Sept. 2, 1958 R. WIDMER 2,850,679

DELAY NETWORK

Filed March 7, 1955

FIG. 1

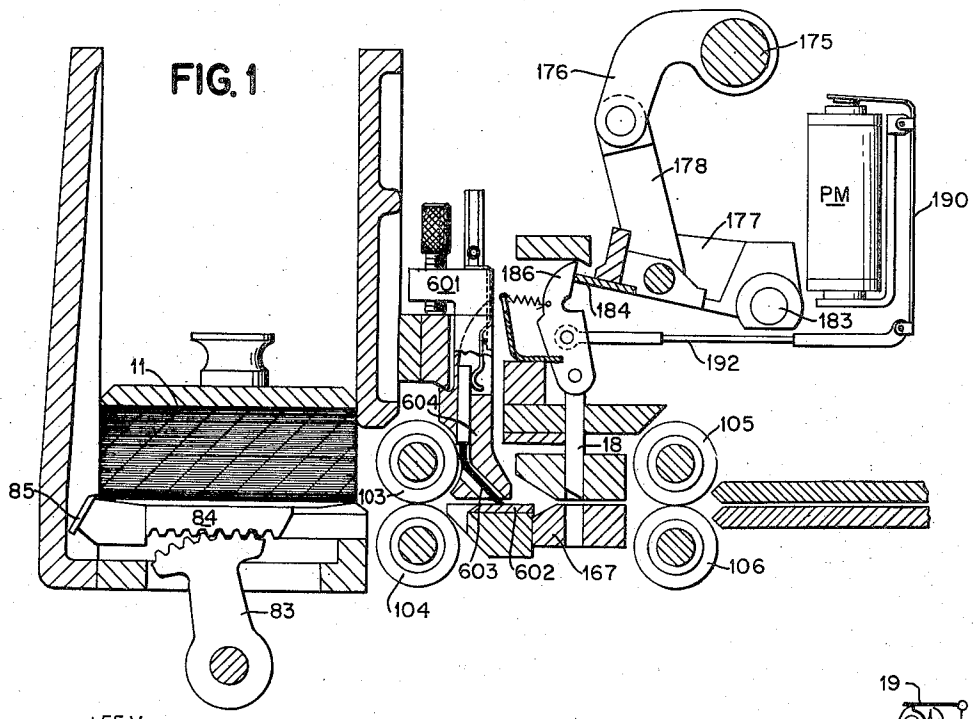


FIG. 3

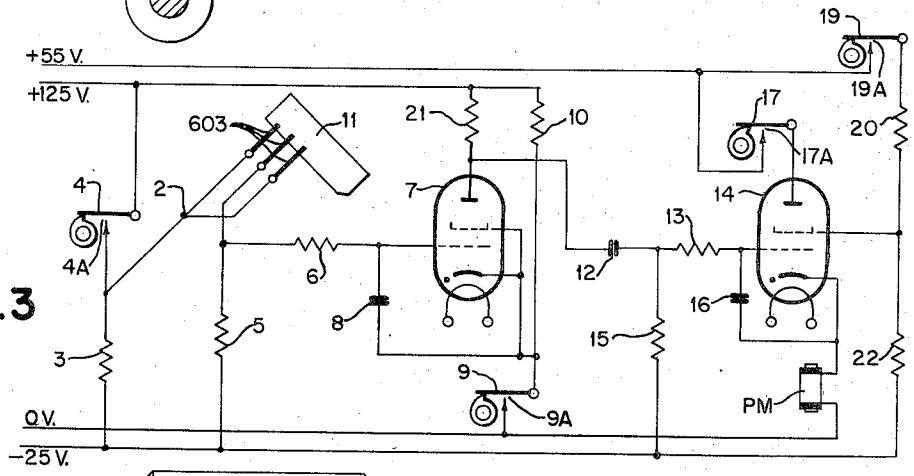
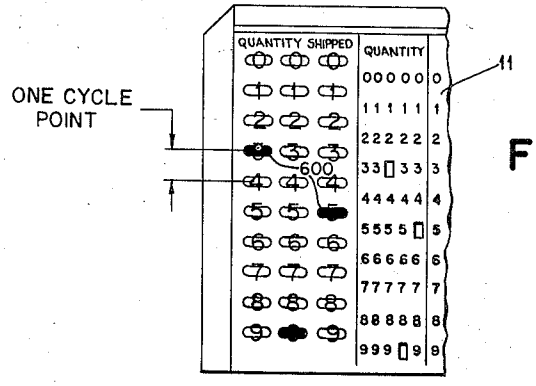


FIG. 2



INVENTOR.
RUDOLF WIDMER

BY

William Lang

United States Patent Office

2,850,679

Patented Sept. 2, 1958

2,850,679

DELAY NETWORK

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

Application March 7, 1955, Serial No. 492,342

Claims priority, application Germany March 31, 1954

4 Claims. (Cl. 315—166)

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 1½ cycle points separate the mark sensing brush location from the punch station. Since each mark location on the card is ½ 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

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 ½ 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.

References Cited in the file of this patent

UNITED STATES PATENTS

2,056,301	Schroter	Oct. 6, 1937
2,228,883	Morgan	Jan. 14, 1941
2,249,819	Gulliksen	July 22, 1941
2,260,039	Leroy	Oct. 21, 1941
2,264,621	Cox	Dec. 2, 1941
2,275,396	Johnson	Mar. 3, 1942
2,306,404	Potts	Dec. 29, 1942
2,419,601	Silver	Apr. 29, 1947
2,649,502	Odell	Aug. 18, 1953