

Oct. 4, 1932.

G. F. DALY ET AL

1,880,422

ELECTRIC TRANSFER MECHANISM

Filed Sept. 2, 1927

7 Sheets-Sheet 1

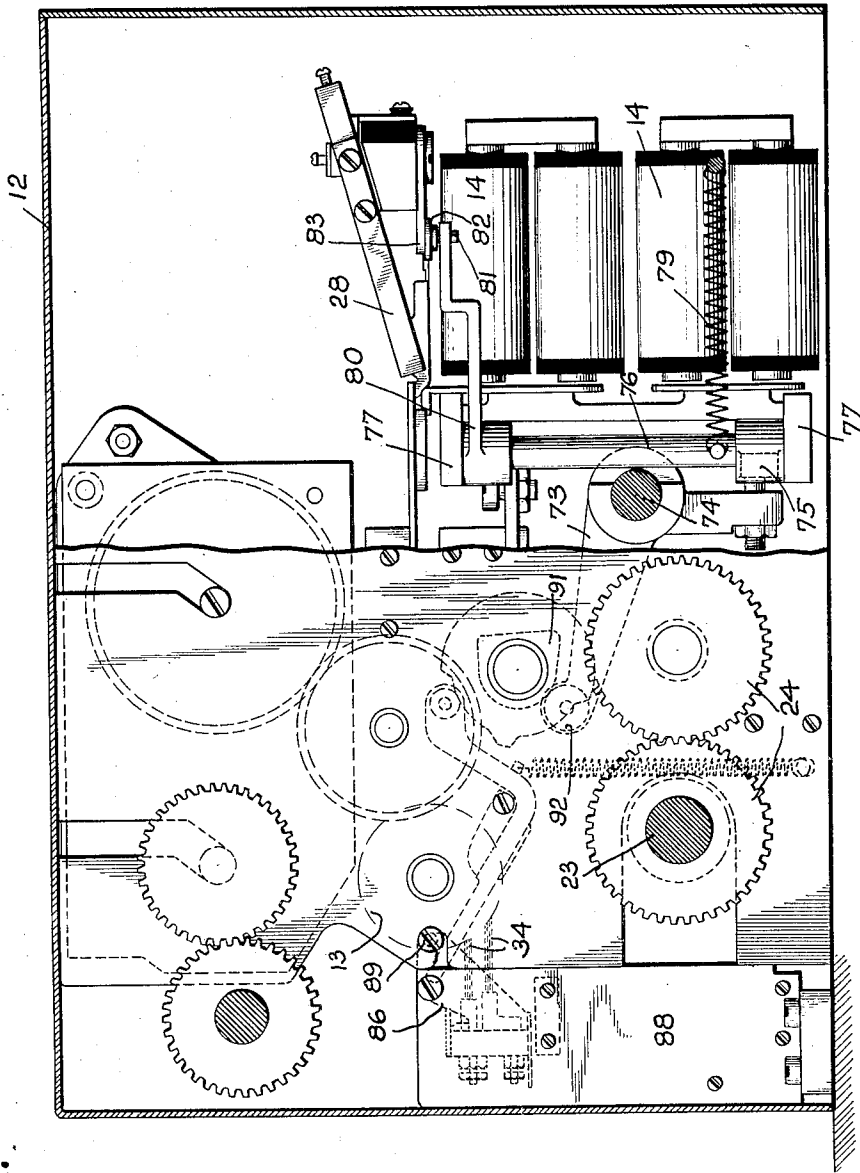


Fig. 1.

