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JAMES W BRYCE, OF BLOOMFIELD, NEW JERSEY, ASSIGNOR TO THE TABULATING
MACHINE COMPANY, OF ENDICOTT, NEW YORK, A CORPORATION OF NEW JERSEY

CONTROLLING DEVICE FOR RECORD-CONTROLLED MACHINES

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The invention relates to improvements in automatic controlling devices for record-controlled machines such as tabulating machines. In machines of this class provision is made for sensing the record group designating perforations and for modifying or otherwise bringing about a different functional operation of the machine when there are unlike designating perforations in two successive records.

Heretofore such operation has been performed by energizing individual magnets under the control of the brushes and these magnets in turn when energized establish a supplementary control circuit. The previous devices have utilized and necessitated the use of direct current and have employed a considerable number of contacts in various circuits. A cord circuit contact was included for each magnet and the control circuit including a number of contacts serially disposed therein and through which all controlling current had to pass in order to maintain the operation of the machine.

The present invention has for its objects the provision of devices of such character that alternating current may be utilized in place of the direct current in the various card circuits thereby dispensing with the use of a multiplicity of contacts.

A further object of the present invention resides in the provision of a novel arrangement of the controlling circuit whereby the use of series contacts is obviated. Contacts in parallel are employed any one of which may establish a normally open controlling circuit and thus bring about a change in the operation of the machine. Heretofore the controlling circuit has been a normally closed one and changes of record groups have opened the said circuit to bring about the control of the machine.

A further object of the present invention resides in a novel arrangement of control magnets having double windings, one winding being energized from a card circuit from one brush and record perforation and the other winding being energized under the control of the other brush which cooperates with a perforation upon a different card. In the

event that both windings are energized concurrently, the record perforations agreeing, there is no attraction of the armature or relay arm and, consequently, the machine continues in operation. However, if the record perforations of two analyzed cards do not agree there is an unbalancing of the differentially wound control magnet and this magnet will then act to attract its armature and effect control of the control circuit.

While the instrumentalities proposed find particular utility in machines employing alternating current in the brush or card circuits the differentially wound control magnets and controlled contacts materially simplify the control section of the machine as they obviate the use of a large number of mechanical devices heretofore employed for tripping, releasing and restoring the various contacts.

Further objects and advantages will be hereinafter pointed out in the accompanying specification and claims and shown in the drawings which by way of illustration show preferred embodiments of the invention.

In the drawings, Fig 1 shows diagrammatically one embodiment of the invention.

Fig 2 shows a modification of the arrangement shown in Fig 1 in which a single controlling relay is employed in place of individual relays shown in Fig 1.

Figs 3 and 3a taken together show a complete tabulating machine embodying my improved control system. The control system wiring in these figures is shown by heavy lines.

Referring now to Fig 1 M represents an alternating current generator which may be of magneto type if desired. Contacts T-5 establish a circuit from the A C generator M to the common line 10 supplying A C impulses to the upper and lower brushes 11, 12. Contacts T-5 break the brush circuit during the intervals between cards and establish this brush circuit during the period that the perforated fields of the cards are passing under the brushes. The successive cards which pass under the brushes are respectively designated 13 and 14. Upon the

