

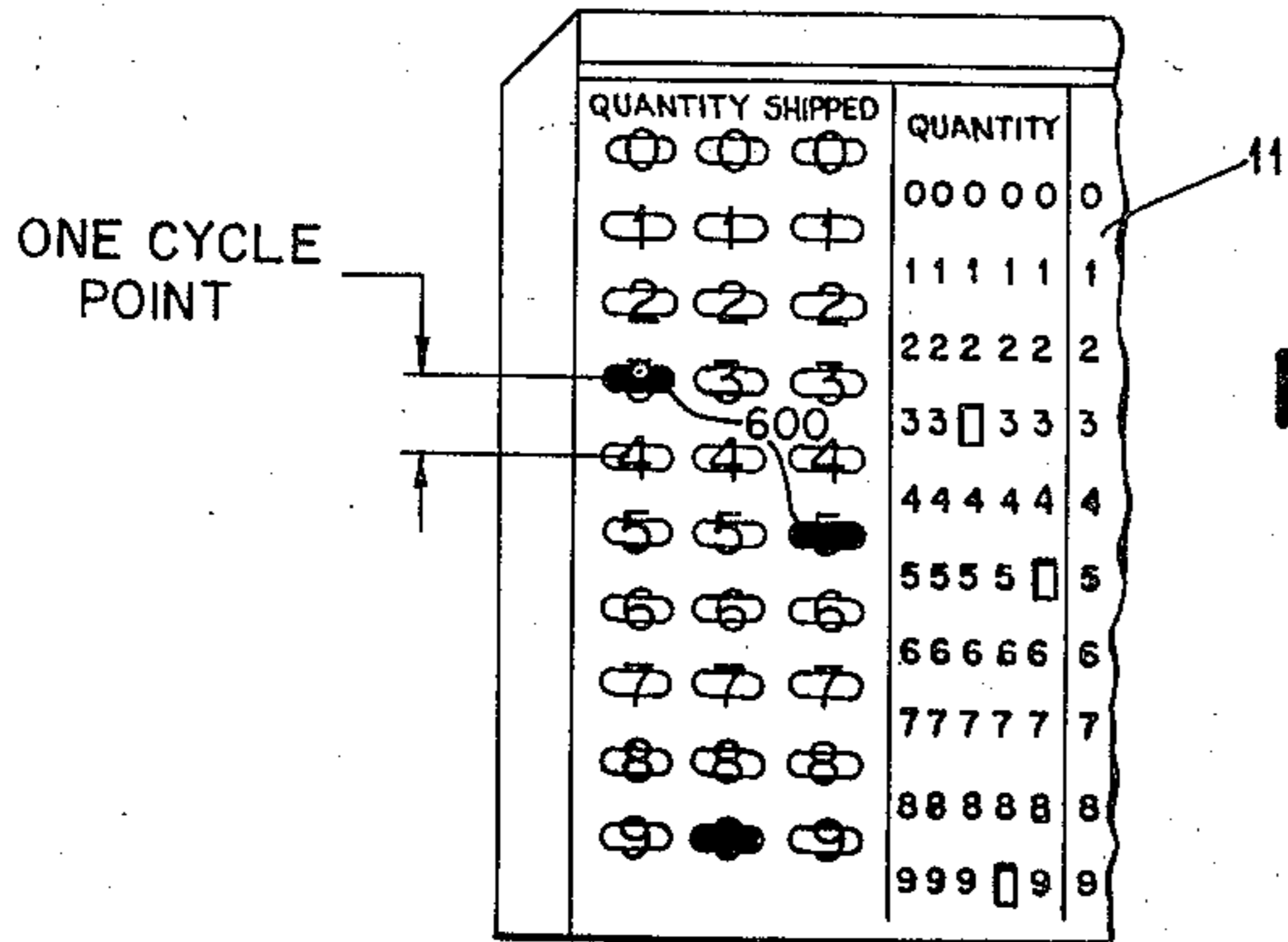
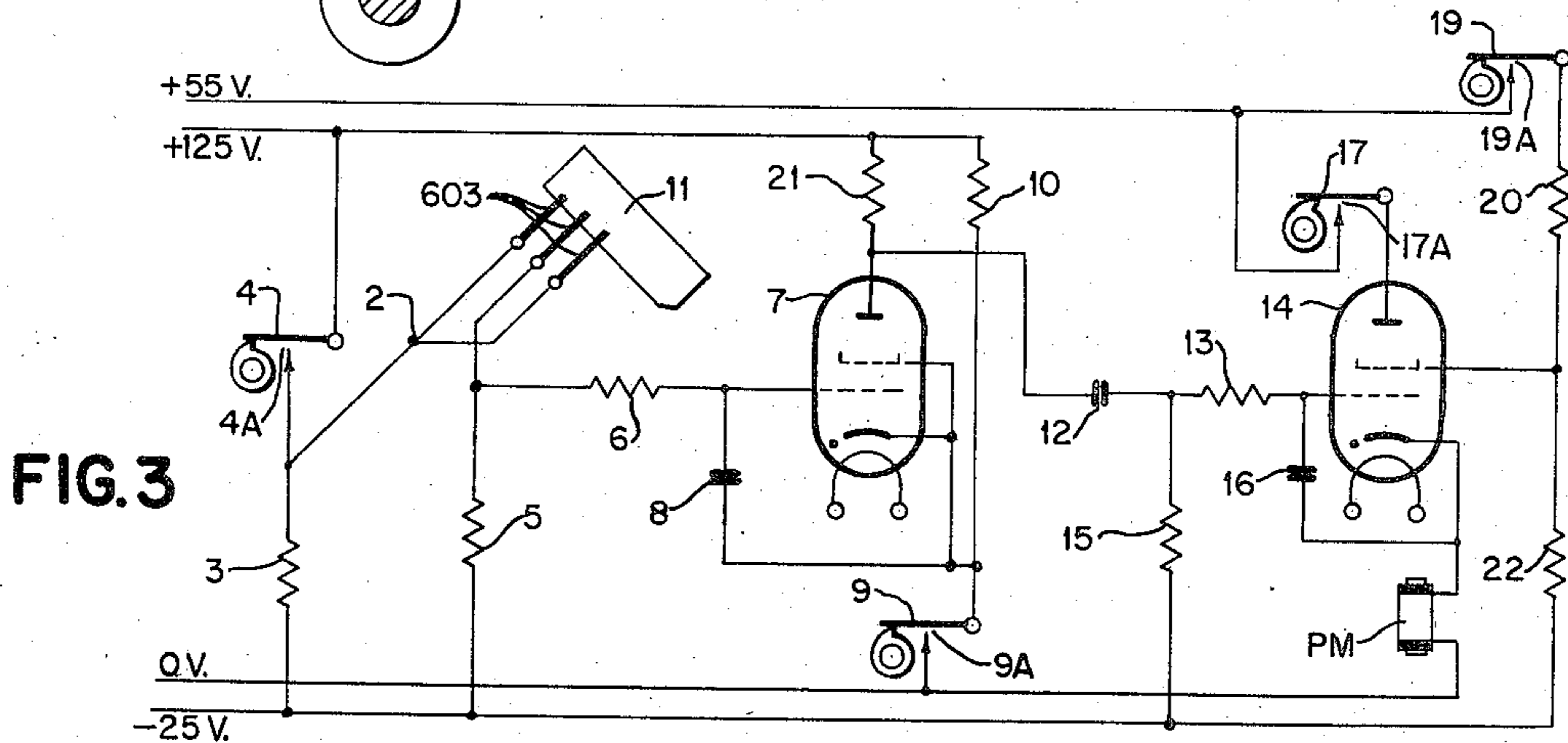