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7 Sheets-Sheet 2

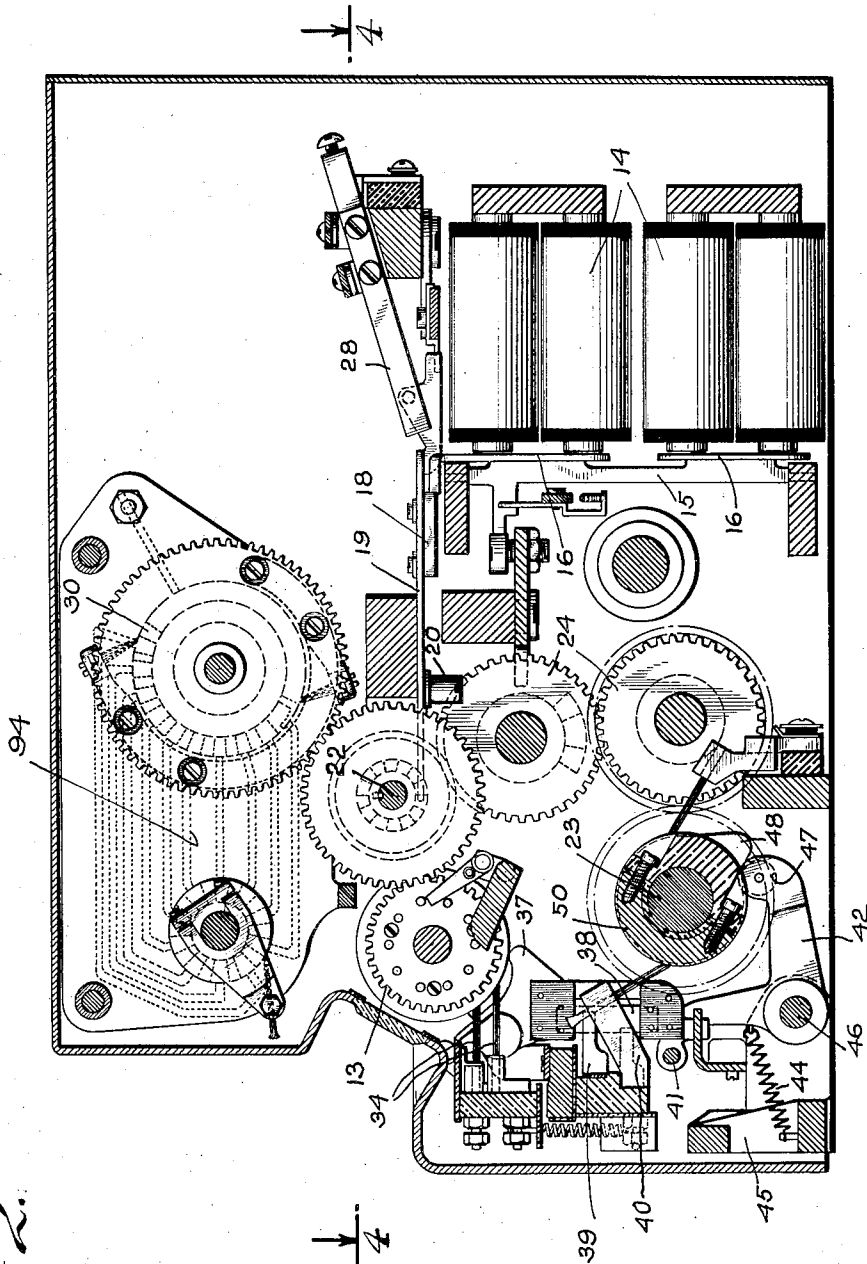


Fig. 2.

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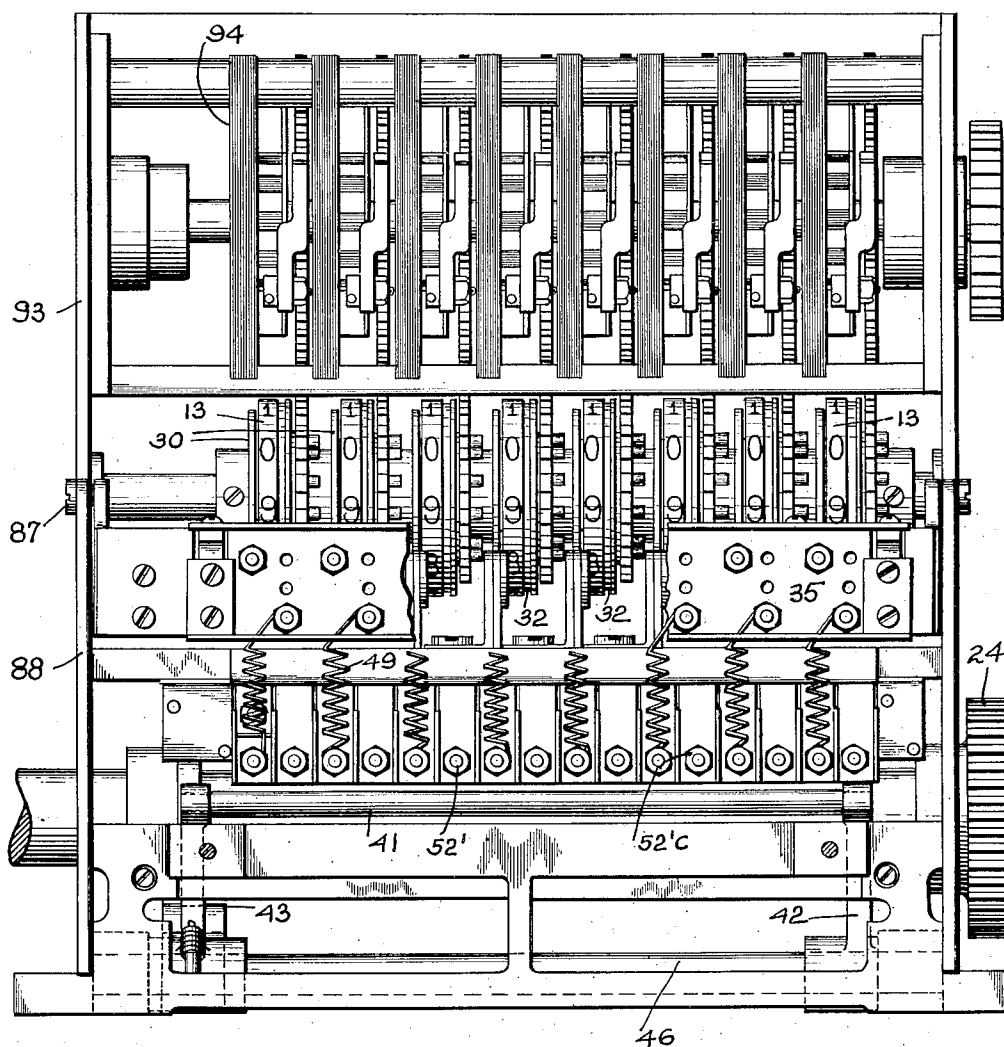
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Fig. 3.



