

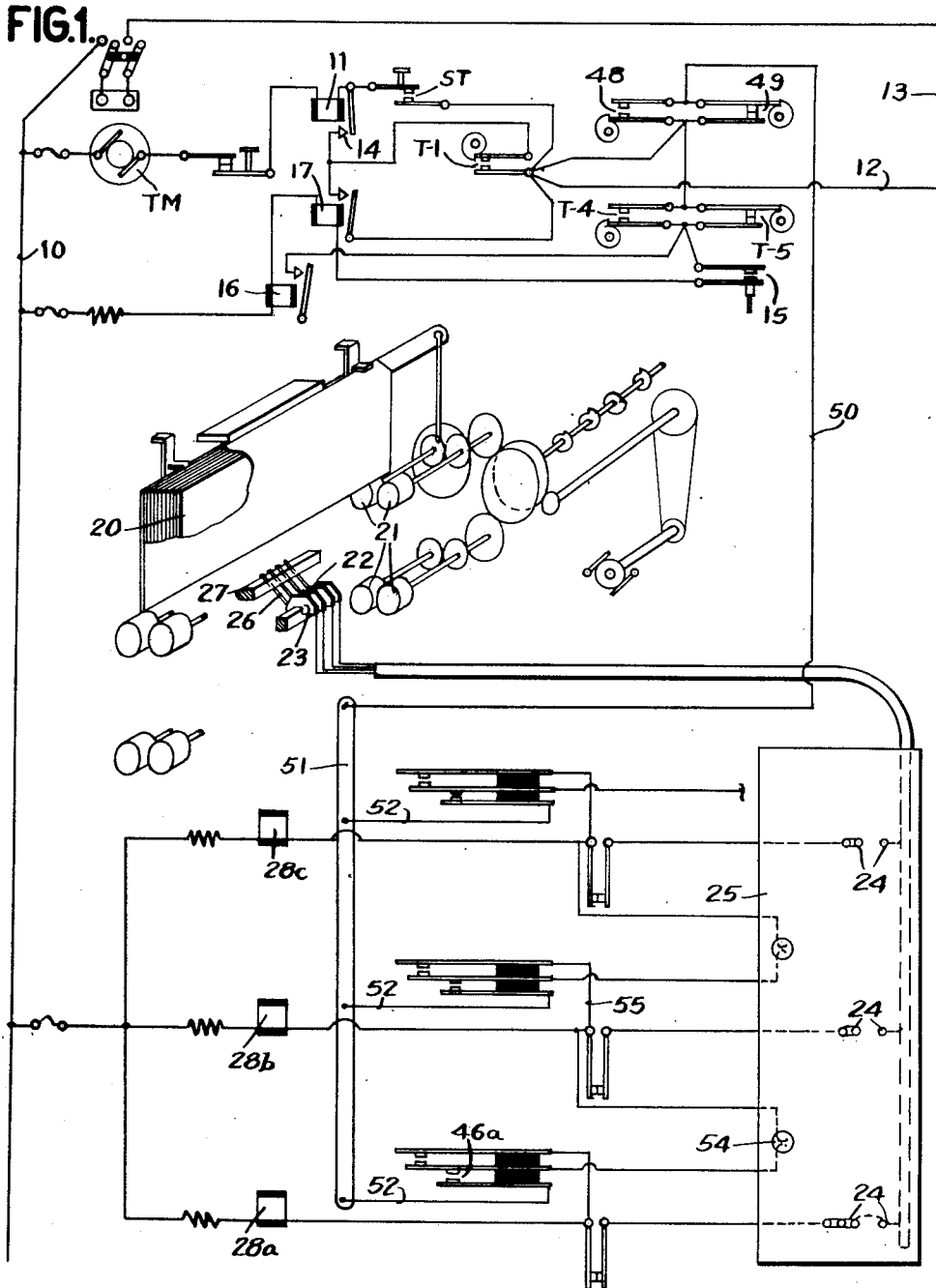
Sept. 12, 1933.

