Jan. 24, 1928. **1,656,999**

F. R. BULL

ELECTRIC SORTING MACHINE FOR PERFORATED CARDS

Filed Feb. 7, 1924 3 Sheets-Sheet 1

Fig. 1

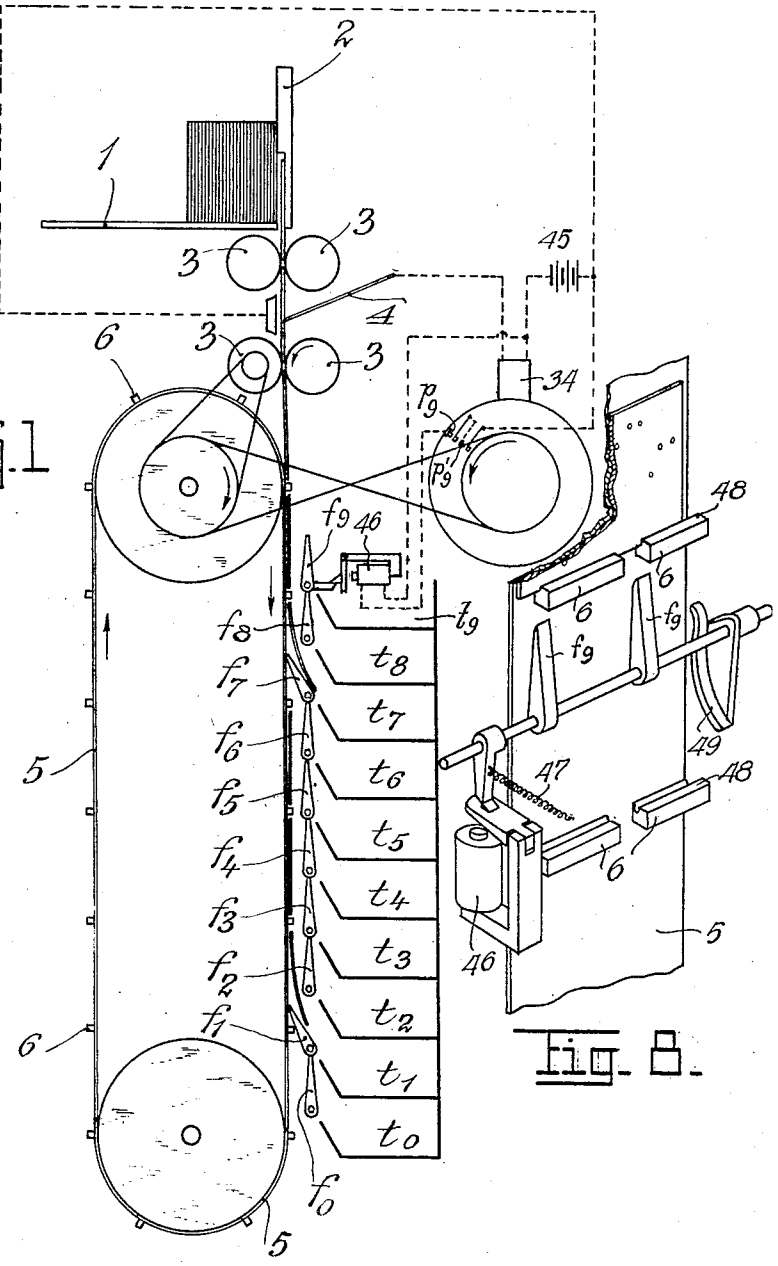


Fig. 8.

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Fig. 2.

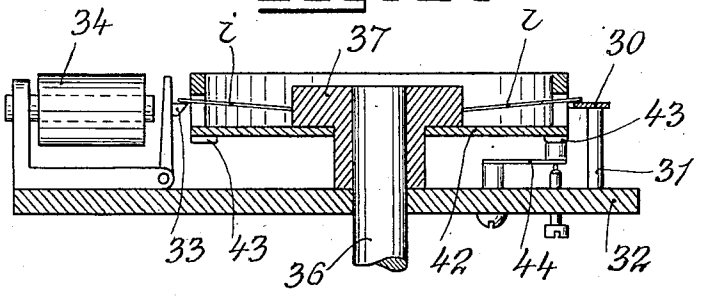
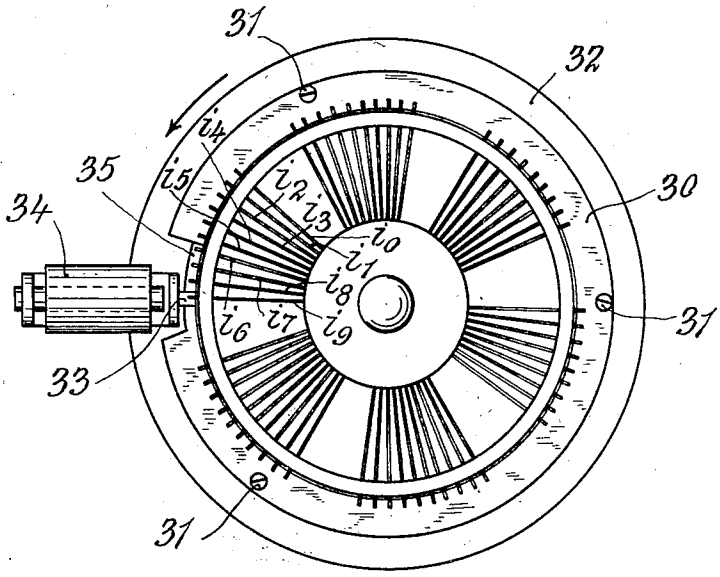


Fig. 3.