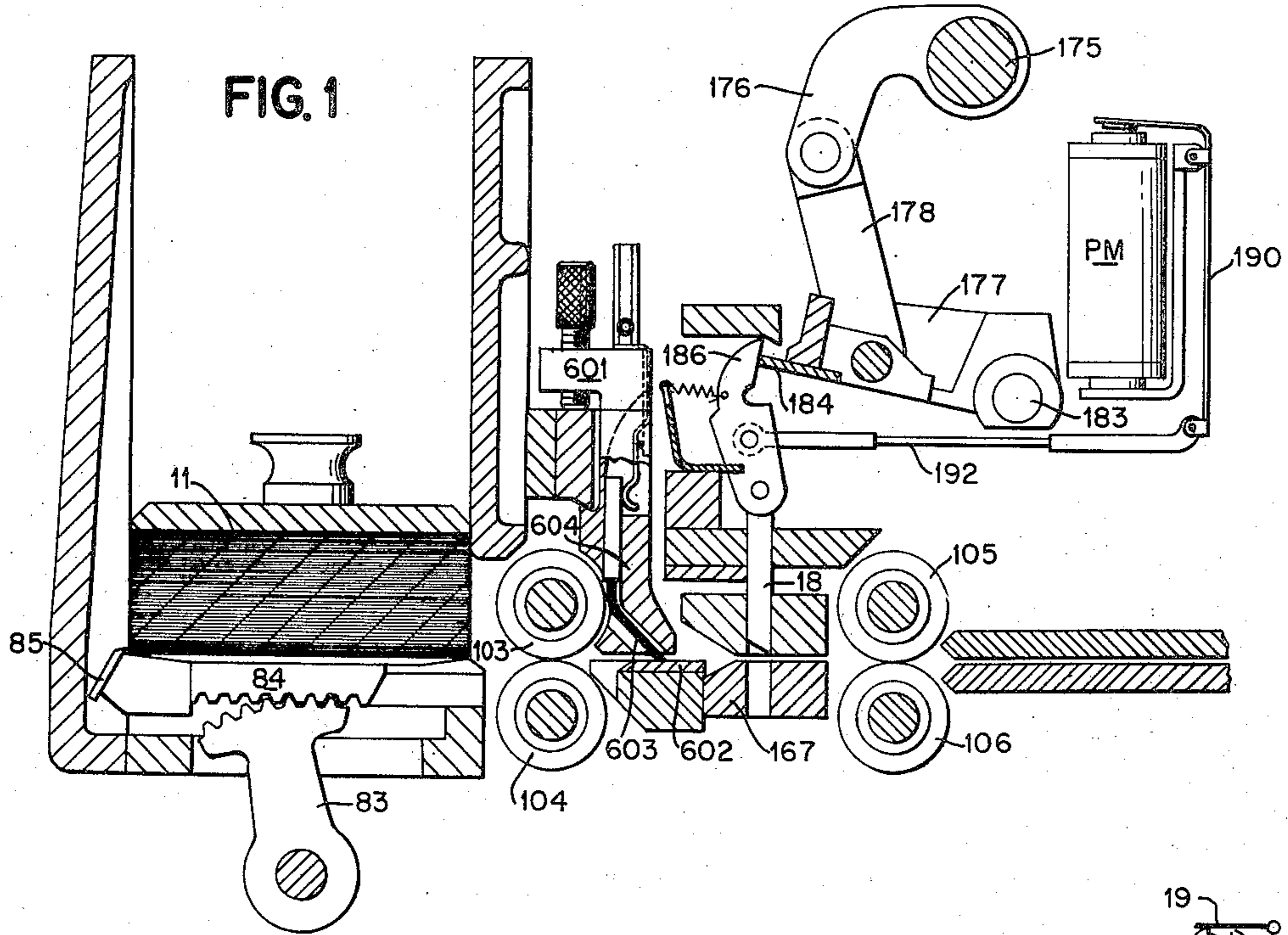
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R. WIDMER