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1,926,893

ELECTRIC TRANSFER FOR TABULATING MACHINES

Original Filed Aug. 5, 1927 3 Sheets-Sheet 1



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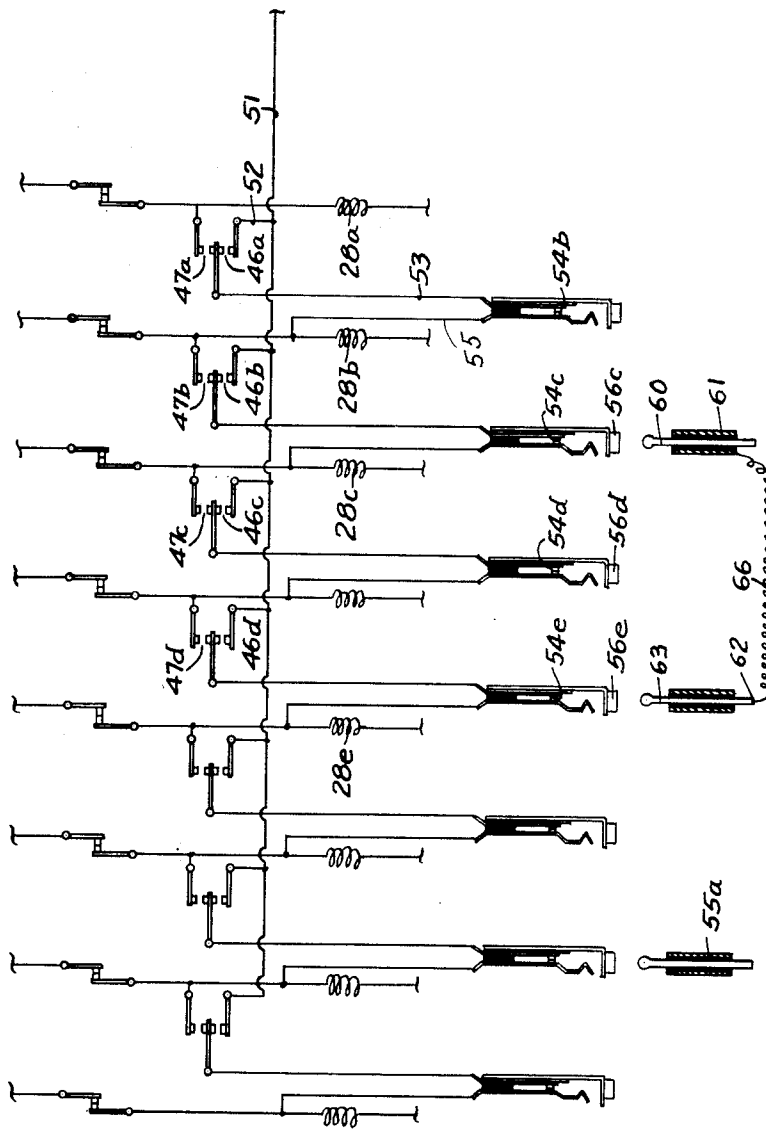
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FIG. 2.



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FIG. 4.

