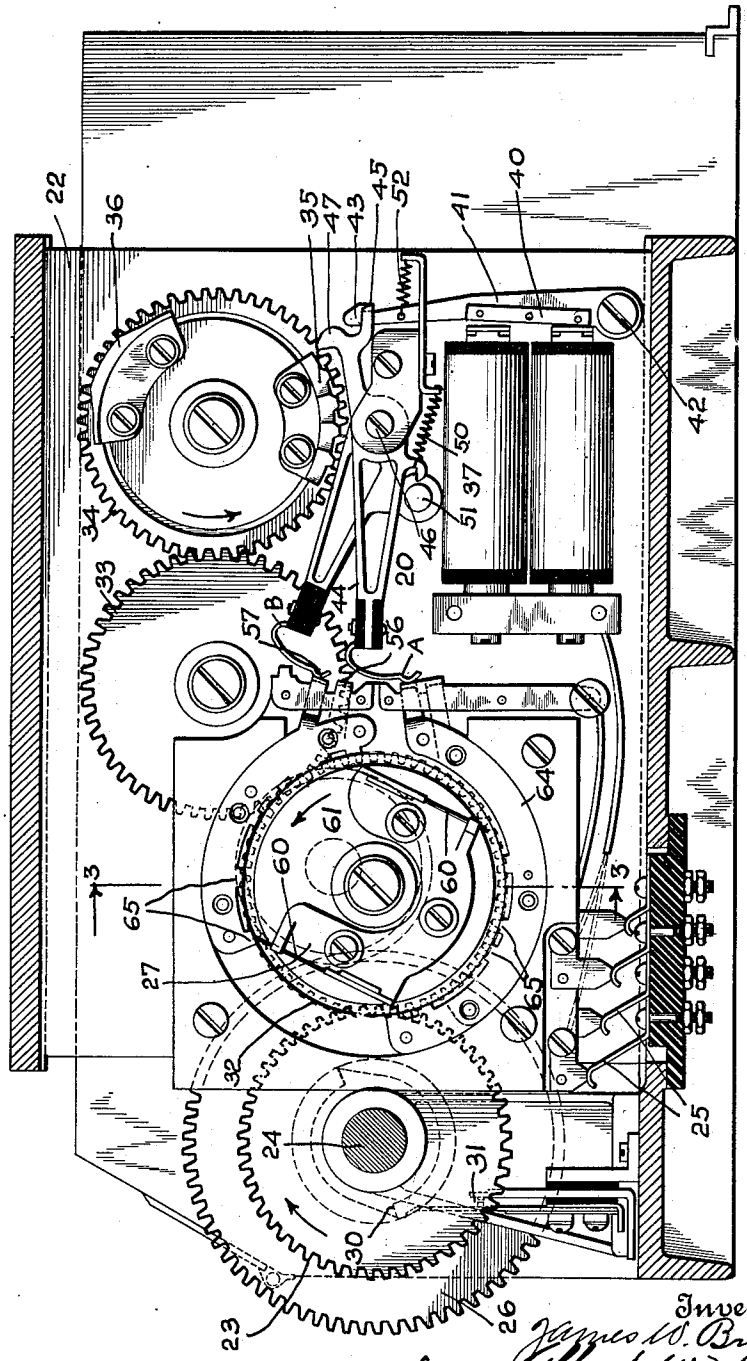
Sept. 24, 1929. J. W. BRYCE ET AL 1,729,028

TRANSPOSING DEVICE FOR TABULATING MACHINES

Original Filed May 13, 1926 5 Sheets-Sheet 1

FIG. 1.



Inventor
James W. Bryce
Gilbert W. Mills
By their Attorney
C. O. Nelson

Sept. 24, 1929. J. W. BRYCE ET AL 1,729,028

TRANSPOSING DEVICE FOR TABULATING MACHINES

Original Filed May 13, 1926 5 Sheets-Sheet 2

FIG. 2.