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ELECTRIC TRANSFER MECHANISM

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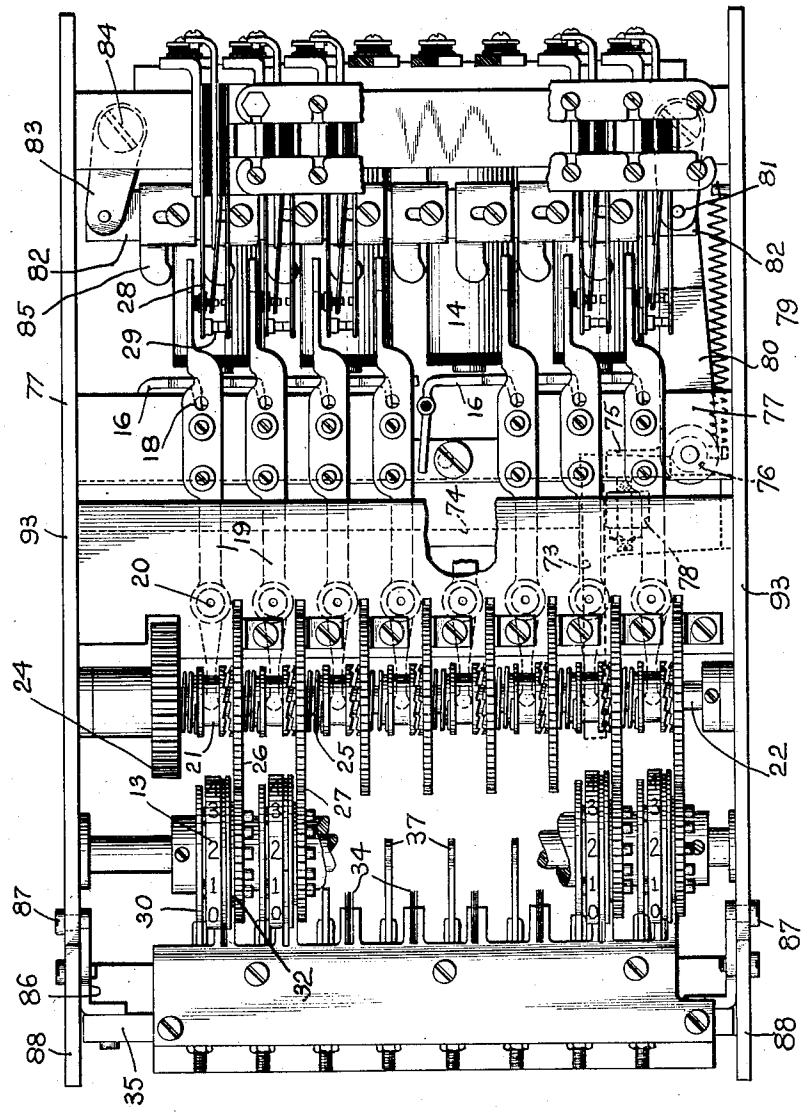


Fig. 4.

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Fig. 5.

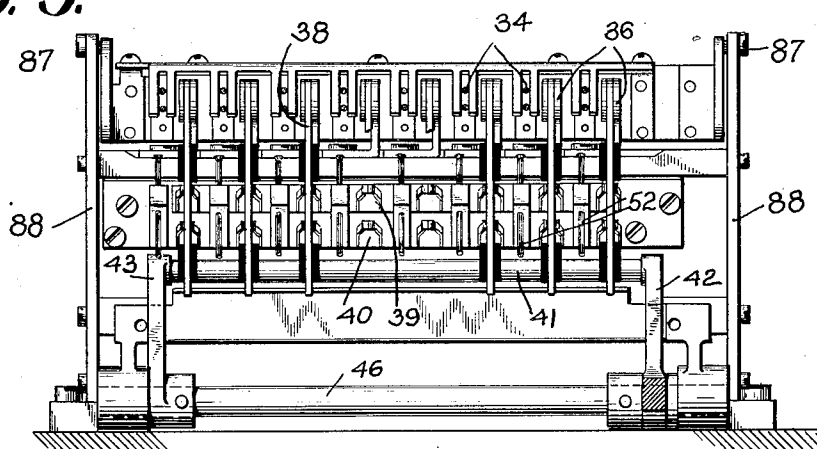
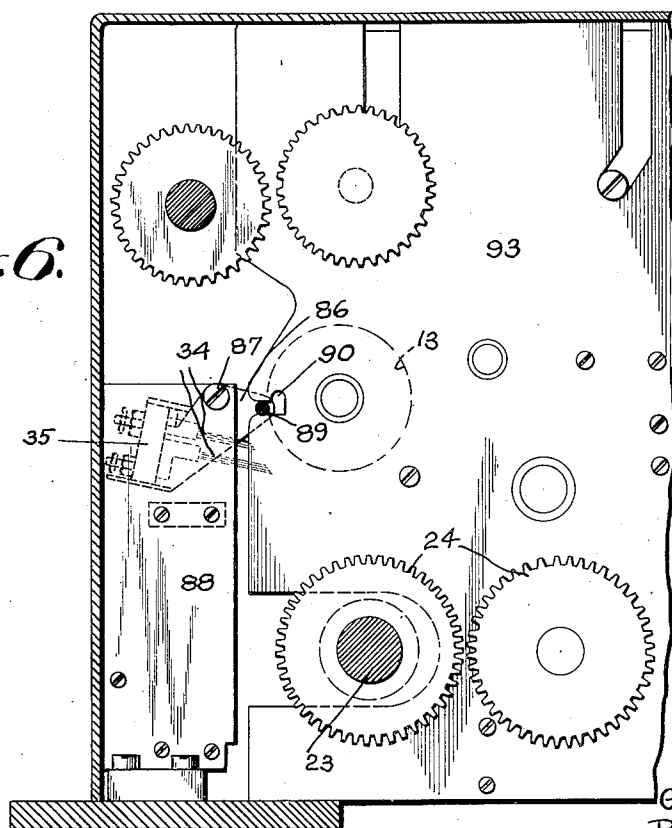


Fig. 6.



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Fig. 8.