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DELAY NETWORK

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INVENTOR.
RUDOLF WIDMER

BY

William Lang

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DELAY NETWORK

Rudolf Widmer, Stuttgart, Germany, assignor to International Business Machines Corporation, New York, N. Y., a corporation of New York

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This invention relates to a machine for perforating record cards, and, more particularly to a perforating machine, wherein, differentially positioned conductive marks are sensed on successive record cards at one time interval for effecting the punching of perforations thereon in positions corresponding to the sensed conductive marks at another time interval.

In mark sensing devices pencil marks of conductive material (e. g. high graphite content lead) which were previously applied on a record material are electrically sensed by contact brushes, after which the sensed data is punched in some desired column of the card. In such devices, three contact brushes per card column are used, the two outer brushes being connected together and to a power source and the central brush being insulated from the other two brushes. During the passage of cards through the sensing station, the presence of a suitable mark electrically connects either or both of the outer brushes with the central brush and develops a pulse for operating a punch magnet at the punch station. However, since it is desired to punch this sensed information in the same card, the mark sensing pulse must be delayed until the corresponding column of the card is below the punch magnet. A mark sensing and punching device of this character is disclosed in U. S. Patent Nos. 2,007,391, 2,275,396 and Reissue Patent No. 21,133.

In the disclosed mark sensing and punching arrangement $1\frac{1}{2}$ cycle points separate the mark sensing brush location from the punch station. Since each mark location on the card is $\frac{1}{2}$ cycle point above the corresponding hole location, this means that two cycle point delay (equivalent to approximately 80 milliseconds) is necessary from the time a mark is sensed until a punch should operate. In the invention disclosed in Patent No. 2,275,396 this needed delay is accomplished by a rotary type of data storage means, which is operated in synchronism with the record card feeding mechanism.