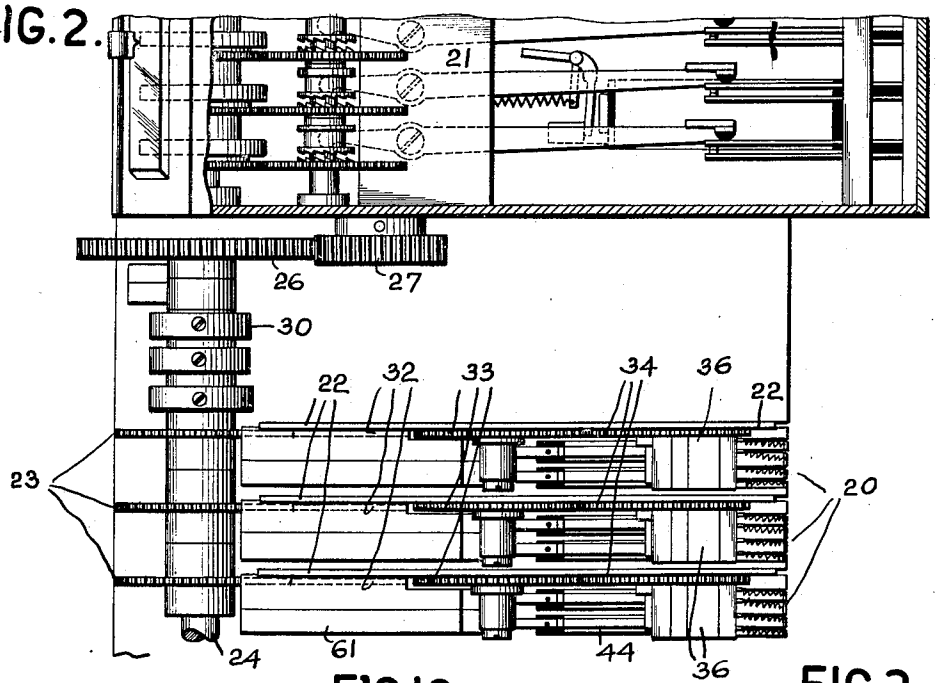


FIG. 12.

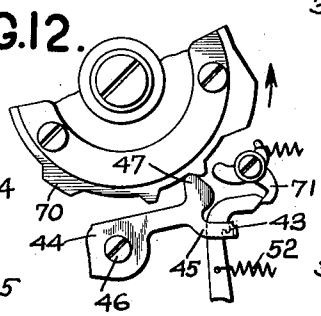


FIG. 3.

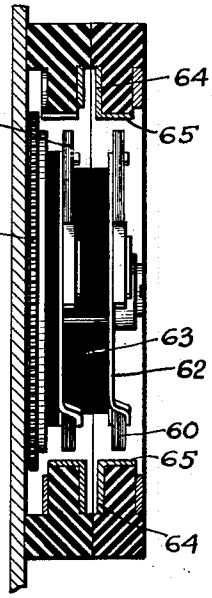
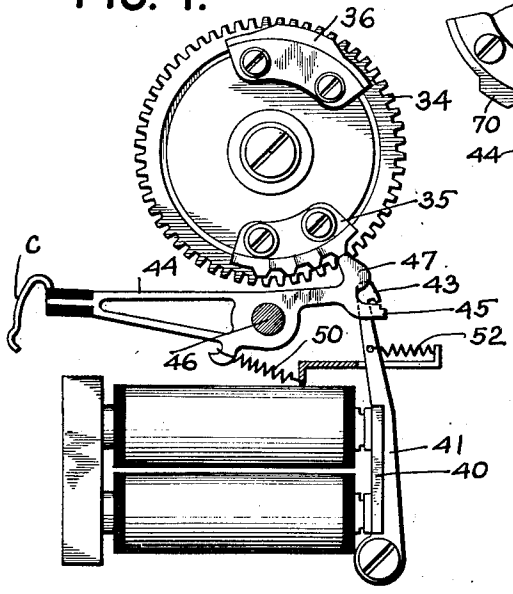


FIG. 4.



Inventor
James W. Bryce
Albert W. Mills
By their Attorney
W. Wilson

Sept. 24, 1929. J. W. BRYCE ET AL 1,729,028

TRANSPOSING DEVICE FOR TABULATING MACHINES

Original Filed May 13, 1926 5 Sheets-Sheet 3

FIG. 7.

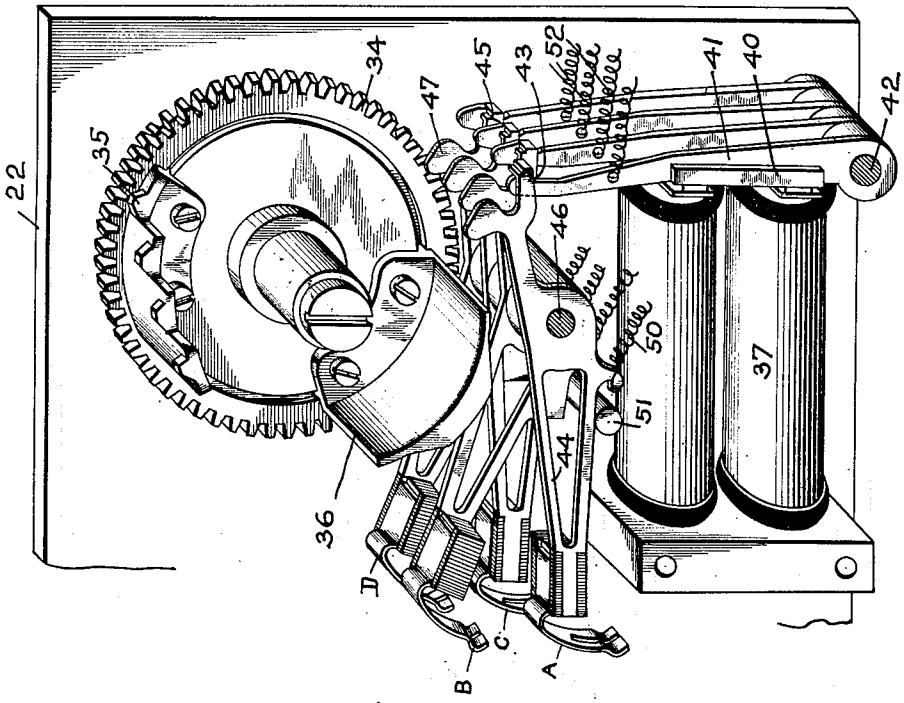


FIG. 5.