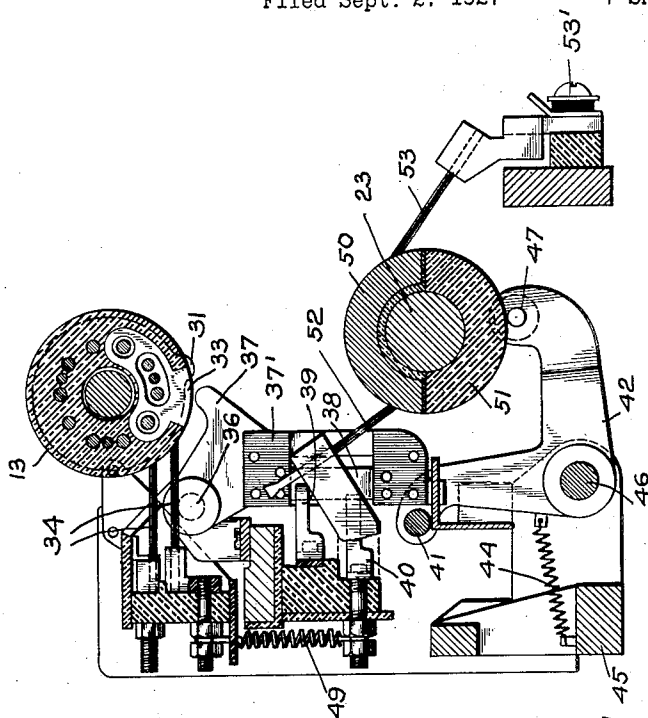
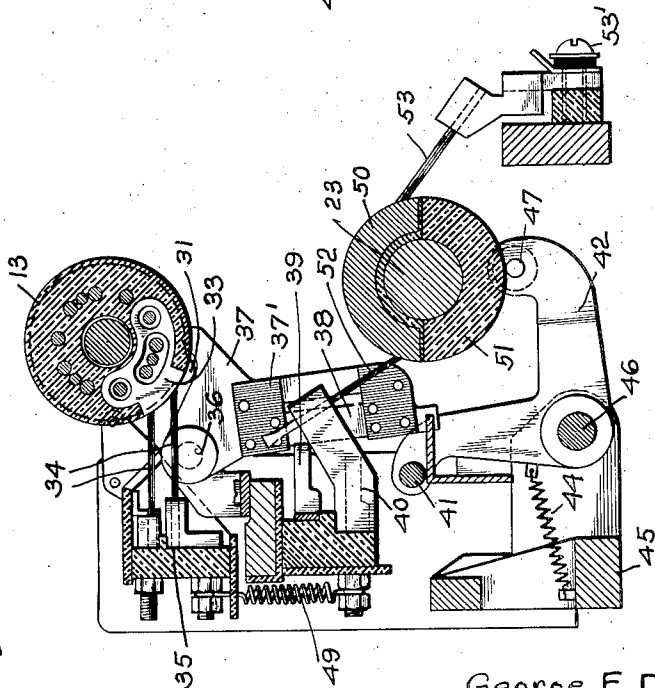


Fig. 7.



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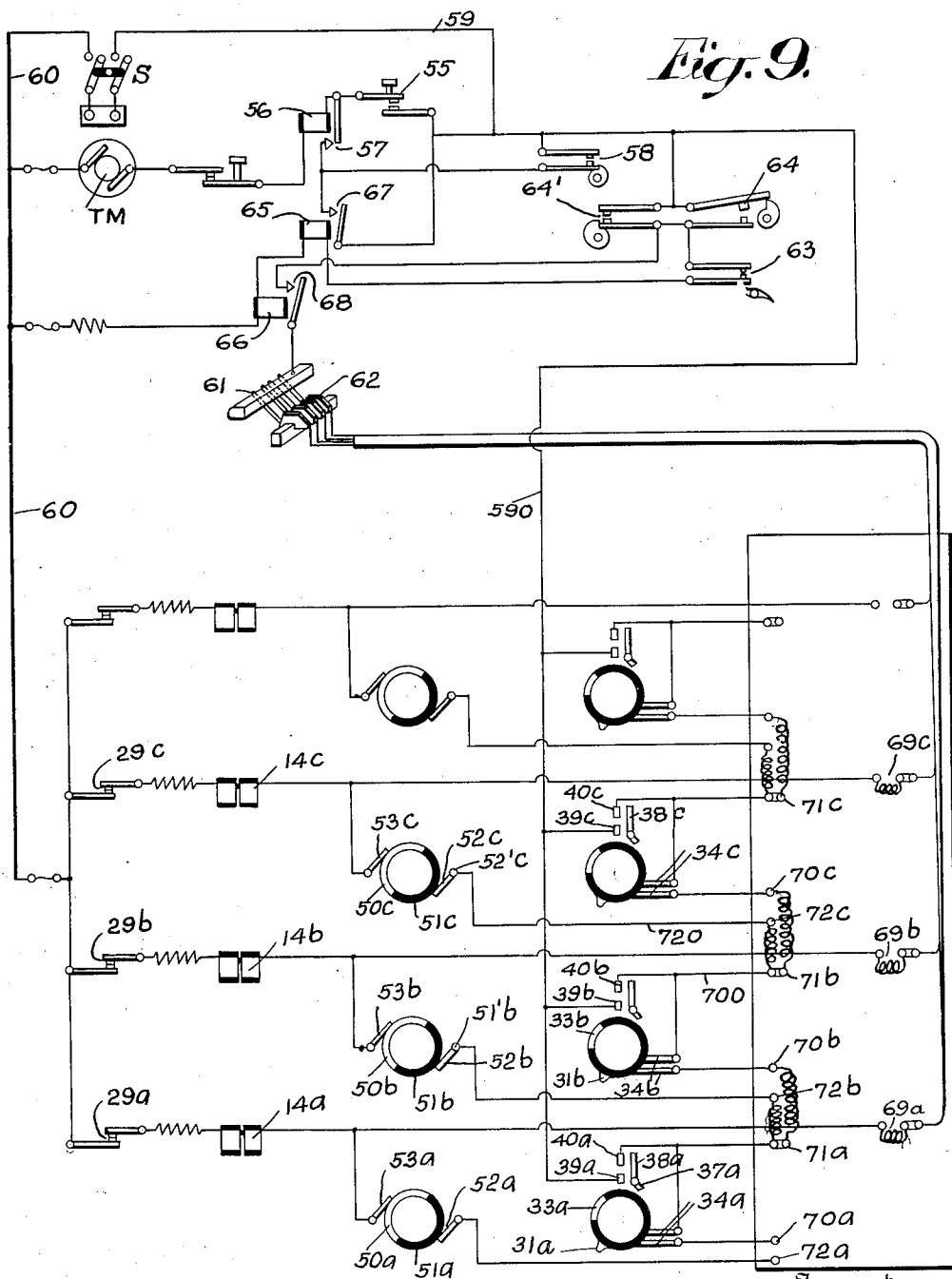
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ELECTRIC TRANSFER MECHANISM

