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CARD CONTROLLED COMMUTATOR

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2 Sheets-Sheet 2

FIG. 3

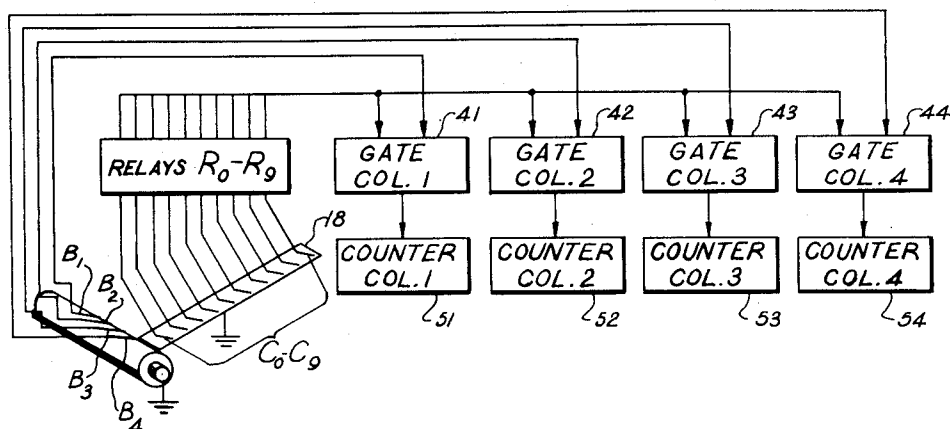
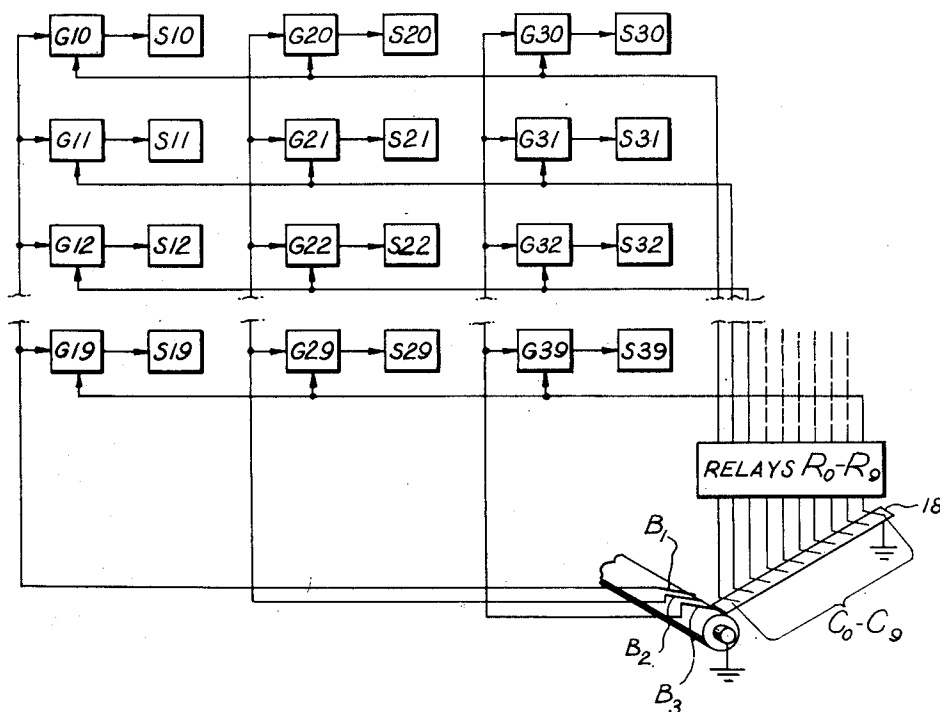


FIG. 4



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CARD CONTROLLED COMMUTATOR

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13 Claims. (Cl. 235—61.11)

This invention relates to business machines adapted to utilize record cards and particularly to commutators for manifesting the significant reading positions of record cards in business machines.