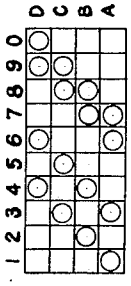
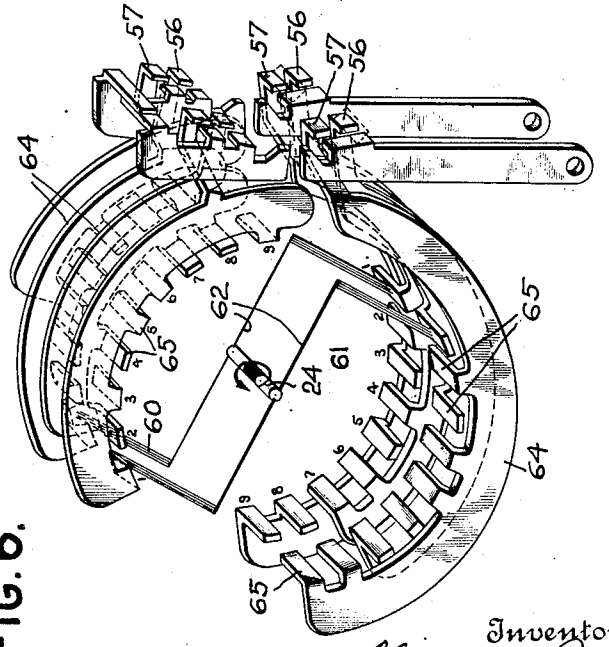


FIG. 6.



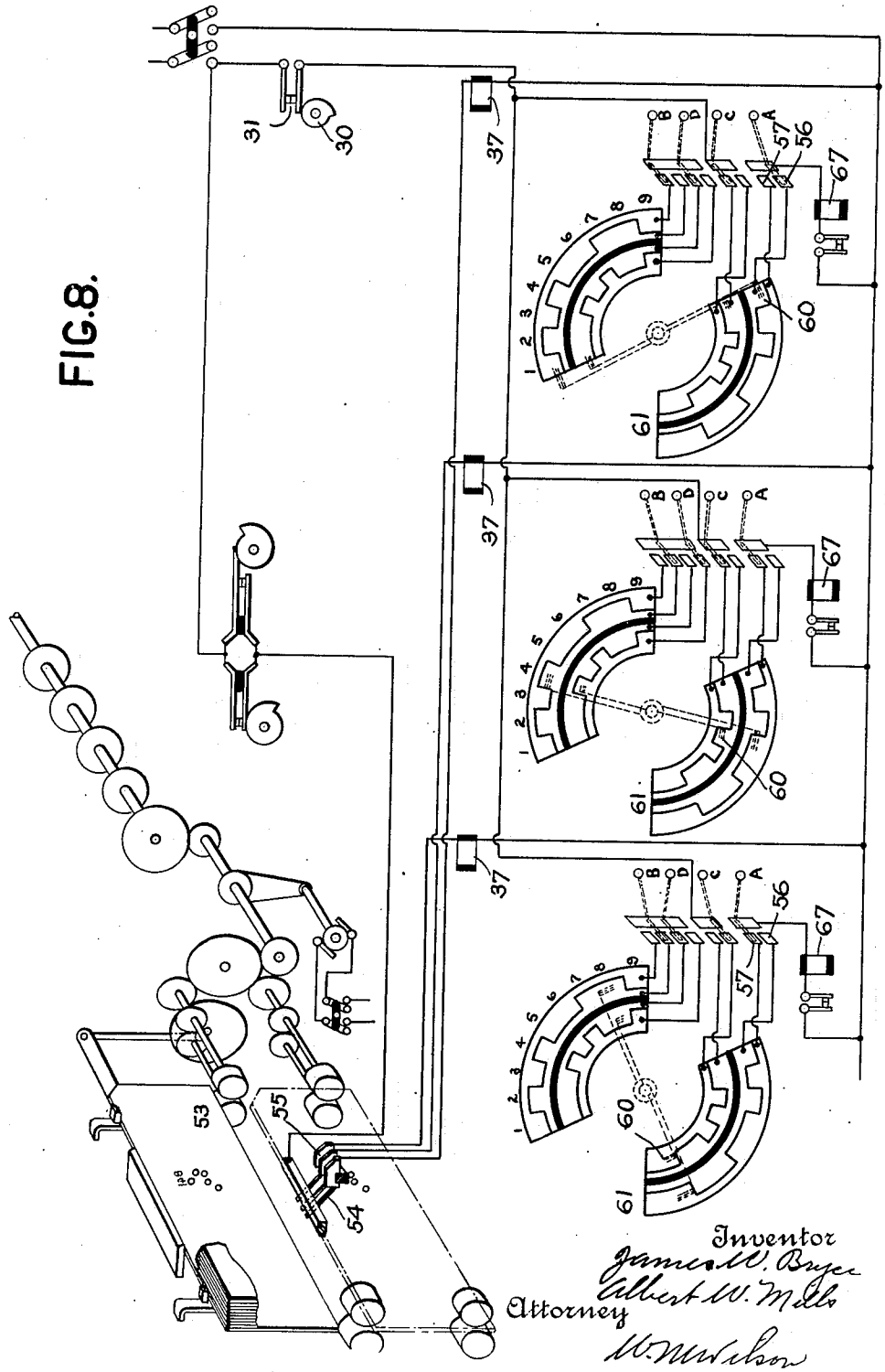
Inventor
James W. Bryce
Gilbert W. Mello
By their Attorney
W. W. Wilson