Filed Sept. 2, 1927

7 Sheets-Sheet 7



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UNITED STATES PATENT OFFICE

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ELECTRIC TRANSFER MECHANISM

Application filed September 2, 1927. Serial No. 217,076.

The invention concerns an electrical transfer mechanism of the general type disclosed in the U. S. patent to Lake No. 1,372,865, March 29, 1921, and has for its principal object to provide for more positive operation of the contacting devices and to provide a simplified and more rugged construction of the mechanical parts.

Another object of the invention is to provide for improved construction and operation of electrical transfer mechanism to the end that all contacts may be made positive in their operation, eliminating the use of springs for either opening or closing them.

Another object of the invention is to provide a more compact arrangement of the transfer mechanism incidentally facilitating access to the several parts for the purpose of adjustment, repair or replacement.

Another object of the invention is to provide separate contact mechanism for transferring when a counter element passes through zero as a result of an amount entering operation and for transferring when a counter element passes through zero as a result of a transferring operation.

Still another object of the invention is to provide for the use of commutator devices in the transfer mechanism in place of the cam controlled and spring contacts heretofore used to the end that adjustments are made simpler, replacements and repairs easier and the mechanical structure substantially more rugged.

The Lake electrical transfer system, above referred to, and which may be considered as typical of the development of the art to the present, provides a set of three spring contacts for each counter element. One of these contacts is common to the other two and through its own resiliency engages one when the associated counter element stands in its nine position at the end of an adding cycle and engages the other at the end of an adding cycle whenever the counter element has passed through its zero position during the cycle. An electrical impulse is applied to one of the contacts after the adding portion of the cycle. If any counter element has passed through zero during the cycle this

impulse will be passed through the proper closed contacts to the counter magnet of the next higher denominational order element to enter one unit on this element. Any element which stands at nine at the end of a cycle will pass the impulse to the next higher unit only in the event that the next lower unit has passed through its zero position during the same cycle. This is effected by wiring the contacts which close in the nine position of each element in series with each other and also in series with the contacts of the next lower denominational order which close in response to the passing of the element through its zero position. All transfer operations necessary are thus effected by a combination of series and multiple circuits automatically prepared during the adding cycle and energized instantaneously after the adding portion of the cycle.

The present invention contemplates substantially the same arrangement of parallel and series circuits for effecting the complete transfer operation at the end of an adding cycle. In its preferred form, however, the set of three contacts which govern transferring operations resulting both from amount entering operations and other transferring operations, are replaced by separate contact devices for the two sorts of transfer. That is, one contact device controls transfer when an element passes through its zero position and an entirely separate contact device controls transfer when the element stands in its nine position and receives a transferred unit. Each of these contact devices is designed to open and close when necessary independently of any inherent resiliency or of any springs. The preferred form of contact device for closure when the element stands at nine comprises a commutator fast or geared to the element and coacting with brush mechanism to close a break in a control circuit when the element reaches its nine position. The preferred form of contact device which closes when the element passes through zero consists of a knife switch which is positively moved to circuit closing position by means of a cam associated with the element and positively moved to circuit opening position by a

cam operated bail. The contact device for applying the operating impulse consists of a commutator with coacting brushes which are bridged at the proper point in each machine cycle. Thus the entire transfer mechanism is positive in its operation and rugged in construction.

The invention may be understood from the following detailed description which should be read in connection with the accompanying drawings in which:

Fig. 1 is a side elevation of the counter.

Fig. 2 is a side section of the counter.

Fig. 3 is a front elevation of the counter with the front of the casing removed and parts broken away to show the interior.

Fig. 4 is a plan section taken on line 4—4 of Fig. 2.

Fig. 5 is an elevation looking from the right of Figs. 7 and 8 with certain parts removed to more clearly show others.

Fig. 6 is a partial elevation showing the counter in the process of removal from the main frame.

Figs. 7 and 8 are detail views of the transfer elements.

Fig. 9 is a wiring diagram of the system showing the transfer and adding circuits.

It will be understood that the improvement is applicable to any machine wherein a transfer must be effected from one accumulator or counter element to another and the machine described herein in connection with the improvement is merely selected as an example.

The machine shown herein has the same general structure as that shown and described in the patents to C. D. Lake, Nos. 1,307,740 and 1,534,531 with those changes however, made necessary by the substitution of the transfer mechanism which constitutes the present invention for the transfer mechanism of the patented machines.