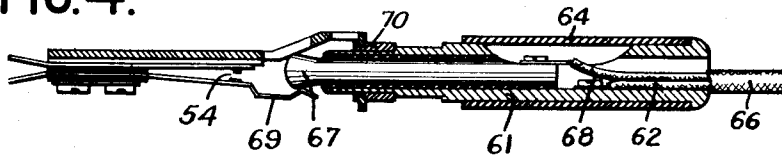
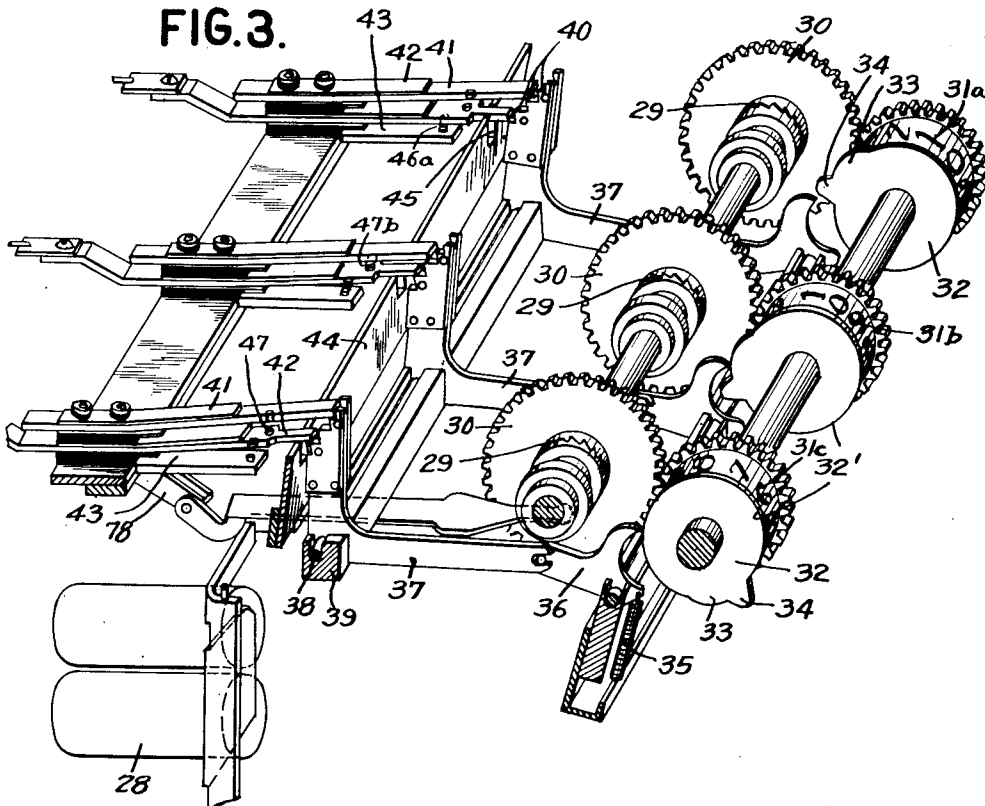


FIG. 3.



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## UNITED STATES PATENT OFFICE

1,926,893

## ELECTRIC TRANSFER FOR TABULATING MACHINES

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Original application August 5, 1927, Serial No. 210,769. Divided and this application November 12, 1930. Serial No. 495,080

5 Claims. (Cl. 235—133)

The invention relates to improvements in accounting machines and is particularly concerned with an improvement in the method of associating denominational order elements together to form accumulating banks which may consist of any desired elements regardless of their physical and structural arrangement in the machine. The invention further concerns mechanism for adapting such banks after they have been formed to adding operations.

The several denominational order elements of an accumulating bank in accounting machines are ordinarily provided with a fixed transfer system which provides for transferring in order from each unit to a physically adjacent one. That is, the tens and hundreds units elements, etc., for the bank are fixed at the time the machine is built and the order cannot be varied without redesigning the machine. In my copending application, Serial No. 721,504, filed June 21, 1924, now Patent 1,723,499 there is disclosed a method of associating any different elements together to form banks by forming each element as a unit including transfer transmitting mechanism and transfer receiving mechanism which is electrically controlled and which transmitting and receiving mechanism can be plugged from each unit to any other unit thereby providing for universal flexibility of operation of the machine. This differs from the prior practice in that each element is separate and requires plugging to form a bank.

The principal object of the present invention is to devise a system which shall partake of the advantages of both systems. That is, the several elements are associated together for transfer in a definite order and in effect form an accumulating bank always ready for operation as was the case in the prior form of practice. In the present case, however, the transfer transmitting mechanism and the transfer receiving mechanism of each element while normally connected, is arranged so that a simple operation will simultaneously not only interrupt the normal transfer operation but also associate any desired units together.