Sept. 24, 1929. J. W. BRYCE ET AL 1,729,028

TRANSPOSING DEVICE FOR TABULATING MACHINES

Original Filed May 13, 1926 5 Sheets-Sheet 4

FIG.8.



Inventor
James W. Bryce
Albert W. Mills

Attorney
W. W. Wilson

Sept. 24, 1929. J. W. BRYCE ET AL 1,729,028

TRANSPOSING DEVICE FOR TABULATING MACHINES

Original Filed May 13, 1926 5 Sheets-Sheet 5

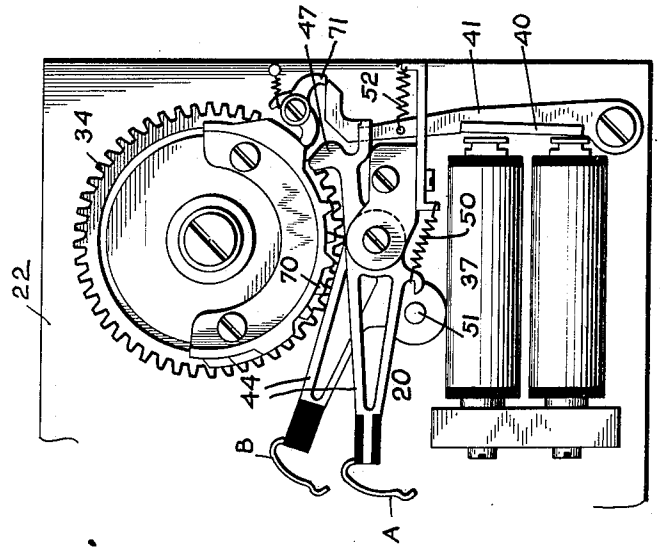


FIG. 9.

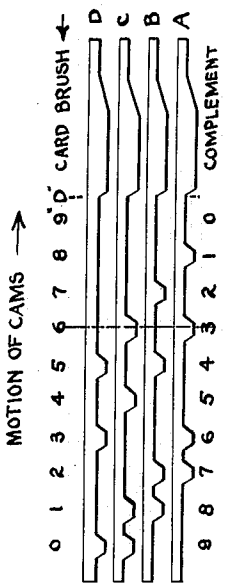


FIG. 11.

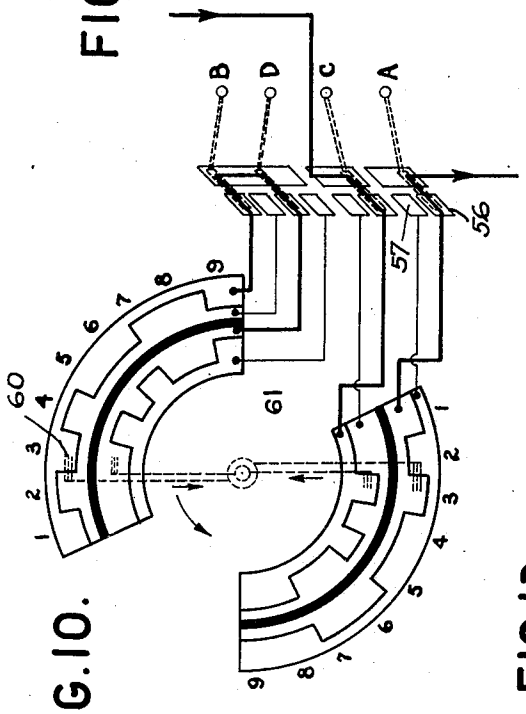


FIG. 10.

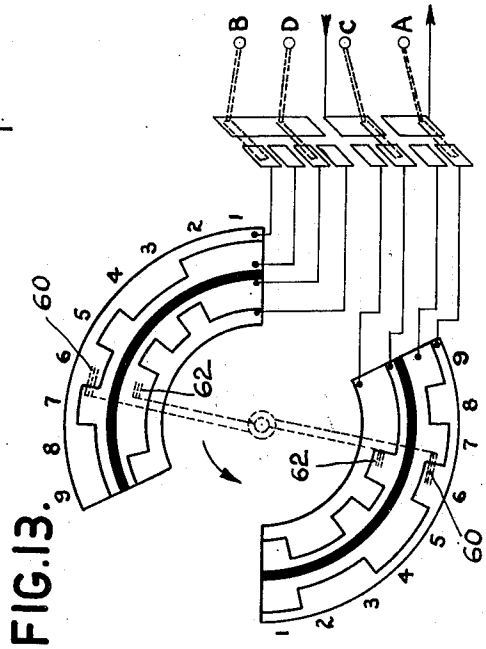


FIG. 13.