opposite sides of the cards from the brushes contact blocks 15 and 16 are provided, which contact blocks are wired to opposing windings 17, 18. Both windings 17 and 18 at their ends are connected to a common ground circuit 19. The magneto or A C generator M is also connected to ground at 20. It will be understood that if perforations are concurrently under brushes 11 and 12 there will be a current flow through both windings 17 and 18 and inasmuch as these windings oppose each other the magnetizing effect will be neutralized. If a perforation comes under either brushes 11 or 12 at a time when there is not a perforation under the other brush one or the other of windings 17 or 18 will be energized while the other winding will not be energized. In this event there is a magnetizing effect which can act to attract an armature 21. There is one of these armatures 21 for each of the various columns. Armatures 21 are connected to a circuit 22 which receives current from the generator M. When attracted by the unbalanced action of any one or more of coils 17, 18, one or more of the armatures 21 will be raised and will establish a circuit to a line 23, which line extends to a control coil 24 connected to ground as shown. The energization of control coil 24 will attract an armature 25 and interrupt a control circuit 74. This control circuit 74 may extend to any control magnet in the record-controlled machine which is intended to be deenergized to bring about a modification of the operation of the machine. Inasmuch as the energization of a coil 24 is only momentarily due to the pulsations of current which are supplied from generator M, provision is made for retaining armature 25 in position to maintain the opening of control circuit 74. One method of effecting this is by providing a latch 27 provided with a suitable spring and an engaging notch 28 to catch armature 25 when the latter is attracted by the energization of coil 24. After the card cycle is completed provision must be made for releasing armature 25 from notch 28 and this is preferably effected by means of a cam 30.

The arrangement shown in Fig 2 is substantially identical with that shown in Fig 1 with the exception that a single relay 21a is employed in place of the multiple relay armatures 21 of Fig 1. The arrangement of the windings 17 and 18 is such that they are disposed so as to jointly and individually act upon armature 21a. For example, the coils could be of pancake form and spaced closely together, the armature 21a being placed adjacent the end of the coil assembly in any desired manner.

The circuit diagram shown in Figs 3 and 3a is that of a tabulating machine now in general use and more fully described in the application of G F Daly and R. E. Page,

Serial No. 6980, filed February 5, 1925 now Patent No 1,762,145, dated June 10, 1930. For simplicity of illustration the alternating current control has been made entirely separate from the regular D C card circuit and machine control. The A C and control circuits are shown by heavy lines. Similar reference characters are employed as on Fig 1 so far as possible. From contact blocks 15 and 16 suitable cable connections are shown leading to the opposed windings 17 and 18. In order to utilize selective columns and for suppressing the operation on desired columns coils 17 and 18 are not permanently connected to the common return line 19 leading to the ground but instead are connected to individual plug sockets 31. Corresponding plug sockets 32 are provided in the return line 19 which leads to the ground. By employing proper plug connections between the desired sockets 31 and 32 the desired differential opposed magnets 17 and 18 can be brought into circuit. Thus the control may be used on a less number of columns than the eight which are illustrated or any desired column can be cut out of controlling action. It is obvious that instead of employing the individual relays 21 a common relay armature such as 21a may be employed. The control circuit 74 extends to the usual control relays 91 and 84 of the tabulating machine and maintains the operation of the tabulating machine during the period of the cycle when cam contacts C-1 break. Interruption of this control circuit 74 brings about a stoppage of the tabulating machine or otherwise modifies the operation thereof.

It is obvious from the above that the arrangement described is capable of detecting differences in successive cards of the single hole or Hollerith type. In this type of cards double punchings frequently occur and since they are usually in error it is desirable that attention be called to this fact. Where two perforations occur in one card and one of these corresponds to a perforation in a successive card magnet windings 18 and 17 will both be energized and machine operation will continue. However the presence of any perforation in one card without a corresponding perforation in a successive card will be immediately sensed by either the upper or lower brushes and cause energization of either magnet 17 or 18 alone to alter machine operation. This detection may be effected irrespective of the previous agreement of other and corresponding perforations of successive cards, as would be likely to occur in cards arranged according to the combinational or other system involving plural perforations in a single card column.

What I claim is

1. An automatic control for a tabulating machine and the like comprising a plurality of magnets each comprising a coil energized

under the control of a record perforation derived from one record and an opposed coil energized under the control of a record perforation in a different record, said coils neutralizing each other upon the agreement of the perforations in both records and exerting a magnetizing effect upon the disagreement of the perforations in the records, and means for bringing about a controlling operation upon the occurrence of said magnetizing effect in any one or more of said magnets

2 A controlling device for a perforated record controlled machine including a plurality of perforation sensing elements, and a magnet being controlled thereby and having opposed windings arranged to neutralize each other upon the sensing of concurrent perforations by said sensing means

3 A record controlled machine having a plurality of index point controlled circuits, magnet windings in each of the aforesaid circuits, said windings being opposed to each other whereby neutralizing effects are secured upon the said windings receiving current from corresponding index point perforations

4 A controlling device for a perforated record controlled machine, including a differentially wound magnet having opposing coils receiving current under the control of separate perforations of a plurality of perforated records, said coils being grounded to neutralize each other upon the agreement of the records and to provide a magnetizing effect upon a disagreement of the perforations of said records.