Cards are read in business machines by being fed past column reading brushes which are instrumental to generate data-representing signals as perforations are sensed at selected index points in the respective card columns. The data represented by these selectively located perforations in a card are analyzed by means of a pulse emitter, which generates a pulse for timing or synchronizing purposes as each index point on the card is fed past a reading brush. In conventional practice the emitter comprises a rotating armature adapted to make brief electrical connections sequentially with a series of contacts disposed peripherally about the center of rotation. The rotation of the emitter armature is so timed with respect to the card feed rollers that pulses are generated at the emitter contacts at a rate corresponding to that at which the card index points are fed past the reading brushes.

With an emitter of the conventional type it is necessary to feed each card to the reading brushes at a predetermined point in the basic timing cycle of the machine so that the time relationship of the emitter pulses to the respective index points being fed past the reading brushes is the same for each card. This is usually accomplished by actuating a picker knife at predetermined intervals in the machine timing cycle to pick a card from a stationary stack of cards and start it through the feed rolls. After the cards have been started at the proper time, they may be analyzed at any subsequent station in the machine without being stopped and restarted, provided that the card feed is kept in synchronism with the basic timing cycle of the machine. If, however, the desired state of synchronism is not maintained, as after a punching operation or the like in which the cards are momentarily halted, it is necessary either to delay feeding the card out of the punching station or other stopping point until a proper starting instant has arrived, or subsequently to stop the card in order to restart it in synchronism with the analyzer emitter. It is apparent that this requirement reduces machine speed and efficiency. Moreover, when the emitter is synchronized with both the feeding means and the basic timing cycle of the machine, it is apparent that any slippage of the cards in the feeding means will be likely to cause analyzing errors.

It is an object of this invention to provide an improved commutator for manifesting the position of a record card with respect to a given reading means, which commutator does not require synchronization with the basic timing cycle of the machine.

It is also an object of this invention to provide a commutator adapted for use in analyzing moving record cards which have been started in their travels at random times, or whose movements of necessity have fallen out of step with the basic timing cycle of the machine.

It is another object of this invention to provide a card analyzing commutator which will not be affected by

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slippage of the card while it is being read or prior to its being read.

The above stated objects of this invention are accomplished by the provision of a card analyzing commutator whose operation is controlled by or is responsive to the movement of the card itself.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings which illustrate, by way of example, the principle of the invention and the best modes which have been contemplated of applying that principle.

In the drawings:

Fig. 1 is a perspective view of a feed roller, reading brushes and commutator brushes which may be utilized in carrying out the purposes of the invention.

Fig. 2 is a schematic and circuit diagram of the commutator brushes and the circuits associated therewith.

Fig. 3 is a schematic and block diagram of a device embodying one form of the invention.

Fig. 4 is a schematic and block diagram of a device embodying a second form of the invention.

In Fig. 1 a punched record card 10 of a well known type is shown being fed over a contact roller 12. In the embodiment shown the punched card is fed in the direction of its index point columns and with the "12" index row foremost. Mounted above the contact roller 12 and parallel to its axis is a reading brush block 14. Parallel column reading brushes 16 extend downwardly from the reading brush block 14 and in the direction of card travel. In the absence of a record card the trailing ends of the reading brushes 16 bear against the grounded contact roller 12.

The reading brushes 16 are positioned to cooperate with the respective columns of index points on the record cards. As a card is fed between the contact roller 12 and the reading brushes 16, each of the perforations P in the card permits the momentary contact of a reading brush 16 against the contact roller 12, which is assumed connected to ground potential.

Extending in the direction of card travel from a location adjacent the top of the contact roller 12 is a card guide plate 18 having a flat surface of electrically conductive material adapted to support and guide the record cards as they travel beyond the contact roller 12. A commutator brush block 20 of insulating material, also extending in the direction of card travel, is mounted parallel to and above one side of the card guide plate 18 and perpendicular to the reading brush block 14.