The present invention is an improved delay means which is capable of delaying the sensed pulse for the required time interval prior to operating the punch magnet. The delay means is composed of a group of mechanical and electronic components whose synchronized operation produces the required two cycle point delay. As one pair of cam contacts closes each time that a mark on a moving card is sensed at the sensing station, the pulse developed energizes an electronic circuit which operates in conjunction with other cam contacts to energize the corresponding punch magnet to accomplish the desired punching operation.

Accordingly, the principal object of the present invention is to provide an improved delay means between the sensing station and the punch station in a record controlled perforating machine.

Another object is to provide an efficient delay means which is capable of compensating in time for the physical distance between the sensing station and the punch station and between the mark location and the corresponding hole location on the card.

Other objects of the invention will be pointed out in

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the following description and claims and illustrated in the accompanying drawings which disclose, by way of example, the principle of the invention and the best mode which has been contemplated of applying that principle.

In the drawings:

Fig. 1 is a sectional elevation view of a record controlled perforating machine showing the feeding, sensing and perforating devices.

Fig. 2 is a detailed view showing a portion of the record card.

Fig. 3 is a schematic diagram of the invention.

In Fig. 1 is shown the essential elements of the card controlled perforating machine disclosed in Reissue Patent No. 21,133 referred to hereinabove. Only that part of the machine containing the mark sensing and perforating mechanism is illustrated. In briefly explaining the operation of this part of the machine, the same reference characters are employed as in this patent to facilitate the description thereof.

The record cards containing the conductive marks are placed in hopper P, and are fed individually by oscillating arm 83, reciprocating slide 84, and picker knife 85 to the feed rollers 103 and 104. The individual cards are then fed by the said feed rollers past a mark sensing station, which is disposed ahead of the punching station. The mark sensing station is composed of the sensing brush assembly 601, which contains a plurality of spaced sets of stranded wires 603 in an insulating member 604, and an insulating bar 602. The said sensing brushes are arranged with respect to the punching station so that the mark positions on the cards are sensed two cycle points before the corresponding mark positions sensed are fed to the punching station.

The delay circuit of Fig. 3 is controlled by a set of said sensing brushes 603, upon sensing the conductive marks, for storing the sensed data for two machine cycle points. At the end of this time interval, as the card is moved into the punch station the delay circuit effects the energization of the related punch magnet PM to perforate the card in the positions corresponding to the sensed marks. One such delay circuit is provided between each set (three wires) of brushes 603 and a particular punch magnet PM.

Energization of said magnet PM rocks its armature structure 190, drawing a link 192 to the right, to effect coupling between an interposer 186 and a plate 184. The plate 184 is carried by member 177 pivoted at 183 and oscillated by means of a link 178 connected to an arm 176 on shaft 175. The desired punch 18 is brought down into die 167 when the associated interposer 186 is coupled to plate 184. Rollers 105 and 106 then convey the punched card to the usual stacker.

Referring to Fig. 2, there is shown a partial card with conductive marks in index positions "3," "9" and "5," indicating that 395 is the quantity of the item identified by the card. It will be noted that the marking positions for the conductive marks are located above the corresponding punch positions, for example, the "3" marking position is located between the "2" and "3" punch positions. Stated another way, the marking position is $\frac{1}{2}$ cycle point removed from the corresponding punch position.

Fig. 3 illustrates schematically the circuit which delays each pulse developed by a conductive mark sensed by a set of brushes 603 before operating the corresponding magnet PM. In this figure, one set of brushes 603 is shown in exaggerated form making contact with one column of a card 11. The two outer wires or brushes 603 are connected together at juncture 2, and through a resistor 3 they are normally connected to a -25 volt source. When cam 4 closes its contacts 4A, the outer brushes 603 also become connected to the +125 volt source.

The inner brush 603 is insulated from the two outer brushes 603 and is in electrical contact with said outer brushes only when a conductive mark is sensed on a card. Inner brush 603 is connected through resistor 5 to a -25 volt supply and through current limiting resistor 6 to the control grid of gaseous tube 7. The control grid is thus normally at negative potential and non-conductive, and becomes conductive only when the central brush 603 is in electrical contact with either or both outer brushes 603 through a conductive mark on a card 11.

Between the control grid of tube 7 and the cathode and the screen grid, which are tied together, is capacitor 8. When cam 9 closes its contacts 9A, the cathode and screen grid of tube 7 are connected directly to the 0 volt source. The cathode and screen grid are also connected through resistor 10 to the +125 volt source. Thus when the contacts of cam 9 are open, the cathode of tube 7 is at the same potential as the control grid and the tube cannot conduct. When no mark is sensed by brushes 603, the control grid is more negative than the cathode regardless whether or not cam contacts 9A are closed. Only when a mark is sensed simultaneously with the closure of contacts 4A and 9A will the proper voltage differential exist between the control grid and cathode of tube 7 to fire said tube. The anode of tube 7 is connected through resistor 21 to the +125 volt supply.