Referring to Figs. 1 and 3, contained in a casing 12 is a series or bank of like accumulating, registering or number bearing wheels 13 (Fig. 3) each with ten digit space characters or type and adapted to be singly, successively or simultaneously turned by any suitable means to add columns of figures. Assuming the right hand accumulating wheel (Fig. 3) to represent units, the next tens and so on, whenever the wheel of one denominational order has been turned through a complete revolution or ten digit spaces, a carrying or transfer operation must be effected to advance the wheel of the next higher order one character or digit space. With the structural details of the machine in other respects than that related to the accumulating mechanism, this application is not concerned and these will be described only so far as may be necessary for a complete understanding of the invention now under consideration.

There is a controlling magnet 14 for each

register wheel 13 and the magnets are arranged in two horizontal rows staggered in position. Coacting with each magnet is a vertical rod 15 (Figs. 2, 3 and 4) pivoted on the frame and carrying an armature 16 facing the magnet pole. An extension on this pivoted armature structure engages a stop 18 at the outer end of a clutch lever 19 pivoted on a pin 20. The other end of the clutch lever is splined to clutch collar 21 rotatable with a shaft 22 constantly driven by the tabulating drive shaft 23 through a train of gearing 24. Upon energization of magnet 14, armature 16 is attracted and oscillates on the frame so that the extension disengages the stop 18 on the clutch lever. The latter being unlatched, permits coil spring 25 to move the clutch collar teeth into mesh with coacting teeth on a gear 26 freely rotatable on shaft 22, whereupon gear 26 starts to rotate and through a gear 27 on the counter wheel turns the counter wheel on its shaft. The upper end of the clutch levers when latched engage flat springs 28 which constitute one member of contacts 29. When unlatched, the clutch levers permit the springs 28 to move outwards opening contacts 29, the purpose of which will be hereinafter brought out in connection with the explanation of the circuit diagram.

As in the above referred to patents, the magnets 14 are energized at a point in the cycle proportional to the value of the designation on the ordinary Hollerith card. The designations are usually in the form of perforations variously located from a given datum line in fixed index positions. The value of a perforation is fixed by its index position. As the card feeds past the usual analyzing brushes, the positions successively reach the brushes at correspondingly successive points of the cycle. When a perforation encounters the brushes, the latter contact therethrough and complete a circuit energizing magnet 14 at a time proportional to the value of the perforation. The energization of the magnet effects rotation in the manner described, of the corresponding counter wheel which turns an amount corresponding to the value of the perforation. For example, if a 9 perforation be sensed by the brushes, the wheel will rotate through 9 digit spaces. If the wheel initially reads 0 after rotation through 9 digit spaces it will read 9. However, if the wheel initially reads 2, after rotation through 9 digit spaces, it will read 1 and hence a transfer must be effected to the counter wheel of the next higher denominational order to turn the latter one digit space. The following description relates to the improvement in the means for effecting such transfer.

Referring to Figs. 3, 7 and 8 each register wheel 13 has secured to it what may be termed an adding wheel cam 30 which has one raised part 31. Around the periphery of the register wheel, which is of insulated ma-

terial, and on the right hand edge of said wheel as viewed in Fig. 3 is an annular groove 32. Set into the body of said register wheel is a piece of conducting material 33 so located that a portion of this conducting material is bared along the bottom of the aforesaid groove. Wiping on the bottom of the annular groove 32 are two contact brushes 34 fastened to the frame 35 and insulated therefrom.

Pivoted at 36 is a member 37 to one end of which is fastened an insulating plate 37' which in turn carries a knife blade 38 adapted to cooperate with a pair of split blades 39 and 40, said blades constituting a single knife switch. The upper edge of blade 38 normally rests on the split blade 39 as shown in Fig. 7, thus holding the opposite end of member 37 adjacent to the periphery of the adding wheel cam 30.

When the number 9 on a registering wheel is at the indicating line, brushes 34 are both making contact with the conductive insert 33 as shown in Fig. 7. When the register wheel advances one additional space, passing from the 9 to the 0 position, the projection 33 on the adding cam 30 strikes the nose of member 37 rotating the latter and the blade 38 carried thereby in a clockwise direction about pivot 36. Thereupon, said knife blade enters both split blades 39 and 40 taking the position shown in Fig. 8 which position it retains until completion of the transfer operation.

After the transfer operation, the blade 38 is restored to its normal position shown in Fig. 7 by the following means: a rod 41 is rigidly attached to one arm of a bell crank 42 at the right side of the frame (Fig. 5) and to a similar arm 43 at the left side of the frame. The bell crank 42 and the arm 43 are rigidly fastened to the shaft 46 journaled at its ends in the frame of the machine. The free arm of the bell crank carries a roller 47 yieldingly urged by spring 44 attached to frame 45 into engagement with cam 48 (Fig. 2) fixed to the drive shaft 23. This cam is timed to rotate the bell crank 42 in a clockwise direction about its pivot axis 46 immediately after the transfer has been completed. This rotation moves the bail 41 to the right which causes said bail to carry with it those knife blades 38 which were at that time contacting with both split blades 39 and 40 as shown in Fig. 8 restoring said knife blades to their normal position as viewed in Fig. 7. The lower split blade 40 is electrically connected to the lower of the two brushes 34 by the wire 49.

A commutator (Figs. 7 and 8) comprising a sector 50 of conducting material and a sector 51 of insulating material is mounted on the main drive shaft 23, there being one such commutator for each card column. Two brushes 52 and 53 wipe on this commutator and are so spaced that both brushes are on

the conductive sector 50 simultaneously for only a short interval of the rotation of said commutator.