A series of ten commutator brushes C₀—C₉ aligned in the direction of card travel is mounted in the commutator brush block, with the ends of these brushes likewise extending individually in the general direction of card travel and contacting the card guide plate 18 in the absence of a record card. Each of the commutator brushes C₀—C₉ corresponds to a respective row of index points on the record cards, and the brushes are spaced from each other by a distance equal to the spacing between the rows of index points on the record cards. The point at which each commutator brush contacts the card guide plate 18 is spaced from the line of contact of the reading brushes 16 on the contact roller 12 by a distance equal to the spacing between the forward "12" edge of the record cards and the corresponding row of index points on the record cards.

Although the conventional record card has twelve rows of index points, only ten of these, the "0" to "9" rows, are utilized in the embodiments shown and described. It is to be understood that this is done for the purpose of simplifying the illustration and description and that modification of the embodiments to utilize all twelve rows or any other desired number of rows is within the concept of this invention. It is also to be understood that the

card may be fed with any desired edge foremost without altering the concept of the invention.

As a record card is fed over contact roller 12 and under the reading brushes 16, the forward edge of the card will pass successively under the commutator brushes C_0 - C_9 causing them to be sequentially lifted and insulated from the grounded card guide plate 18. The location of the commutator brush block 20 at one side of the card guide plate 18 permits the passage of the unperforated margin of the record card under the commutator brushes. The spacing of the commutator brushes C_0 - C_9 from the reading brushes 16, as previously explained, is such that as each commutator brush becomes disconnected from ground potential by the passage of a record card, the corresponding row of index points on the record card at that instant is about to pass between the reading brushes 16 and the contact roller 12.

Fig. 2 shows the individual relay circuits associated with the commutator brushes C_0 - C_9 . The connection and operation of the circuit of commutator brush C_0 will be considered first. In the absence of a record card this brush contacts the card guide plate 18, which is at ground potential. The terminal of the commutator brush C_0 is connected through a resistor 30 to a source of positive potential. A condenser 32 and the relay coil of a relay R_0 are serially connected across the resistor 30. A diode 34 is connected across the coil of the relay R_0 with its anode connected to the positive potential side of the coil. The armature of relay R_0 is normally open and is connected to an output line L_0 . The contact of relay R_0 is connected through a line 40 to ground potential. In the absence of a record card a circuit is established from ground potential through the card guide plate 18, the commutator brush C_0 and the resistor 30 to a source of positive potential. The potential drop across the resistor 30 maintains an equal potential drop across the condenser 32.

Commutator brush C_0 is the first commutator brush encountered by a record card as it is fed past the reading brushes B_1 - B_5 . As the contact of the commutator brush C_0 with the card guide plate 18 is broken, the potential across condenser 32 caused by the current flow through the resistor 30 is removed. Condenser 32 thereupon discharges through the resistor 30 and the coil of relay R_0 , causing a voltage pulse through the coil approximating a sawtooth shape with an amplitude and slope predetermined by the values of the applied voltage and the circuit components. The relay R_0 acts as an amplitude discriminator, causing the relay armature to close against its contact for a predetermined period of time. As the forward edge of the record card passes under the commutator brush C_0 , therefore, the armature of relay R_0 closes and the output line L_0 is connected to ground potential for a predetermined period of time. The spacing between the commutator brush C_0 and the column reading brushes B_1 - B_5 , and the velocity of card travel are arranged so that the period for which the armature of relay R_0 is closed corresponds in time with the passage under the reading brushes B_1 - B_5 of the zero index point row on the record card.

The remaining commutator brushes C_1 - C_9 have identical associated circuits and relays R_1 - R_9 , each of which operates in the same manner as does the commutator brush C_0 and its associated circuit and relay R_0 . Each relay R_0 - R_9 has its armature connected to a separate output line L_0 - L_9 and has its contact connected through a common line 40 to ground potential. As a record card passes under the commutator brushes C_0 - C_9 the armatures of relays R_0 - R_9 are successively closed, each for a predetermined period of time. The closing of each of the armatures of relays R_0 - R_9 manifests the passage under the column reading brushes B_1 - B_5 of a respective row of index points of the record card.