The preferred method of accomplishing this is to use an electric transfer system in which the transmitting mechanism of each unit is connected to the receiving mechanism of an adjacent unit by spring contacts normally in contact but adapted to be readily separated by inserting a plug between them.

By the use of a suitable jack, a single operation will not only interrupt the normal transfer

sequence of the units but will connect any unit to any other desired unit for transfer.

This application constitutes a divisional application of Serial No. 210,769, filed August 5, 1927 (now Patent No. 1,882,764, dated October 18, 1932), to which reference may be had for details of construction of other inventions not directly concerned herein.

The general objects then reside in new and improved means for reforming a normally operative accumulator bank into other banks, each of which may consist of any desired elements and to provide for adapting these reformed banks for adding operations.

Other objects and advantages will be herein-after pointed out in the following description which should be read in connection with the accompanying drawings which show by way of example a preferred embodiment of the invention.

In the drawings:

Fig. 1 is a circuit diagram of a tabulating machine embodying the invention;

Fig. 2 is a circuit diagram showing the machine adapted for various transferring operations.

Fig. 3 shows in perspective the main elements of the accumulator with the associated transfer controlling devices;

Fig. 4 shows a longitudinal section of jack and plug.

The circuit diagram shown in Fig. 1 is a conventional one which has been selected to illustrate the invention in connection with a tabulator. The operation of substantially the same circuit is fully described in the patent to C. D. Lake, No. 1,307,740, and will be very briefly summarized.

The motor TM which drives the card and tabulating mechanisms may be started by depressing the start key ST whereupon a circuit is established from the left line 10 through relay 11, the start key contacts, and line 12 to right line 13. Energization of relay 11 closes contacts 14 to establish a shunt circuit around the start key through cam contacts T—1, timed to open once each cycle. When cards are feeding, they close the usual card lever contacts 15 and thereby establish a circuit extending through relay 16, motor control relay 17, the card lever contacts, and cam contacts T—4 and T—5 which are timed to close the circuit during the passage of the data bearing portion of the card and open it at other times. The cam contacts T—4 and T—5 are both closed during the portions of the machine cycle when cam contacts T—1 are opened. The motor control relay when energized closes a shunt circuit around the cam contacts T—1 so

that as long as cards are feeding, the motor remains in operation regardless of the periodic openings of cam contacts T—1. After the last card is fed, the card lever contacts open, de-energizing relay 17 and opening the shunt circuit around contacts T—1 which are opened near the end of the cycle, opening the TM motor operating circuit, and causing the motor to stop.

When the TM motor is in operation, and cards are in the magazine, a card 20 is fed by feed rolls 21 through well-known analyzing devices 22, the lower contacts 23 of which are individually connected to plug sockets 24 on the plug board 25. The analyzing brushes 26 have a common contact bar 27 which is ultimately connected to the right supply line. When the brushes encounter a perforation in the card, a circuit is completed through the counter magnet at a time depending on the position of the perforation in the card column, so that the counter controlled by the magnet will be actuated an amount corresponding to the position of the perforation on the card in a manner well-known in the tabulating art as for example shown and described, in the patents to C. D. Lake, No. 1,307,740 and No. 1,372,965.

In brief, the contact of the analyzing brushes results in energizing the counter magnet 28 (one of which is shown in perspective in Fig. 3) corresponding to the column in which the perforation occurs. The energized magnet attracts its armature and permits engagement of the constantly rotating clutch 29 with the gear 30 which drives the counter wheel 31. Similarly the occurrence of a perforation in any column causes the actuation of the counter wheel 31 corresponding to said column.