Inventor
James W. Bryce
Albert W. Mills
By their Attorney
W. M. Wilson

Patented Sept. 24, 1929 1,729,028

UNITED STATES PATENT OFFICE

JAMES W. BRYCE, OF BLOOMFIELD, AND ALBERT W. MILLS, OF EAST ORANGE, NEW JERSEY, ASSIGNORS TO THE TABULATING MACHINE COMPANY, OF ENDICOTT, NEW YORK, A CORPORATION OF NEW JERSEY

TRANSPOSING DEVICE FOR TABULATING MACHINES

Continuation in part of application Serial No. 108,834, filed May 13, 1926. This application filed May 21, 1928. Serial No. 279,308.

This invention relates to tabulating machines, and more particularly to mechanism for transposing the meaning of readings taken from a particular record by such machines.

The present case is a continuation in part of our copending case Serial No. 108,834, filed May 13, 1926.

In tabulating machines heretofore constructed, it has been usual to provide perforated record cards and to take readings therefrom by means of a single brush sensing the perforations in the card while the cards are in motion. In certain other tabulating machines a combinational hole record was provided which was sensed either by brushes or by a plurality of pins. In the latter case it was necessary to read the perforations with the cards at rest. Inasmuch as a particular type of tabulating machine is required to read each of the above mentioned type of records, it is desirable to provide a mechanism capable of reading one type of record and controlling thereby a machine normally capable of being actuated only by a different type of record.

It is therefore an object of this invention to provide a machine capable of translating readings of one type into readings of a different type.

Another object is to provide a machine capable of transposing the order of the digits comprising the sensed record or reading.

A further object is to provide for sensing a direct record or reading and obtaining another reading which is a complement thereof.

The above objects, and others which will be apparent as the nature of the invention is disclosed, are accomplished in accordance with the present invention by providing a mechanism capable of setting up and temporarily retaining contacts in accordance with a sensed record. The set-up contacts are used to complete a circuit to various segments of a stationary commutator which is then sensed by brushes and a reading obtained therefrom for controlling a record actuated device of any desired type. By choosing the proper commutator arrangement, a set-up obtained from any particular type of record may be sensed and used to actuate a machine normally responsive to records of a different type, or the order of the readings may be arbitrarily transposed and used to actuate a machine in the new sequence.

Although the novel features which are believed to be characteristic of this invention will be pointed out with particularity in the claims appended hereto, the invention itself, as to its objects and advantages, the mode of its operation and the manner of its organization, may be better understood by referring to the following description taken in connection with the accompanying drawings forming a part thereof in which

Fig. 1 is an elevation of the translating mechanism constructed in accordance with this invention;

Fig. 2 is a plan view of a portion of a bank of translating devices showing the manner of attachment to the accumulator of a tabulating machine;

Fig. 3 is a section taken on the line 3—3 of Fig. 1, disclosing certain details of the translating device;

Fig. 4 is a detail view of a portion of the set-up mechanism;

Fig. 5 shows a combinational hole record card;

Fig. 6 is an enlarged detail view of the brush and commutator used for reading the set-up combination;

Fig. 7 is a detail view of the set-up and reset mechanism constructed in accordance with this invention;

Fig. 8 is a circuit diagram showing the connections of the various apparatus;

Fig. 9 is a detail view of a modified form of set-up mechanism;

Fig. 10 is a diagrammatic representation

of the brush and commutator arrangement used in connection therewith;

Fig. 11 is an enlarged view of a series of cams to be used with the set-up mechanism;

Fig. 12 is a detail view of a portion of the release mechanism used with the set up devices shown in Fig. 9, and

Fig. 13 is a diagrammatic representation of a brush and commutator arrangement, similar to Fig. 10 but designed to emit readings in complementary values.

Referring to the figures more in detatil, the translating mechanism comprises a plurality of units 20, (Fig. 2) one unit being employed for each index column of the controlling record. A portion of a bank of such units is shown in Fig. 2 associated with an accumulator or counting mechanism 21. Each unit is integrally mounted on a base plate 22 (Figs. 1 and 2) and is held thereby in mesh with gear wheel 23 on main driving shaft 24 which here makes one complete revolution per card cycle. Current is supplied through contacts 25 when the unit is in position in the machine. This construction permits the units to be removed and interchanged at will. The accumulator element is driven from shaft 24 through gears 26 and 27 (Fig. 2) in the usual manner. One form of accumulator to which this invention may be applied is disclosed in a patent to Lake, No. 1,307,740 dated June 24, 1919. Inasmuch as the accumulator and its actuating mechanism form no part of this invention a more detailed description is not given herein.

Gear 23 and cam 30 (Fig. 1) are attached to shaft 24 and revolve in conjunction therewith. Cam 30 is used to control contacts 31 whereby certain operations of the set-up mechanism are interrupted during a portion of a card cycle. Contacts 31 are opened during one half of each revolution of shaft 24 and closed during the other half of the revolution.