The commutator brushes C_0 - C_9 regain contact with

the card guide plate 18 after the card has passed beyond the brushes. The potential drop across resistor 30 is re-established as the current flow is restored from the positive potential source through resistor 30, the commutator brush C_0 and the card guide plate 18 to ground potential. The potential drop across resistor 30 causes the condenser 32 to be recharged through the diode 34. Diode 34 parallels the coil of relay R_0 and prevents the relay from being actuated as the condenser 32 is recharged. In the same manner the condensers associated with the circuits of the remaining commutator brushes C_1 - C_9 are recharged without actuating the associated relays R_1 - R_9 as the card passes out of the analyzing station. As a following card enters the analyzing station, the cycle is repeated, the successive closing of the armatures of relays R_0 - R_9 causing each of the output lines L_0 - L_9 to be sequentially grounded for a predetermined period, thereby manifesting the passage of respective rows of card index points past the reading brushes B_1 - B_5 .

The output lines L_1 - L_9 may be connected in common to transmit a pulse sequence to utilization devices in timed relationship with the passage of card index points past the column reading brushes. Alternatively the output lines L_0 - L_9 may be connected distributively to separate utilization devices which are operated selectively as respective rows of card index points are fed past the column reading brushes. Examples of the two methods are shown in Figs. 3 and 4, respectively.

Fig. 3 shows an analyzer with a card controlled commutator in which numerical data punched in record cards are converted into pulse sequences and transmitted to pulse counters. The commutator brushes C_0 - C_9 contact the grounded card guide plate 18 in the absence of a record card. The commutator brush terminals are connected to their respective relays R_0 - R_9 in the manner described with reference to the circuits of Fig. 2. The output lines of the relays R_0 - R_9 are connected in common to each of four gating devices 41, 42, 43 and 44. As a record card passes through the analyzing station a pulse of predetermined duration appears at each of the relay outputs, each pulse corresponding to the passage of a respective row of card index points past the row of reading brushes B_1 , B_2 , B_3 and B_4 . A sequence of pulses in timed relationship to the passage of the card thus appears in the connection common to the outputs of relays R_0 - R_9 and is applied to each of the four gating devices 41, 42, 43 and 44.

The four column reading brushes B_1 , B_2 , B_3 and B_4 , which brush against the grounded contact roller 12, are provided for sensing perforations in respective columns or record cards. The terminal of each reading brush is connected to a respective one of the gating devices 41, 42, 43 and 44. Four counters 51, 52, 53 and 54 are provided for storing the data analyzed from the four card columns sensed respectively by the reading brushes B_1 , B_2 , B_3 and B_4 . Each of the counters 51, 52, 53 and 54 is connected to the output of a respective one of the gating devices 41, 42, 43 and 45.

The gating devices 41, 42, 43 and 44 are adapted to pass to their associated counters, in the absence of pulses from the reading brushes, the pulse sequence appearing at the common output of relays R_0 - R_9 . When a reading brush encounters a perforation in a card a pulse of ground potential is applied to the associated gating device, causing the gating device to block admittance to its associated counter of the remaining pulses from the relays R_0 - R_9 . With this arrangement each of the counters receives a number of pulses corresponding to the numbers punched in the respective card columns. The numbers can be stored and manifested in the counters and utilized in ways well known to the art. Reciprocal numbers can be entered into the counters by reversing the operation of the gating devices so that they normally are closed and do not open to pass pulses from the re-

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lays R_0 - R_9 until perforations are sensed in the respective card columns.

It is assumed in these examples that each card is fed with its "12" edge foremost. The time relationship of the pulses caused by the sensing of perforations in the card columns with respect to the pulses from the outputs of relays R_0 - R_9 must be determined in each case so as to give the proper numerical input to the counters. Means (not shown) may be provided to reset the counters before the passage of a following card or to provide for the accumulation of additional numerical entries into the counters.

Fig. 4 shows an analyzer utilizing a card controlled commutator operated distributively to store punched card data. A storage element is provided for each index point position in the three columns of card index points to be analyzed. Ten of the storage elements S_{10} - S_{19} correspond to the "0" to "9" index point positions in the first one of the columns. The storage elements S_{20} - S_{29} and S_{30} - S_{39} similarly correspond to the index point positions in the second and third of the columns to be analyzed. These storage elements S_{10} - S_{39} store and manifest in well known ways the presence or absence of perforations in the corresponding index positions of a card.