5 An automatic control device for a tabulating machine and the like comprising a control circuit, a plurality of record controlled magnets for controlling said circuit, each of said magnets being controlled by the record perforations of a plurality of records, each said magnet having provisions for neutralizing the magnetic effect thereof upon the agreement of the perforations of different records

6 A control device for a record controlled machine comprising a plurality of magnets, means for neutralizing the magnetizing effect of one or more of said magnets upon the agreement of the controlling record perforations and for establishing a magnetizing effect in one or more of said magnets upon the disagreement of controlling record perforations

7 The invention set forth in claim 6 in which means is provided for controlling the operation of the machine upon the occurrence of a magnetizing effect in any one or more of said magnets

8 A control device arranged to compare the perforations of a pair of records comprising magnet devices having windings independently energized under the separate control of the perforations of said records,

said magnet devices having provisions for automatically neutralizing their magnetic action upon the agreement of the respective perforations of different records, and a control means which is kept out of operation when said neutralizing effect occurs in all of said magnet devices

9 An automatic control system for a record controlled machine comprising separate mechanisms for analyzing concurrently two successive records, circuits controlled by said mechanisms and means controlled by balanced current conditions in said circuits for determining one type of machine operation and by unbalanced current conditions in said circuits for determining another type of machine operation

10 An automatic control system for a record controlled machine comprising separate mechanisms for analyzing concurrently two successive records, a separate circuit controlled by each mechanism and means conjointly controlled by said circuits for determining one type of machine operation on current flow in both of said circuits and another type of machine operation on current flow in only one of said circuits

11 An automatic control system for a record controlled machine comprising analyzing mechanism including a single brush for successively searching index points in a column of a controlling record and a single brush for synchronously searching index points on a column of a succeeding record, a circuit controlled by each brush, and means conjointly controlled by said circuits in accordance with balanced current conditions therein during complete record analysis for determining one type of machine operation and for determining another type of machine operation on unbalanced current conditions at any time during the record analysis

12 An automatic control system for a record controlled machine comprising analyzing mechanism including a single brush for successively searching index points in a column of a controlling record and a single brush for synchronously searching index points in a column of a succeeding record, a circuit controlled by each brush and means conjointly controlled by said circuits in accordance with simultaneous current changes in each to determine one type of machine operation and controlled by said circuits in accordance with current changes in one alone to determine another type of machine operation

13 An automatic control system for a record controlled machine comprising analyzing mechanism including a single brush for successively searching index points in a column of a controlling record and a single brush for synchronously searching index points in a column of a succeeding record, a circuit controlled by each brush and means conjointly controlled by said circuits in accordance with

unchanged current conditions or simultaneous current changes during a complete record analyzing operation to determine one type of machine operation after the termination of the record analysis and controlled in accordance with non-concurrent current changes in the circuits for determining another type of machine operation after the termination of the record analysis

14 An automatic control system for a record controlled machine comprising analyzing mechanism for sensing index points on a controlling record and analyzing mechanism for concurrently sensing index points on a succeeding record, separate circuits controlled by each mechanism, electro magnetic means conjointly controlled by said circuits including magnetizing means energized in opposing senses by said circuits and means controlled by said electromagnetic means in accordance with like and unlike index points on succeeding records for controlling machine operation

