reversely, means for imparting a movement of one unit to either of the wheels of the lowest order, and controlling means therefor comprising a device arranged to cooperate with either wheel of the highest order and to cause an actuation of said first
 100 mentioned means upon a passage of said wheels of the highest order through zero to a value of opposite sign.

77. In a machine of the class described, a main totalizer, an auxiliary totalizer, differentially movable actuators for said totalizers, setting devices controlling the coupling of said main totalizer with said actuators and the simultaneous coupling of said auxiliary totalizer with said actuators for certain operations, a row of keys, a differential setting member controlled by said keys and constituting a common adjusting member for said setting devices, a device controlled by the key in said row permitting the longest
 115 movement of said setting member for annulling the portion of the setting devices adapted to effect the coupling of said auxiliary totalizer with said differential actuators, said setting devices being adapted to couple said auxiliary totalizer to said differential actuators without said main totalizer when said last mentioned key is depressed alone.

78. In a multiple totalizer of the type in which the counting wheels are arranged in laterally undisplaceable groups; each group comprising a single order of all the totalizers; the combination with each of said groups, except in the highest order, of a common laterally undisplaceable stop and trans-
 125 130

fer member; means for rotating selected counting wheels in one direction for adding and in the reverse direction for total taking; a tens transfer tooth on each counting wheel
5 adapted to strike the stop and transfer member of the corresponding group; means to limit rotation of said stop and transfer members in one direction to cause the arrest of tens transfer teeth striking the same in total
10 taking operations; said stop and transfer members being adapted to tilt upon being struck by a tens transfer tooth in adding operations; and transfer mechanism controlled by said stop and transfer members.

15 79. In a totalizing mechanism adapted for addition and subtraction, means for materially embodying the sign of the total contained in said totalizing mechanism comprising a member adapted to be adjusted in different
20 positions corresponding respectively to positive and negative totals, driving means for imparting movements of adjustment to said member, control means for said driving means in the highest order of the totalizing
25 mechanism adapted to initiate a driving movement of said driving means only upon a passage of said totalizer from a positive to a negative balance, or vice versa.

30 The foregoing signed at Cologne, Germany, this 4th day of February 1925.

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fer member; means for rotating selected counting wheels in one direction for adding and in the reverse direction for total taking; a tens transfer tooth on each counting wheel adapted to strike the stop and transfer member of the corresponding group; means to limit rotation of said stop and transfer members in one direction to cause the arrest of tens transfer teeth striking the same in total taking operations; said stop and transfer members being adapted to tilt upon being struck by a tens transfer tooth in adding operations; and transfer mechanism controlled by said stop and transfer members.

79. In a totalizing mechanism adapted for addition and subtraction, means for materially embodying the sign of the total contained in said totalizing mechanism comprising a member adapted to be adjusted in different positions corresponding respectively to positive and negative totals, driving means for imparting movements of adjustment to said member, control means for said driving means in the highest order of the totalizing mechanism adapted to initiate a driving movement of said driving means only upon a passage of said totalizer from a positive to a negative balance, or vice versa.

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DISCLAIMER

1,896,936.—Bruno Bornkessel, Ernst Breitling, Wilhelm Brauer, and Karl August Lehmann, Essen, Germany. BOOKKEEPING MACHINE. Patent dated February 7, 1933. Disclaimer filed January 21, 1937, by the assignee, The National Cash Register Company.

Hereby enters this disclaimer to claim 58 in said specification.
[Official Gazette February 23, 1937.]

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