Each storage element is connected to the output of a similarly numbered coincidence gate, G_{10} - G_{39} . The ten coincidence gates G_{10} - G_{19} corresponding to the index point positions in the first column are connected to the column reading brush B_1 . The coincidence gates G_{20} - G_{29} are connected in common to the column reading brush B_2 and the coincidence gates G_{30} - G_{39} are connected in common to the column reading brush B_3 .

The ten commutator brushes C_0 - C_9 are connected to and actuate their respective relays R_0 - R_9 in the manner described with reference to Fig. 2. The output of relay R_0 is connected to the coincidence gates G_{10} , G_{20} and G_{30} . Similarly each of the outputs of the remaining relays R_1 - R_9 is connected in common to the respective row of coincidence gates corresponding to the row of card index points with which the relay is associated.

Each of the storage elements S_{10} - S_{39} is adapted to manifest the presence of a perforation in a corresponding card index position whenever its associated coincidence gate receives simultaneous ground potential pulses from its connected column reading brush and from its connected commutator relay. As a record card is fed past the column reading brushes B_1 - B_3 the front edge of the card successively passes under and insulates each of the commutator brushes C_0 - C_9 . As the contact of each commutator brush with ground potential is broken the respective relay armature closes against its grounded contact for a predetermined period. The spacing of each of the commutator brushes C_0 - C_9 from the reading brushes B_1 - B_3 is such that the closing of the associated relay corresponds in time to the passage of a respective row of card index points past the reading brushes. Thus, each row of coincidence gates in turn receives a ground potential pulse from its connected commutator relay at the same time a corresponding row of card index points passes the reading brushes B_1 - B_3 .

A perforation in a particular column of index points in a record card causes a ground potential pulse to pass through the respective column reading brush to the connected row of coincidence gates which corresponds to the particular column of index points. The coincidence gate which receives a ground potential pulse from its connected column reading brush coincident in time with the receipt of a ground potential pulse from its connected commutator relay will cause its associated storage element to manifest the presence of a perforation in the corresponding card index point position. The manifestations may be utilized or the storage elements reset by means (not shown) well known to the art before a following card enters the reading station.

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It is to be understood that the words "row" and "column" referring to card index point positions are relative terms and can be retained or interchanged to refer to index point positions on cards which are fed endwise instead of sidewise through a record card controlled machine.

The methods of applying the invention described and shown in Figs. 3 and 4 are merely illustrative of two embodiments of the card controlled commutator, and many other applications of the invention will be apparent to those skilled in the art. The embodiments shown can easily be adapted to operate with all twelve rows or any other number of rows of a conventional business machine card. The embodiments also can be adapted to other kinds of record cards which can be fed through the machine in any desired manner. It is an obvious modification of the disclosed embodiments and is within the scope of the invention to place the commutator brushes before instead of after the reading brushes so that pulses manifesting the card position are generated as the commutator brushes slip off the rear edge of the record card as it is fed under the reading brushes. Similarly the commutator brushes could be so spaced from the reading brushes that the pulses manifesting the card position would be generated as each of the commutator brushes in turn encountered a perforation punched into the record cards.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to preferred embodiments thereof, 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. It is the intention, therefore, to be limited only as indicated by the scope of the claims appended hereto.

The invention is claimed as follows:

1. In a business machine adapted to utilize record cards and which has card reading means and card feeding means associated therewith, a commutator for successively manifesting a plurality of predetermined significant positions occupied by each of a series of record cards with respect to the card reading means comprising, in combination, a plurality of sensing devices disposed in a given sequential arrangement along the direction of card travel for successively sensing the presence of each record card as it is fed past the card reading means, and a plurality of manifesting devices each connected to a respective one of said sensing devices for manifesting the transition of the respective sensing device from one state to another caused by passage of a predetermined edge of each record card, each of said sensing devices being so spaced from the card reading means that each manifesting device manifests a particular significant position occupied by a record card with respect to the card reading means.