The set-up mechanism 20 which will be first described is driven from gear 23 through a driving train comprising gears 32, 33 and 34. Gear 34 is provided with a stepped cam 35 the purpose of which will be hereinafter described and a reset cam 36. The set-up mechanism operated by cams 35 and 36 is shown more in detail in Figs. 4 and 7. Magnet 37 is provided with four armatures 40 to each of which is rigidly attached an arm 41. Arms 41 are pivoted on rod 42 and terminate at their free ends in detents comprising undercut slots 43. Arms 44 pivoted on rod 46, are provided at one end with a set of contact elements A, B, C and D respectively, and at their other ends with projections 45 and 47. Projections 45 enter slots 43 in arms 41 and normally lock the latter against movement.

As stepped cam 35 is rotated with gear wheel 34, it successively depresses projections 47 on the various arms 44 and disengages projections 45 from their retaining slots 43, releasing the corresponding arms 41 to permit movement thereof upon energization of magnet 37. Although each of the four armatures is attracted whenever magnet 37 is energized only those armatures which are released by cam 35 at that particular moment are permitted to move, the other armatures being held in a stationary position by the detent means above described.

When the cam 35 has released a particular armature for movement and magnet 37 has at the same time been energized, the released armature 40 is attracted and together with arm 41 is moved to the left (Fig. 7). The detent means comprising slot 43 in arm 41 and projection 45 in arm 44 is then completely released allowing the arm 44 to be given a slight counterclockwise rotational movement by the force of springs 50 until a shoulder on the arm abuts on stop member 51 which prevents further movement. Projection 45 then prevents arm 41 from returning to its original position when magnet 37 is deenergized. After the various arms carrying contacts A, B, C and D have been set as required and a reading derived therefrom in a manner to be later described, upon further rotation of gear wheel 34 reset cam 36 engages projections 47 and depresses the same releasing projections 45 from their retaining position on arms 41 and allowing arms 41 to be restored to their original position in response to a force applied by springs 52. Having assumed their original position they are again locked by the detent means comprising projections 45 and slot 43 above described. The device is then in condition to receive the next set-up in accordance with the subsequent record card.

The set-up mechanism just described is operated in response to record cards 53 (Fig. 8) which are successively passed under brushes 54. Whenever a brush senses a perforation in the record card, contact is made to the cooperating metallic member 55 and a circuit completed through magnet 37 which is temporarily energized. Magnet 37 will then attract its armatures and the particular one which happens to be released by cam 35 at that intant will be moved to the left and corresponding arm 44 assumes and retains its new position.

A combinational hole record card similar to that shown in Fig. 5 is employed with this machine, each of the digits being represented by a particular combination of perforations in the A, B, C and D positions. Cam 35 is timed with respect to the passage of record card 53 under brushes 54 so that brushes A, B, C and D (Fig. 7) are released successively at the exact moment that brush 54 traverses the A, B, C and D positions, respectively, of the record card. The result is that the com-

bination set-up by arms 44 corresponds to the combination of perforations in the record sensed by brush 54.

Brushes A, B, C and D on arms 44 make contact with conducting strips 56 or 57 (Figs. 1, 6, 8 and 10) according to their respective set-up positions. The combination set up by mechanism 20 is analyzed by brushes 60 attached to gear wheel 32. These brushes make contact with the various segments of commutator 61 connected to conducting members 56 and 57. The construction of brushes 60 and their manner of arrangement may be seen by referring to Fig. 3 which shows a sectional view thereof. Brushes 60 are connected mechanically to the gear wheel 32 by means of metallic strips 62 which are rigidly attached to wheel 32 and insulated therefrom by means of insulating discs 63.

Commutators 61 are shown in detail in Figs. 6, 8 and 10 and in section in Fig. 3. They consist of cast or stamped blocks having rim portions 64 and contacting strips 65. The various contacting strips or segments are so interrelated that a circuit is completed by the brushes in a particular angular position, depending upon the set-up combination of contacts A, B, C and D. Brushes 60 are timed in respect to the commutator to send an impulse through counter magnets 67 at the proper instant to operate the accumulator clutch to enter the amount indicated by the set-up combination code. Contact 31, operated by cam 30 (Fig. 8), is adapted to open the circuit to brushes 60 during half of each card cycle. Inasmuch as the brushes make one complete revolution per card cycle they are energized during one half of each revolution only. The half revolution during which contact 31 is open occurs while set-up mechanism 20 is being operated. During the second half of each revolution of brushes 60 contact 31 is closed. The circuit is then completed by brushes 60 to counter magnets 67 to permit energization thereof whereby the accumulator may be controlled in a manner well known in tabulating machines.

The operation of the device may be briefly summarized as follows: During the first half of each card cycle the perforations on the card are sensed and the combination thereon set up and retained by mechanism 20. During the second half of the cycle the set-up combination is read by brushes 60 and a circuit is completed through the counter magnets to control the accumulator or other record actuated device.