15 An automatic control system for a record controlled machine comprising analyzing mechanism including a single brush for successively sensing index points in a column of a controlling record and a single brush for synchronously sensing index points in a column of a succeeding record, a separate circuit controlled by each brush, electromagnetic means conjointly controlled by said circuits including magnetizing means energized in opposing senses by the two circuits and means controlled by said electromagnetic means in accordance with like current conditions during analysis in the two circuits for determining one type of machine operation and in accordance with unlike current conditions during analysis in the two circuits for determining another type of machine operation

16 An automatic control system for a record controlled machine comprising analyzing mechanism including a single brush for successively sensing index points in a column of a controlling record and a single brush for synchronously sensing index points in a column of a succeeding record, a separate circuit controlled by each brush, electromagnetic means conjointly controlled by said circuits including magnetizing means energized in opposing senses by the two circuits, means controlled by said electromagnetic means in accordance with simultaneous changes in current flow in the two circuits for determining one type of machine operation and controlled by said electromagnetic means in accordance with a change in current in one circuit alone at any time during record analysis to determine another type of machine operation and means for delaying the effects of the determined control until the termination of the record analysis

17 An automatic control system for a record controlled machine comprising ana-

lyzing mechanism for sensing index points on a controlling record field and a second analyzing mechanism for sensing index points on a succeeding controlling record field, a circuit controlled by the first-named analyzing mechanism and having its status changed each time said first-named analyzing mechanism senses index points, a second circuit controlled by said second analyzing mechanism to change its status each time the second analyzing mechanism senses index points, and a machine control circuit controlled conjointly by said first and second circuits

18 An automatic control system for a record controlled machine comprising analyzing mechanism for sensing index points on a controlling record field and analyzing mechanism for concurrently sensing index points on the succeeding record field, separate circuits controlled by said mechanisms, an electromagnet in each circuit, each electromagnet having its status changed by its associated analyzing mechanism each time said latter mechanism senses index points, and a machine control circuit conjointly controlled by said electromagnets

19 In an automatic control system for record controlled machines, analyzing elements for a corresponding column of a pair of records for concurrently sensing designations on both records while in motion, and means controlled by either element for modifying machine operation when the designation in one record includes at least one designation differing from those common to and provided on both records in the corresponding columns

20 In an automatic control system for record controlled machines, a single sensing element for each of a plurality of records, means whereby one or other of the elements detects the presence of a designation on one of the records subsequent to the sensing of corresponding designations on the plurality of records, and a machine control device controlled by said means for controlling the operation of the machine

21 In an automatic control system for record controlled machines, a sensing element for each of a pair of records, and means whereby either element causes the signifying of the presence of any designation on a record without a corresponding designation on a succeeding record after sensing of like designations on both records

22 In an automatic control system for record controlled machines, a sensing element for each of a plurality of records, means whereby either element in the movement of the record past the related sensing element detects a designation not corresponding with a designation sensed by the other element, and a machine control device controlled by said means

23. In a machine controlled by records pro-

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vided with plural perforations, analyzing means for concurrently sensing perforations in a plurality of records while in motion, and means for altering machine operations 5 when a perforation occurs in either record when a corresponding perforation does not occur in the other record and which is in addition to like perforations in both records

24 An automatic control system for a tabulating machine comprising a pair of sensing elements, one for each record, means whereby either element detects the difference between any designation or any possible arrangement of designations on one record from any other 15 designation or arrangement of designations on a succeeding record, and a machine control device operated in accordance with such detection

25 An automatic control system for record controlled tabulating machines comprising a machine control device, electrical analyzing devices, each coordinated with one of a plurality of records, and means whereby said analyzing devices detect differences in 25 any designation or arrangement of designations on one record from any other designation or arrangement of designations on another record to operate the machine control device

26 An automatic control system for record controlled machines comprising a machine control device, an analyzing brush for each of a pair of records for simultaneously analyzing designations in both records, and 35 means whereby either analyzing brush detects, to operate the machine control device, a designation on only one record in addition to other and like designations on both records

40 In testimony whereof I hereto affix my signature

JAMES W BRYCE.