2. In a business machine adapted to utilize record cards and which has card reading means and card feeding means associated therewith, a commutator for successively manifesting a plurality of predetermined significant positions occupied by each of a series of record cards with respect to the card reading means comprising, in combination, a plurality of sensing devices disposed in a given sequential arrangement along the direction of card travel for successively sensing the presence of each record card as it is fed past the card reading means, and a plurality of pulse generating devices each connected to a respective sensing device for generating a pulse in response to the transition of the respective sensing device from one state to another caused by the passage of a predetermined edge of each card, each of said sensing devices being so spaced from the card reading means that each pulse from a particular pulse generating device manifests a particular significant position occupied by a record card with respect to the reading means.

3. In a business machine adapted to utilize record cards and which has card reading means and card feeding means associated therewith, a commutator for successively manifesting a plurality of predetermined significant positions occupied by each of a series of record cards with respect to the card reading means comprising, in combination, a plurality of sensing devices disposed in a given sequential arrangement along the direction of card travel at intervals equal to the spacing between adjacent rows of card index points for successively sensing the presence of each record card as it is fed past the card reading means, and a plurality of manifesting devices each connected to a respective one of said sensing devices for manifesting the transition of the respective sensing device from one state to another caused by the passage of a predetermined edge of each record card, each of said sensing devices being so spaced from the card reading means that said plurality of manifesting devices manifest in succession a given positional relationship of successive rows of card index points on each record card with respect to the card reading means.

4. In a business machine adapted to utilize record cards and which has card reading means and card feeding means associated therewith, a commutator for successively manifesting a plurality of predetermined significant positions occupied by each of a series of record cards with respect to the card reading means comprising, in combination, a plurality of commutator brushes disposed in a given sequential arrangement along the direction of card travel for successively sensing the presence of each record card as it is fed past the card reading means, and a plurality of pulse generating devices each connected to and controlled by a respective one of said commutator brushes for generating a pulse in response to the transition from one state to another state caused in said commutator brush by the sensing of the passage of a predetermined edge of each record card, said commutator brushes being so spaced from the card reading means that each pulse from a particular pulse generating device manifests a particular significant reading position occupied by a record card with respect to the card reading means.

5. In a business machine adapted to utilize record cards and which has card reading means and card feeding means associated therewith, a commutator for successively manifesting a plurality of predetermined significant positions occupied by each of a series of record cards with respect to the card reading means comprising, in combination, a plurality of commutator brushes disposed in a given sequential arrangement along the direction of card travel at intervals equal to the spacing between adjacent rows of card index points for successively sensing the presence of each record card as it is fed past the card reading means, and a plurality of pulse generating devices each connected to and controlled by a respective one of said commutator brushes for generating a pulse of predetermined duration in response to the transition from one state to another state caused in said commutator brush by the sensing of the passage of a predetermined edge of each record card, said commutator brushes being so spaced from the card reading means that said pulse generating devices generate a sequence of pulses in which each pulse has a predetermined duration corresponding in time to the passage of a particular row of card index points past a given position with respect to the card reading means.

6. In a business machine adapted to utilize record cards and which has card reading means and card feeding means associated therewith, a commutator for successively manifesting a plurality of predetermined significant positions occupied by each of a series of record cards with respect to the card reading means comprising, in combination, a plurality of commutator brushes disposed in a given sequential arrangement along the direction of card travel, contact means against which each of said commutator brushes bears for completing an electrical circuit,

each of said electrical circuits being adapted to be interrupted by the passage of each record card as it is fed between said commutator brushes and said contact means so that two transitions occur in the condition of each of said electrical circuits with the passage of each record card, and a plurality of pulse generating devices each connected to and controlled by a respective commutator brush for generating a pulse in response to a given one of said two transitions occurring with the passage of each record card, said commutator brushes being so spaced from the card sensing means that each pulse from a particular pulse generating device manifests a particular significant reading position occupied by a record card with respect to the card reading means.