The anode of tube 7 is also connected through capacitor 12 and resistor 13 to the control grid of gaseous tube 14. In its normal condition the control grid of tube 14 is negatively biased by resistor 15 which is connected to the -25 volt source. As in the case of tube 7, the control grid is connected through a capacitor 16 to the cathode of tube 14. The cathode of tube 14 is connected through punch magnet PM to the 0 volt line, said punch magnet being energized only when tube 14 is sufficiently conductive.

A form of coincidence arrangement is employed to control the operation of tube 14. The anode of tube 14 is connected to the +55 volt line only when cam 17 closes its contacts. The screen grid is connected through resistor 18 to the -25 volt source, and, when cam 19 closes its contacts, also through resistor 20 to the +55 volt source. Tube 14 conducts sufficiently to operate magnet PM only when cam 17 closes its two contacts. The rotation of cams 4, 9, 17 and 19 is synchronized with the movement of the cards 11, since the cams are mounted on the card advance shaft (not shown). The cams are also synchronized in relation to each other in a manner to provide the required two cycle point delay, as is described below.

In operation, cam contacts 4A are closed each time brushes 603 are at an index point position. In the absence of a mark on the particular position being sensed, only the two outer brushes 603 will be at a positive potential. The inner brush 603, being insulated from the two outer brushes, will remain at a negative potential and tube 7 will not conduct at this time.

However, as soon as a conductive mark is sensed, the three brushes are electrically connected to the +125 volt source and the control grid of tube 7 is made positive. The closure of contacts 9A now makes the cathode more negative than the control grid and so the tube fires. Conduction will continue during the period of closure of cam contacts 4A and 9A. The voltage drop across anode resistor 21 developed at this time is coupled through capacitor 12 to the control grid of tube 14 and makes the control grid more strongly negative than the normal -25 volts provided by resistor 15. This means that when tube 7 is conductive, tube 14 must be non-conductive.

As cam 9 continues its rotation to open its contacts, tube 7 no longer conducts, and the potential at the lower end of resistor 21 approaches its maximum level of +125 volts. As a result, the control grid of tube 14 becomes sufficiently positive for conduction. Before cam contacts 9A open, cam 19 closes its contacts, which action makes

the screen grid of tube 14 positive. This causes tube 14 to conduct but not sufficiently to energize punch magnet PM. Immediately after contacts 19A are closed, cam 17 closes its contacts to connect the anode of tube 14 to the +55 volt supply. With contacts 19A and 17A closed simultaneously the maximum current flows through tube 14, operating punch magnet PM, which rocks its armature structure 190 (see Fig. 1) to effect coupling between interposer 186 and plate 184 for accomplishing a perforation of the moving card.

The cams are so synchronized with the card movement that punch magnet PM is energized just as the card presents its punch position to punch 18. In this way the time consumed between the energization of punch magnet PM and the lowering of punch element 18 is taken into consideration.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a preferred embodiment, 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 following claims.

What is claimed is:

1. A delay net work adapted for use in record card controlled machines to delay the signal effect of an input pulse, comprising a first and second pair of cam contacts, a first gas discharge device, said first and second pair of contacts making the first discharge device conductive at one time interval when an input pulse is applied to said first discharge device, a third and fourth pair of cam contacts synchronized to operate with said first and second pair of cam contacts, a second gas discharge device, said second pair of contacts extinguishing said first discharge device and making the control grid of said second discharge device positive, said third pair of cam contacts applying a positive potential to the screen grid of said second discharge device, the positive condition of both grids being capable of firing said second discharge device, and said fourth pair of cam contacts applying a positive potential to the anode of said second discharge device, to make said second discharge device fully conductive in order to energize an output device.

2. The invention according to claim 1, wherein said first and second pair of contacts close simultaneously at a predetermined point of each operating cycle, said third pair of contacts close before said second pair of contacts open, and said fourth pair of contacts close after said third pair of contacts have closed.

3. The invention according to claim 2, wherein a resistor connected between said third pair of cam contacts and said second discharge device connects the screen grid of said second discharge device to a positive source whenever said third pair of contacts close thereby causing said second discharge device to fire but not to conduct sufficiently to energize an output device.

4. The invention according to claim 3 in which said screen grid current limiting resistor is part of a voltage divider.

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