Each counter wheel is provided with a cam 32 having two raised parts 33 and 34 of different heights. Held in engagement with cams 32 by springs 35 are pawls 36, pivoted to the horizontal arms of the right angled plates 37 which are pivoted at 38 on a frame member 39. The forward top edge of each plate 37 carries a series of steps 40. When pawl 36 is on the 1—8 portion 32' of the cam 32, which occurs when the counter wheel reads 1 to 8, a contact blade 41 rests on the uppermost step, a second contact blade 42 rests on the third step, and a third fixed contact blade 43 is beneath the second blade and out of engagement therewith. A bail 44 during the adding portion of the cycle is in an elevated position and while the accumulating wheel is in the 1—8 positions with its corresponding contact blades retained on the first and third steps 40, the upper edge of the bail is located above the second plate, the end of which is then positioned within a slot 45 of the bail, the slot being too narrow however to permit entrance of the first contact blade. When the counting wheel during the adding cycle has a 9 at the reading position, the lower cam portion 33 engages the end of pawl 36, depressing its other end and rocking plate 37 clockwise with the result that the vertical arm of plate 37 is moved a step to the right so that the upper contact blade leaves the upper step and drops onto the upper edge of the bail (as shown in Fig. 5 of the drawings of the Patent #1,882,764) which keeps it out of contact with the second contact blade resting on the third step in normal position.

When the counting wheel moves from the 9 to the 0 position, the pawl 36 is depressed still further by passage of cam part 34, moving the plate 37 and steps 40 another step to the right as a result of which the second contact blade moves off the third step 40 and drops to the bottom of

the ball slot 45 by which it is held out of contact with the fixed contact blade 43 by the bail 44 which is in its upper position at the time. This position is indicated in Fig. 6 of the Patent 1,882,764.

Assuming the counter wheels are connected for column to column transfer, after the adding portion of the cycle, the transfer is effected from wheel to wheel by the lowering of the bail 44 by means described in Patent No. 1,372,965, above referred to. Prior to the transfer operation those accumulators which read 9 will have their corresponding upper contact blades resting on the upper edge of the bail and free of the steps 40 on which they normally rest as described above. As the bail is lowered during the transfer, the upper contact blade moving with it contacts with the second contact blade (as indicated in Fig. 7 of the Patent 1,882,764) closing upper contacts 47 and coming to rest on the second step 40. Those wheels which passed from the 9 to the 0 position before the transfer operation will have their corresponding second contact blade resting on the bottom of the ball slot and free of the third step on which it normally rests as hitherto explained. When the bail lowers, the second contact also lowers and contacts with the fixed contact blade 43, closing lower contacts 46 (as shown in Fig. 8 of the Patent 1,882,764). The first contact blade which had previously been released from the first step as the wheel reached the 9 position will also lower but being prevented from lowering still farther by the second step, it will not engage the second contact blade which is now below its normal position and in contact with the fixed blade. Those counting wheels which are at the 1—8 positions have their corresponding contact blades resting in the 1st and 3rd step and lowering of the bail has no effect thereon.

To illustrate the transfer operation, assume the wheels to read 699 during the early part of the adding cycle and that later in the adding cycle one is added to the units wheel, the counter then reading 690 before the transfer operation is completed, as shown in Fig. 3, where 31a is the units wheel, 31b the tens wheel, and 31c, the hundreds wheel. The appended letters a, b, c, etc. will hereinafter respectively indicate units, tens, hundreds elements, etc. The lower contacts 46a (Fig. 2) of the units wheel are in position to make and the upper contacts 47b of the tens wheel are likewise in readiness to make while the hundreds wheel contacts are open. After the adding cycle, as the transfer operation occurs, the bail 44 lowers, permitting closing of contacts 46a and 47b. At this point, the transfer contacts 48, 49 (Fig. 1) close, permitting an impulse to be sent through line 50 to bus bar 51, through line 52, contacts 46a, now closed, line 53, normally closed jack contacts 54b of the tens accumulator unit, and the tens counter magnet 28b, resulting in the addition of one of the tens wheel which now reads 0. At the same time, the transfer impulse from jack contacts 54b goes through line 55, tens contacts 47b, now closed, jack contacts 54c and magnet 28c of the hundreds wheel resulting in the addition of one to the latter wheel which now reads 7. Contacts 46c and 47c being open, the transfer impulse will be transmitted no further, the wheels now reading 700 and the transfer being completed.