7. In a business machine adapted to utilize record cards and which has card reading means and card feeding means associated therewith, a commutator for successively manifesting a plurality of predetermined significant positions occupied by each of a series of record cards with respect to the card reading means comprising, in combination, a plurality of commutator brushes disposed in a given sequential arrangement along the direction of card travel at intervals equal to the spacing between adjacent rows of card index points, contact means against which each of said commutator brushes normally bears to complete an electrical connection, said commutator brushes and said contact means being adapted to have said record cards pass between them so that said electrical connections are opened by the passage of the forward edge and closed by the passage of the rearward edge of each record card, a source of electrical potential having one of its sides connected to said contact means, a plurality of pulse forming devices each connected between a respective commutator brush and the other side of said source of electrical potential for forming a current pulse having a given polarity when said electrical connection is opened and having the opposite polarity when said electrical connection is closed, and a discriminating device connected to each of said pulse forming devices for generating a manifesting pulse of predetermined duration in response to each current pulse of a predetermined polarity, said commutator brushes being so spaced from the card reading means that each manifesting pulse of predetermined duration corresponds in time to the passage of a particular row of card index points past a predetermined position with respect to the card reading means.

8. In a business machine adapted to utilize record cards and which has card reading means and card feeding means associated therewith, a commutator for successively manifesting a plurality of predetermined significant positions occupied by each of a series of record cards with respect to the card reading means comprising, in combination, contact means adjacent the card reading means and extending in the direction of card travel, a plurality of commutator brushes disposed in a given sequential arrangement along the direction of card travel at intervals equal to the spacing between adjacent rows of card index points, each of said commutator brushes normally bearing against said contact means to make an electrical connection, a source of electrical potential having one of its sides connected to said contact means, a plurality of resistors, each resistor being connected between a respective commutator brush and the other side of said source of electrical potential to complete a plurality of parallel electrical circuits through said commutator brushes, said commutator brushes and said contact means being adapted to be insulated from each other by the passage of each record card which is fed between them thereby opening said electrical circuits, a condenser and a relay coil serially connected across each of said resistors, a unidirectional current conductor connected across each of said relay coils to conduct current in a given direction, each of said relay coils having an associated relay armature which is adapted to be actuated by current flow through the associated relay coil, whereby the passage

of each edge of a record card past each commutator brush causes the associated condenser to change potential and a given one of said potential changes caused by the passage each card causes the associated relay armature to be actuated for a predetermined period of time, said commutator brushes being so spaced from the card reading means that the actuation of each relay armature corresponds in time to a predetermined significant position occupied by a record card with respect to the card reading means.

9. In a business machine adapted to utilize record cards and which has card reading means and card feeding means associated therewith, a commutator for successively manifesting a plurality of predetermined significant positions occupied by each of a series of record cards with respect to the card reading means comprising, in combination, a plurality of commutator brushes disposed in a given sequential arrangement along the direction of card travel for successively sensing the presence of each record card as it is fed past the card reading means, each commutator brush corresponding to a respective row of card index points and being spaced from the card reading means by a distance equal to the spacing between the corresponding row of card index points and a given edge of each record card, and a plurality of pulse generating devices each connected to and controlled by a respective commutator brush for generating a pulse of predetermined duration in response to the transition from one state to another state caused in the commutator brush by the sensing of the passage of said given edge of each record card, whereby each pulse from a particular pulse generating means manifests the passage of a particular row of card index points past the card reading means.

10. In a business machine adapted to utilize record cards, the combination of card reading brushes positioned to cooperate with columns of index points on record cards for sensing perforations in the record cards, card feeding means associated with said card reading brushes, a plurality of commutator brushes disposed in a sequential arrangement in the direction of card travel beyond said card reading brushes, the distance of each commutator brush from said card reading means being equal to the distance of respective rows of card index points from the forward edge of each individual record card, an electrical potential source against which said commutator brushes bear in the absence of a record card, said commutator brushes and said electrical potential source being adapted to have record cards fed between them so that said commutator brushes are insulated from said electrical potential source causing the potential on each of said commutator brushes to be changed, and a plurality of pulse generators each connected to and controlled by a respective commutator brush for generating a pulse in response to the change of potential caused on the respective commutator brush by the passage of the forward edge of each record card, whereby the particular pulse generator which generates a pulse simultaneously with the sensing of a perforation in a particular column by a card reading brush manifests the particular row of card index points in which said perforation is located.