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J W BRYCE

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CONTROLLING DEVICE FOR RECORD CONTROLLED MACHINES

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3 Sheets-Sheet 1

Fig. 1.

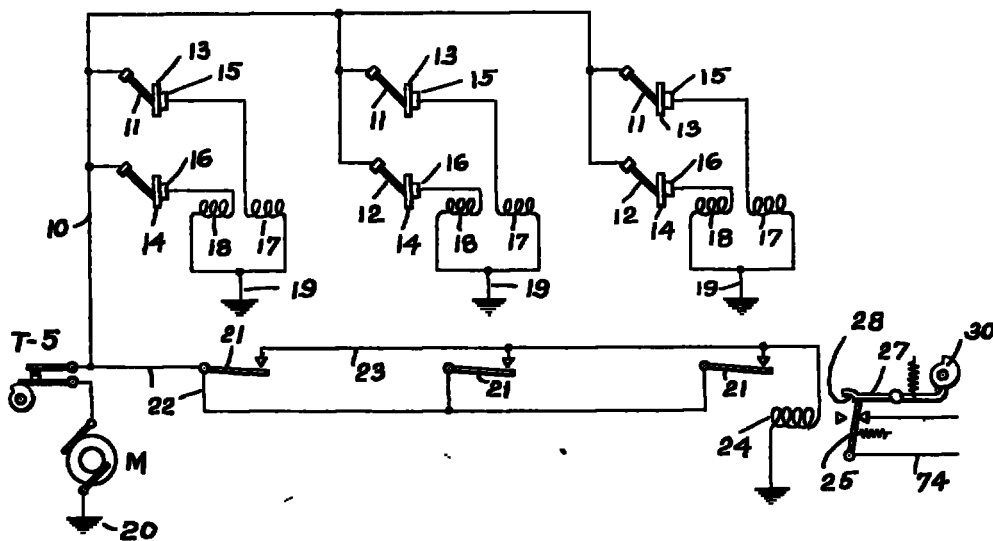
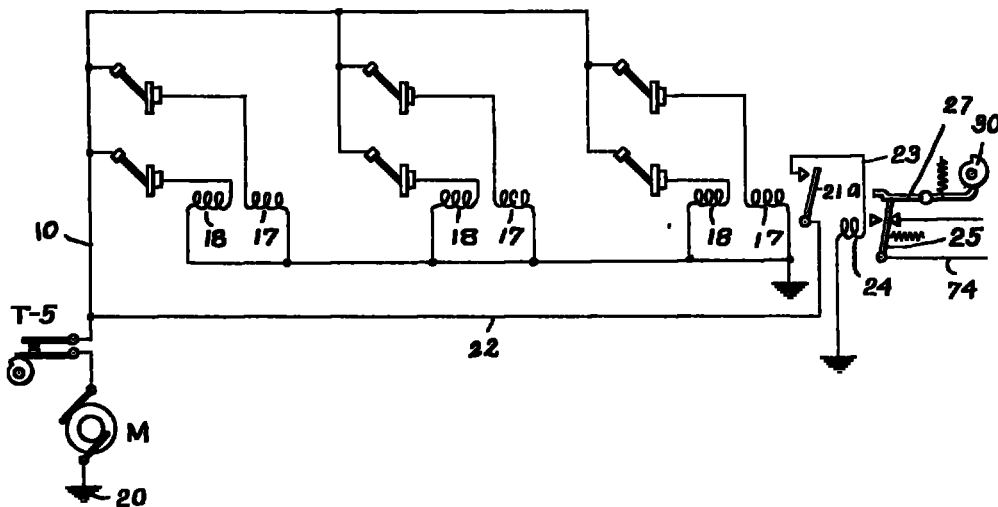


Fig. 2.



Inventor
JAMES W. BRYCE
 By his Attorneys
Cooper, Kern & Dunham

March 21, 1933.