It is sometimes desired to tabulate a plurality of different classifications, the number of which is in excess of the number of counter banks in the ma-

chine. Assume that each of two of these classifications require only four denominational orders to complete an entire tabulation. In such a case, an eight column counter bank by being split in two will provide two four column counters, each sufficient for a classification. In order to split the counter, the plug 55a (Fig. 2) having no external connections is inserted into the jack 56e corresponding to the fifth column thereby opening the jack contacts 54e, and breaking the transfer connection from the fourth column to the fifth column, which otherwise would be made from contacts 46 or 47d to the fifth column counter magnet 28e through the jack contacts 54e.

This machine is also adapted to separate a number into groups of digits when listing it to facilitate its inspection in relation to monetary denominations or the like. For example 3794 may be separated to read 37 94, to print \$37.94. In order to do this, a column is skipped between the second and third digits, the fourth and fifth columns and their corresponding accumulating mechanisms now being used respectively in conjunction with the third and fourth denominational orders of digits on the tabulating card. To skip the third column counting mechanism, 28c etc., a pair of plugs 60 and 63, connected by a wire 66, are inserted respectively into the third and fourth counter wheel jacks 56c and 56d. As shown in detail in Fig. 4 each plug comprises an outer sleeve 64 of insulating material, an inner sleeve 61 of conducting material to which is attached aforementioned wire 66 for connection at 68 to the conducting post 67 seated within the sleeve 61 of the coupled jack plug. When the plug is inserted in a jack, the normally closed contacts 54 are opened and jack contact blade 69 engages post 67 while jack contact sleeve 70 engages the sleeve 61. Thus in Fig. 2 when the plugs are inserted as described, contacts 54c will be opened cutting out magnet 28c so that a transfer impulse coming through either contacts 46b or 47b of the second counter wheel will pass from jack sleeve 70c of the third counter wheel, plug sleeve 61, wire 66, plug post 63 of the coupled jack plug to jack spring contact blade 69 of the opened jack contacts 54d, from which it passes to counter magnet 28d, thus transferring directly from column b to column d and skipping column c. In a similar manner, any selected column or columns may be skipped.

While I have shown and described and pointed out the fundamental novel features of the invention as applied to a single modification it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. I in-

tend to be limited therefore only as indicated by the scope of the following claims.

I claim:

1. A transfer control device for an accumulating apparatus involving a plurality of orders of accumulating elements, a pair of closed transfer connections between each pair of adjacent elements and means for opening the transfer connections between a plurality of pairs of adjacent elements, said means having provisions for connecting an element of lower order for a transfer to an element which is non-adjacent and of higher order.

2. A transfer control device for an accumulator involving a plurality of orders of accumulating elements, a plurality of jacks, each having a pair of normally closed transfer connections between adjacent elements, and insertible means for breaking the connections between pairs of connections to suppress a transfer between pairs of adjacent elements and by means of the transfer connections effect a transfer from a lower order element to a higher order but non-adjacent element.

3. A transfer control device for an accumulating apparatus involving a plurality of orders of accumulating elements, a plurality of jacks each having normally closed contacts to effect closed transfer connections between adjacent elements, and a pair of electrically connected plugs insertible in selected jacks, each plug having provisions for opening the transfer connections between adjacent elements.

4. A transfer control device for an accumulating apparatus involving a plurality of orders of accumulating elements, a plurality of jacks each having normally closed contacts to effect closed transfer connections between adjacent elements, a pair of plugs each insertible in a selected jack to break the transfer connections between adjacent elements, said plugs having connections to effect a transfer between an element of lower order to an element of higher but non-adjacent order.

5. A transfer control device for an accumulating apparatus involving a plurality of orders of accumulating elements, comprising a plurality of normally closed transfer connections between said elements, and an insertible means having provisions for breaking the connections between adjacent elements to suppress the transfer between said elements, said insertible means having provisions for associating for a transfer operation one of the adjacent elements with an element of higher order which differs from the element in which the transfer has been suppressed.

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