This commutator initiates the transfer impulse making one revolution each card cycle and is timed to close the circuit between the brushes 52 and 53 to initiate this impulse immediately after the adding cycle has been completed.

Fig. 9 shows a circuit diagram comprising a simple and well known type of motor control circuit together with the counter circuit. With the switch S closed the tabulating machine driving motor T. M. is started by depressing the start key 55 thus energizing the motor series relay magnet 56 at the same time starting said motor. Relay contacts 57 now being closed through the energization of magnet 56 throw a shunt circuit around start key 55 through cam contacts 58 now closed, thus establishing a holding circuit from supply line 59, through cam contact 58, relay contact 57, relay magnet 56, motor T. M. to supply line 60.

The motor having been started, cards are fed one at a time by means usual in Hollerith machines, between the analyzing brushes 61 and their coacting contacts 62 and in feeding close the card lever contacts 63. Immediately after the front edge of the card starts to traverse the brushes cam contact 64 closes completing a circuit from supply line 59 through cam contact 64, and lever contact 63, motor control magnet 65, counter control magnet 66 to supply line 60. Relay contacts 67 close upon energization of magnet 65, to establish a shunt field around start key 55 through relay contact 57 and its magnet 56 thus maintaining the holding circuit through relay 56 when cam contact 58 breaks just after cam contact 64 makes. The closing of relay contacts 68 upon energization of magnet 66 closes a current path from supply line 59 through cam contacts 64 and 64', relay contact 68 to brush 61 from which point it continues when the sensing brushes 61 strike a perforation in the card through the analyzing contacts 62 to plug sockets 69a, 69b, 69c, etc., through their respective counter magnets 14a, 14b, 14c, etc. depending on which card column or columns contained the perforation, through the contacts 29 to the supply line 60, thus completing the circuit. Energization of a counter magnet 14, as explained, effects movement of the clutch lever 18 to effect rotation of the counter wheel. This movement of the clutch lever, permits contacts 29 to open, as described, thus opening the circuit last referred to, before the analyzing contacts break, thereby avoiding sparking of said latter contacts. Letters, a, b, c, etc. appended to reference numbers designate, respectively, the units, tens, hundreds, etc. denominational order elements of a series of similar elements. To illustrate the

operation of the transfer circuits, let it be assumed that the number 699 at the beginning of a cycle appears at the indicating line of the counter wheels. When prepared for operation, a counter bank will have plug connections, leading from plug board sockets 70b to the terminal post of one of the brushes 34. From the other brush 34, connection is made to a wire 700 leading to plug board socket 71b which is connected to plug board socket 72c having a lead through wire 720 to brush 52c. A connection is also made from socket 71b to the socket 70c leading to one brush 34c of the hundreds order. Connections similar to those described are made for the remaining orders of elements. The counter magnet 14a being the units column of the counter, the posts 70a and 72a will not be connected since there will be no cause to transfer to this column from any other.

In the example given of number 699 on the counter at the beginning of a cycle, a 9 appears on the units wheel which as previously explained will cause the commutator segment 33a to be making contact with both the brushes 34a as indicated in Fig. 7. Likewise a 9 is indicated on the tens wheel so that commutator segment 33b is making contact with both brushes 34b. A 6 is indicated on the hundreds wheel and the commutator 33c will not yet have reached the brushes 34c so that said brushes will at this time be resting on the insulated portion of the commutator. Assume that during the adding cycle, a one is added to the units counter wheel, moving the latter from 9 to 0. As a result, conductor segment 33a moves out of engagement with brushes 34a and cam projection 31a strikes member 37a in passing thus forcing the knife blade 38a into contact with split blades 39a and 40a. As previously indicated, the transfer commutators 50-51 are so timed that the brushes 52 and 53 are both on the conductive segment 50 about the time the 12 position of the Hollerith card is passing the sensing brushes. At this time a circuit is established through supply line 59, line 590, split blade 39a, knife blade 38a, split blade 40a, plug socket 71a, commutator brush 52b, commutator segment 50b, brush 53b, counter magnet 14b, contact 29b to supply line 60, the contact on the commutator 50 being sufficiently long to cause the magnet 14b to move the tens counter one digit space moving it from 9 to 0. Coincident with this operation a circuit is established through the supply line 59, line 590, split contact 39a, knife blade 38a, split contact 40a, plug socket 71a, plug socket 70b, brushes 34b, conductively connected by segment 33b, plug socket 71b, commutator brush 52c, commutator 50c, commutator brush 53c, counter magnet 14c, contacts 29c to supply line 60 thus adding one to the hundreds counter column to turn it from 6 to 7. Neither brushes 34c or knife blade 38c being in trans-

fer position, the transfer operation is completed. After the transfer, bail 41 (Fig. 8) returns the knife blades 38 to their normally open positions as described and the card cycle is completed with the counter wheels now reading 700.