11. In a business machine adapted to utilize record cards, the combination of card reading brushes positioned to cooperate with columns of index points on record cards for sensing perforations in the record cards, card feeding means associated with said card reading brushes, a plurality of commutator brushes disposed in a sequential arrangement along the direction of card travel at intervals equal to the spacing between adjacent rows of card index points, an electrical potential source against which said commutator brushes bear in the absence of a record card, said commutator brushes and said electrical potential source being adapted to have record cards fed between them so that said commutator brushes are insulated from said electrical potential source and the potential on each of said commutator brushes is changed, a plurality of

pulse generators each connected to and controlled by a respective commutator brush for generating a pulse of predetermined duration in response to the change of potential caused on the respective commutator brush by the passage of a given edge of each record card, and an output means connected to all of said pulse generators for deriving a sequence of pulses from said pulse generators as each record card is fed between said commutator brushes and said electrical potential source, said commutator brushes being so spaced from said card reading means that each of said pulses corresponds in time to the passage of a particular row of card index points past a given position with respect to said card reading means.

12. In a business machine adapted to utilize record cards, the combination of card reading brushes positioned to cooperate with columns of index points on record cards for sensing perforations in the record cards, card feeding means associated with said card reading brushes, a plurality of commutator brushes disposed in a given sequential arrangement along the direction of card travel at intervals equal to the spacing between adjacent rows of card index points for successively sensing the presence of each record card as it is fed past said card reading brushes, a plurality of pulse generating devices each connected to and controlled by a respective one of said commutator brushes for generating a pulse of predetermined duration in response to the transition from one state to another state caused in said commutator brush by the sensing of the passage of a given edge of each record card, said commutator brushes being so spaced from said card reading brushes that each of said pulses corresponds in time to the passage of a particular row of card index points past a given position with respect to said card reading brushes, a plurality of gating devices having an opened and a closed position, each connected to a respective one of said card reading brushes and each having another connection in common to each of said pulse generating devices, and a counting device associated with each of said gating devices for counting pulses from said pulse generators when said gating devices are in an opened position, each of said gating devices being adapted to have a given position before the sensing of a perforation and to have its position changed in response to the sensing of a perforation by its connected card reading brush, whereby the number of pulses counted by each of said counting devices during the passage of each record card is indicative of the value of a data signifying perforation located at a selected index point position in the respective card column of said record card.

13. In a business machine adapted to utilize record cards, the combination of card reading brushes positioned to cooperate with columns of index points on record cards for sensing perforations in the record cards, card feeding means associated with said card reading brushes, a plurality of commutator brushes for successively sensing the presence of each record card as it is fed past said card reading brushes, said commutator brushes being disposed in a sequential arrangement at spaced intervals in the direction of card travel, the distance from each commutator brush to said card reading means being equal to the distance of respective rows of card index points from a given edge of each individual record card, a plurality of pulse generators each connected to and controlled by a respective one of said commutator brushes for generating a pulse of predetermined duration in response to the transition from one state to another state caused in said commutator brush by the sensing of the passage of said given edge of each record card, whereby each pulse generator generates a pulse which corresponds in time to the passage of a particular row of card index points past said card reading brushes, a plurality of coincidence gates each corresponding to a respective card index point position, each of said card reading brushes

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being connected to one input of each of the coincidence gates corresponding to a respective column of card index point positions, each of said pulse generators being connected to the other input of each of the coincidence gates corresponding to a respective row of card index point positions, each coincidence gate being adapted to manifest

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the presence of a perforation in the corresponding card index point position in response to the sensing of a perforation by its connected card reading brush and a simultaneous pulse from its connected pulse generator.

No references cited.