The particular set up shown in Fig. 10 serves to illustrate the action of the device. Here the analyzing brushes have sensed the combinational code for "3" (see Fig. 5) and the resulting impulses through magnet 37 have caused levers 44 to shift on the "A" and "C" positions. Then during the revolution of brushes 60 a circuit will be completed through commutator 61 at the proper time to effect an impulse to enter 3 into the accumulators. Tracing the contacts made during the revolution of brushes 60 (Fig. 10) it will be noted that, due to the arrangement of the commutator segments, when brush contacts "A" and "C" are lowered no circuit can be closed except at the "3" index point position of the machine, at which point the brushes are set in Fig. 10. The circuit may be easily traced through the various wires, contact strips, commutator segments and brushes, if it be remembered that the two outer brushes 60 are electrically interconnected and the two inner brushes are likewise interconnected. The current enters through the "C" brush and leaves through the A brush as indicated by the arrows.

It is also possible with this device to enter the complements of numbers represented by combinational hole perforations. For example, if it is desired to enter the nine complement of each number rather than the number itself it is only necessary to rearrange the order of the commutator segments shown in Fig. 10 so that the entering impulses will occur at the proper times to enter 9 when zero is sensed, 8 when 1 is sensed and so on. The commutator segment arrangement for this purpose is shown in Fig. 13. In the particular set up shown the brushes A and C have been shifted, indicating analysis of a record card bearing the code notation for "3".

The brushes 60 and 62 are shown in the act of passing the sixth point of machine operation. At this point a circuit is completed to enter "6", the nine complement of "3", into the accumulators. It will be noted that for other shiftings of the brushes A, B, C and D according to the index point code in Fig. 5 the entering impulse will always occur to enter the complement of the number represented on the control card.

The operation of the device thus far described has been for the sole purpose of allowing a combinational record to actuate a machine normally controlled by a record having a single perforation. However the device may be constructed to be actuated by a single hole record and the reading taken in complementary numbers or the order of the digits may be otherwise arbitrarily transposed as required.

The set-up mechanism for this purpose is shown in Fig. 9 wherein the cam 35 of Fig. 1 is replaced by four cams 70, (one for each arm 44) the details of which are shown in Fig. 11. Each cam 70 is designed to depress one of the arms 44 at the time a single index perforation is passing under one of the brushes 54 the combination of arms depressed corresponding to the particular code determined upon to represent that index point. If magnet 37 is not energized at that instant, arms 41 are not moved and arms 44 will again

resume their normal position when released by cams 70. Magnet 37 will be energized however at a time corresponding to the position of the index point perforated and armatures 40 attracted. Any arm 41 (Fig. 9) that is moved to the left by energization of magnet 37 is then held by a pawl 71 (Figs. 9 and 12) which is drawn into position by its spring and holds arm 41 in its set up position. Then as cam 70 continues on its revolution subsequent projections, for the purpose described above, on cam 70 will cause lever 44 to move up and down until it finally assumes its true set up position which will be determined by the position of arm 41. Thus if any arm 41 has been moved to the left and latched in position by pawl 71 the arm 44 associated therewith will be drawn by spring 50 into its set up position resting on stop 51, also if any arm 41 has not been moved to the left the arm 44 associated therewith will retain the position shown in Fig. 9.

A combination having been set up by brushes A, B, C and D, it may be analyzed by brushes 60 (Fig. 10) to produce an impulse in the counter magnet at the required instant.

Final resetting is then accomplished by the long high projection (adjacent to arrow in Fig. 12) on cam 70 which first engages projection 47 on arm 44, moving arm 44 in a clockwise direction and then releases pawl 71 allowing spring 52 to move arm 41 into its right hand or normal position. Then when projection 47 on arm 44 drops off the long high projection on cam 70 arm 44 will assume the latched position shown in Fig. 9.

If it is desired to read a complement instead of a direct number, the cams shown in Fig. 11 may be designed so that when the card contains a perforation in any position, for instance the three position, the set-up combination of arms 44 will correspond to its complement, or in that case to the digit six. On subsequent reading of the set-up mechanism by the brush 60, a six will be entered into the counter instead of a three.

The machine is also adapted to transpose for complements other than the nine complements or to transpose to any given number or numbers which may be arbitrarily selected. For example, it may be desired to transpose the combination representing "5" on a combinational hole card into a timed impulse representing "7". "7" is of course the twelve complement of "5" and if it is desired to complement the other digits also to "12" the commutator segments may be arranged for this purpose. On the other hand the transposition may be purely arbitrary and the commutator segments may be so arranged that the "3" will be transposed into a "5", for example, the "2" into a "7" and so on for entry into the counters.

These and similar transpositions may also be effected from the usual Hollerith cards on which each number is represented by a single perforation. In this case it is only necessary to rearrange the extensions on the cams shown in Fig. 11 so that an index point in the "5" position on the card will be effective in depressing, for example, the A and B switch levers in Fig. 10 which will give an entering impulse in the "7" position. The cam extensions for the other index points can also be arranged to effect set ups corresponding to any selected characters.

While the invention finds particular utility in transposing record readings of one type into readings of another type, the invention in its broad aspect is not limited to uses in direct connection with a perforated record, but the device may be utilized in accounting machines and the like generally or in other places where a conversion from a given reading into a correlated reading of a different type is desired.