As pointed out, the clutch levers 19 are selectively unlatched by armatures 16 upon energization of the magnets 14 during the adding cycle. At the end of the adding cycle, the released clutch levers must be relatched by the armatures to thereby disengage clutch collars 21 from the counter wheel actuating gears 26, and thus stop rotation of the counter wheels. During the transfer operation, the clutch levers are again selectively unlatched and these latter clutch levers must be relatched again after the corresponding counter wheels have been rotated one digit space by the transfer operation. Thus, the relatching operation is effected twice during a card cycle by the following mechanism:

Referring to Fig. 1, coacting with the cam 91, rotated once per card cycle from the main shaft, is a follower 92 mounted on one arm of a bell crank 73, Fig. 4, pivotally mounted on shaft 74. Cam 91 has two projections designed to give said bell crank 73 two thrusts each card cycle, one after the adding operation and one after the transfer operation, to move said bell crank in a counterclockwise direction. The other arm 78 of the bell crank bears against an extension 75 fixed at an angle to the shaft 76 rotatably journaled in the frame 77. At the opposite end of the aforementioned shaft 76 is fixed an arm 80 pivoted by means of pin 81 to one end of a flat bar 82, (see Figs. 1 and 4), extending the width of the counter. Pivotally connected to each end of bar 82 are similar links 83 which are swingably mounted on the frame on studs 84. A plurality of similar members 85 adjustably mounted on bar 82 are provided with projections adjacent the free ends of the clutch levers 19, as shown in Fig. 4, there being a member 85 for each clutch lever. When cam 91 rocks the bell crank 73 counterclockwise, arm 78 thereof engages extension 75 rotating shaft 76 clockwise against the resistance of a spring 79. Arm 80 fixed to shaft 76 thereupon actuates bar 82 downward, as viewed in Fig. 4, with the result that the projections on members 85 move towards clutch levers 19 and press against the ends of those clutch levers which have been unlatched moving the stops 18 on said levers behind armature latches 16 which thereupon engage the stops to relatch the levers. This relatching action occurs at the end of the adding cycle and at the end of the transfer cycle, as explained above.

Fig. 6 illustrates how the counter mechanism may be removed from the body of the machine for inspection. Frame 35 carrying brushes 34 has an extension in the form of a

plate 86 pivoted at 87 to a frame plate 88 fixed to the body of the machine. The forward end of plate 86 carries a screw 89 (Fig. 1) which when the counter mechanism is in operating position as shown in Fig. 1 is positioned in the end of the vertical portion 90 of a bayonet slot in the side plate 93 of the counter bank frame. The screw 89 is adjusted to tightly engage the surface of said plate 93 when the counter is in operating position and thus retain the counter in said position. When it is desired to remove the counter, the screw 89 is loosened and the counter slid to the right as viewed in Fig. 6. This action results in portion 90 of the bayonet slot camming screw 89 downward, plate 86 then rocking on pivot 87 and screw 89 sliding out of the horizontal portion of the bayonet slot permitting removal of the counter. The transfer assembly shown in Figs. 7 and 8 remains attached to the body of the machine, when the counter is completely removed as described.

In Fig. 2, mechanism 94 is an improved total reading means forming the subject matter of Patent No. 1,861,955 to George F. Daly and although not connected with the present invention is here illustrated to show the relative position of the parts in the complete machine.

While we 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. We intend to be limited therefore only as indicated by the scope of the following claims.

We claim:

1. An electric transfer system for an accounting machine provided with removable accumulating elements, comprising commutator devices associated with said elements and means for moving them in unison with said elements, brush devices normally in contact with the surface of each of said commutators and coacting therewith to close a break in a transfer control circuit and means associated with the accumulator elements for camming the brush devices free from the surfaces of their commutators at the beginning of a removal of the accumulator elements from the machine.

2. An electrical transfer system for an accounting machine provided with accumulating elements movable by equal increments through a cycle to register different amounts, a pair of contact devices associated with each accumulating element and movable into engagement with each other when the associated element completes a cycle of movement, transfer control circuits including the

pair of contacts and electrical means for operating the higher adjacent accumulating element through one increment of movement when the contacts engage, a commutator movable with each of said accumulating elements and brush devices coacting therewith, and transfer control circuits including said brush devices and adapted to be closed by said commutators when the associated accumulating elements register one less increment than a complete cycle, each of said last named circuits being in series with the pair of contacts of the lower adjacent accumulating element and including electrical means for operating the higher adjacent accumulating element, through one increment of movement when both said pair of contacts are in engagement and said transfer control circuits are closed.

3. An electrical transfer system for an accounting machine provided with accumulating elements movable by equal increments through a complete cycle to register different amounts, comprising a first set of contacts associated with each element and adapted to be closed when the element completes a cycle of movement, transfer control circuits in parallel with each other and each including the contacts of one element and electrical means for operating the higher adjacent accumulating element through one increment of movement, a second set of additional contacts associated with each element and adapted to be closed when the element registers one less increment than a complete cycle, additional transfer control circuits each having a branch extending in series through one of said second sets of contacts and the first set of contacts of the lower adjacent element and the electrical means for operating the higher adjacent element through one increment of movement and having an additional branch extending in series with the second set of contacts of the higher adjacent element and a commutator with coacting brush devices for energizing the transfer control circuits at a predetermined time to effect transfer.

4. An electric transfer system for an accounting machine provided with removable accumulating elements, transfer means comprising commutators driven by said elements and brush devices mounted for movement on a bracket and adapted to cooperate with said commutator devices, a cam member carried by a frame carrying said accumulating elements, means actuated by the said member when the elements are moved toward the brushes for moving the brush devices into contact with the commutators, said means also being actuated by said cam member to move the brush devices out of contact with said commutators when the accumulator elements are moved away from the brushes.

5. An electric transfer system for an accounting machine provided with accumulat-

ing wheels, comprising a commutator device
driven by each accumulator wheel, a transfer
control circuit, brushes normally in contact
with said commutator devices and adapted to
close breaks in the transfer control circuit
5 while the related wheels are in the "9" posi-
tion, means for closing the circuit, and addi-
tional means under control of said circuit
for adding units simultaneously on the wheels
10 in the "9" position and the next higher order
wheel.

In testimony whereof we hereto affix our
signatures.

GEORGE F. DALY.
RALPH E. PAGE.

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