J W BRYCE

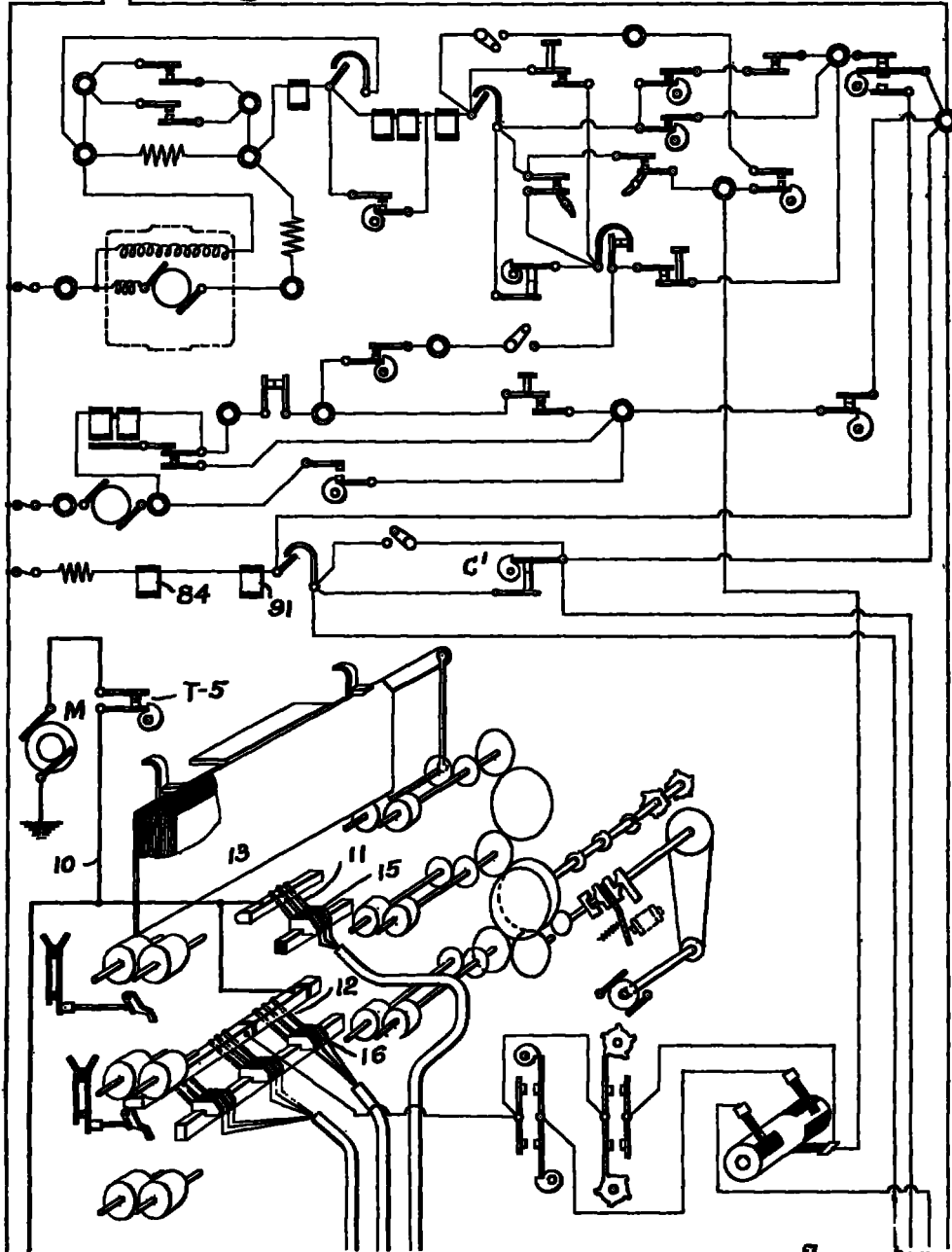
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Fig. 3.