Although this invention has been shown and described as applied to a particular apparatus in a specific manner it is not to be limited thereto but only in accordance with the scope of the invention as defined by the following claims.

What is claimed is:

1. In a machine controlled by representations of a particular type, means including a single brush for sensing said representations, means for transposing the meaning of said representations and means for operating a responsive mechanism in accordance with the meaning of the transposed representations.

2. In a machine controlled by representations of a particular type, means including a single brush for sensing said representations, means for transposing the meaning of said representations and means icluding commutators and brushes for operating a responsive mechanism in accordance with the meaning of the transposed representations.

3. In a machine controlled by representations of a particular type, means including a single brush for sensing said representations, means for transposing the meaning of said representations, a staggered commutator, and brushes cooperating therewith for operating a responsive mechanism in accordance with the meaning of the transposed representations.

4. In a machine controlled by representations of a particular type, means including a single brush for sensing said representations, set-up contacts for transposing the meaning of said representations, and means including brushes and a staggered commutator for operating a responsive mechanism in accordance with the meaning of the transposed representations.

5. In a machine controlled by representations of a particular type, means including a single brush for sensing said representations, means for setting up contacts corresponding

to said representations, means including commutators and brushes for transposing the meaning of said representations and means for operating a responsive mechanism in accordance with the meaning of the transposed representations.

6. In a machine controlled by cards having perforations in columns, means including a single brush for sensing said perforations, a magnet and armatures cooperating therewith for setting up contacts corresponding to said perforations, a commutator and brushes for transposing the meaning of said perforation and means for operating an accumulator in accordance with the transposed meaning.

7. In an accounting machine actuated by readings derived from records, means for setting up and retaining a reading comprising a plurality of rock arms, brushes attached to said arms, a rotating cam for actuating said arms and setting up a reading on said brushes and magnetically operated latching means for retaining said arms in set-up position.

8. In an accounting machine actuated by readings derived from records, means for setting up and retaining a reading, comprising stationary contacts, movable brushes adapted to cooperate with said contacts, a rotatable cam for actuating said brushes and setting up a reading thereon and magnetically operated latching means for retaining said brushes in set-up position.

9. In an accounting machine actuated by readings derived from records, means for setting up and retaining a reading, comprising a stationary commutator including rim-like segments and interleaved fingers attached to said segments and extending in a direction parallel to the axis of said segments.

10. In an accounting machine actuated by readings derived from records, means for setting up and retaining a reading, comprising a stationary commutator including rim-like segments, interleaved fingers rigidly attached to said segments and extending in a direction parallel to the axis of said segments, and revolving brushes adapted to cooperate with said segments.

11. In an accounting machine actuated by readings derived from records, means for setting up and retaining a reading, comprising stationary contacts, movable brushes cooperating with said contacts, a revolvable cam for actuating said brushes and setting up a combination corresponding to a reading thereon, magnetically operated latching means for retaining said brushes in set-up position, a stationary commutator comprising rim-like segments and interleaved metallic fingers connected thereto and extending in a direction parallel to the axis of said rim-like segments, means connecting said commutator to said stationary contacts and revolving brushes cooperating with said commutator for deriving a reading therefrom.

12. In a record controlled accounting machine, data responsive means and means for deriving data from records, means controlled by said data deriving means for transposing the derived data into data of different meaning and means for controlling the data responsive mechanism in accordance with the transposed data.

13. In a record controlled accounting machine, data responsive means and means for deriving data from records while they are in motion, means controlled by said data deriving means for transporting the derived data into data of different meaning and means for controlling the data responsive mechanism in accordance with the transposed data.

14. In a record controlled accounting machine, data responsive means and means comprising a single brush for deriving data from records, means controlled by said data deriving means for transposing the derived data into data of different meaning and means for controlling the data responsive mechanism in accordance with the transposed data.

15. In a record controlled accounting machine, data responsive means comprising mechanism operable at different times to manifest different data, means for deriving data from records and means controlled by said data deriving means for transposing the derived data into timed operations to control said mechanism for manifesting data with a different meaning from that appearing on the controlling records.

16. In a record controlled accounting machine, means responsive to numerical data and means for deriving numerical data from records, means controlled by said data deriving means for transposing the derived numerical data into numerical data complementary thereto and means for controlling the data responsive means in accordance with the complementary data.

17. In a record controlled accounting machine, means responsive to numerical data and means for deriving numerical data from records while they are in motion, means controlled by said data deriving means for transposing the derived numerical data into numercial data complementary thereto and means for controlling the data responsive means in accordance with the complementary data.

18. In a record controlled accounting machine, means responsive to numerical data and means comprising a single brush for deriving numerical data from records, means controlled by said data deriving means for transposing the derived numerical data into numerical data complementary thereto and means for controlling the data responsive means in accordance with the complementary data.

19. In a record controlled accounting machine, data responsive means comprising mechanism operable at differential times to manifest different numerical data, means for deriving numerical data from records and means controlled by said data deriving means for transposing the derived data into timed operations having meanings complementary to the originally derived data and means for controlling said mechanism in accordance with the timed operation.

In testimony whereof we hereto affix our signatures.

JAMES W. BRYCE.
ALBERT W. MILLS.