Inventor
James W. Bryce
 By his Attorneys
Cooper, Kent & Dunham

March 21, 1933

J W BRYCE

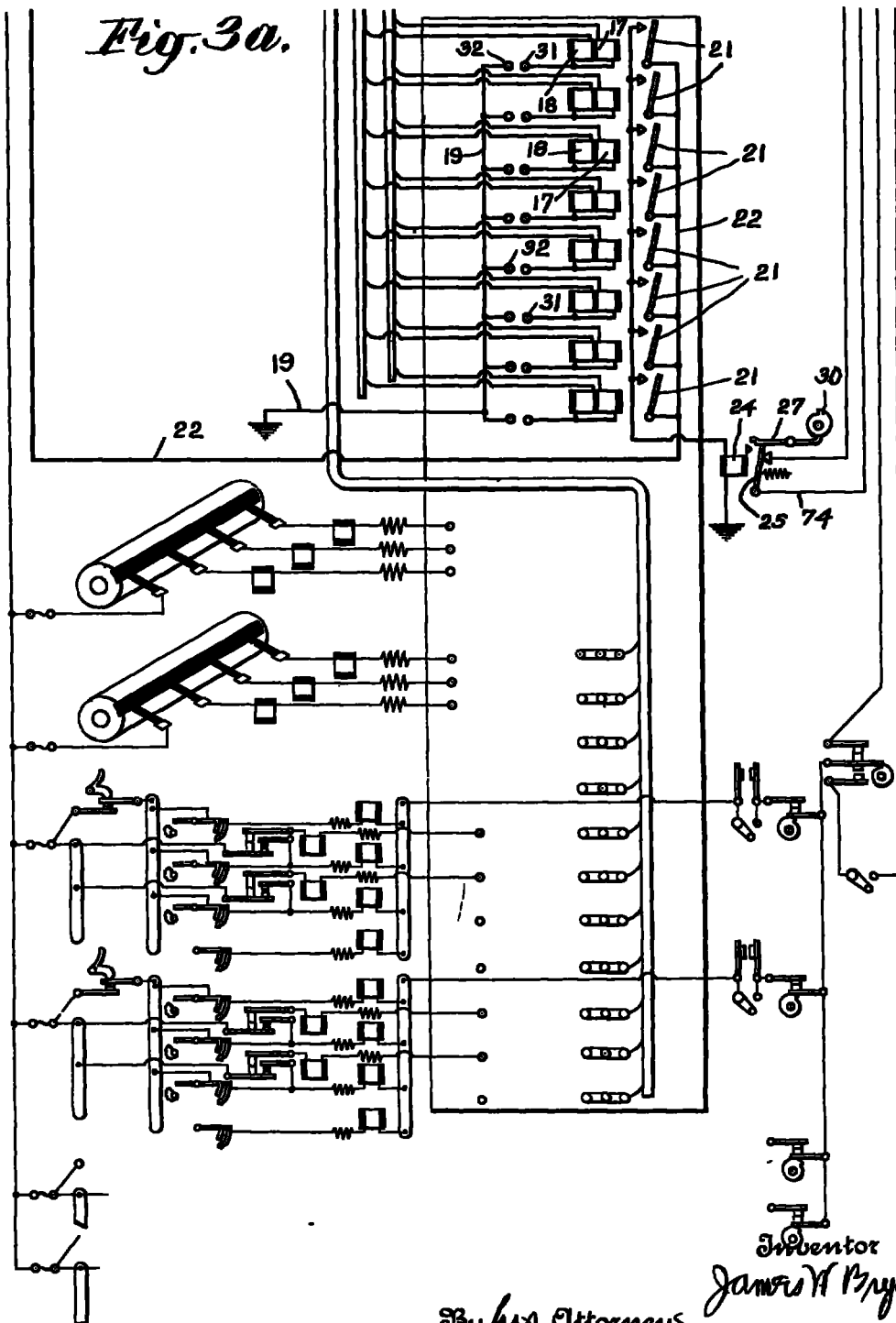
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Fig. 3a.



Inventor
James W Bryce
 By his Attorneys
Cooper, Kern & Dunham