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Fig. 5.

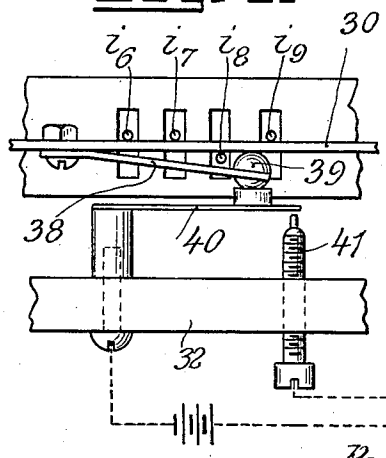


Fig. 6.

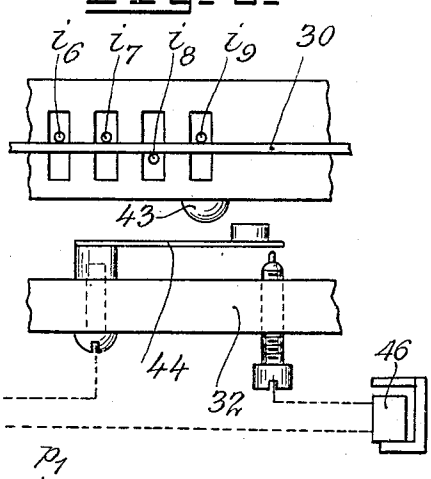


Fig. 4.

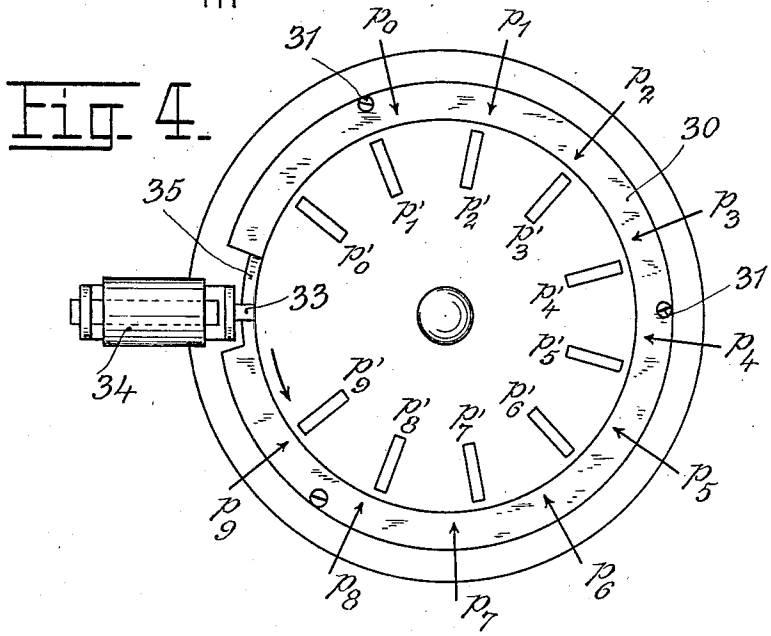
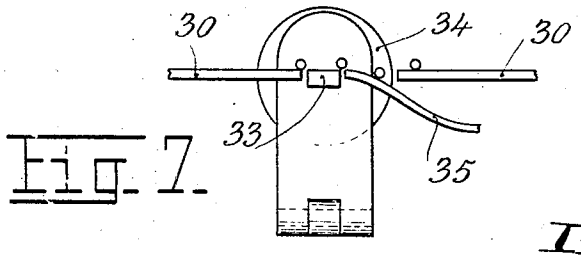


Fig. 7.



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Patented Jan. 24, 1928. 1,656,999

UNITED STATES PATENT OFFICE.

FREDRIK ROSING BULL, OF OSLO, NORWAY.

ELECTRIC SORTING MACHINE FOR PERFORATED CARDS.

Application filed February 7, 1924, Serial No. 691,316, and in Norway January 13, 1923.

Electric sorting machines for perforated cards for statistical and similar purposes are known. In such machines the sorting operation is effected as follows: At the moment, at which a perforation of the card passes an electric contact device, an electric circuit is closed, which sets the guiding member which conveys the card into its respective pocket. The cards must pass through the machine one behind the other at a certain distance apart and, as they must be conveyed slowly past the electric contact device, the number of cards that the machine can deposit in the course of a minute depends on the distance between the separate cards of the series passing through the machine.

The guiding members, which are set by the current impulse of the contact device, are usually returned to their initial position during the interval between the bringing into position of two cards. In order that the return of the guiding members may not be too sudden, the interval of time between the cards must be relatively great at the expense of the efficiency of the machine.

The object of the present invention is to avoid these difficulties by making it possible to pass the cards through the machine very rapidly in succession, without any part of the machine being required to move with excessive violence. The invention is mainly characterized by the feature that between the card contact device and the guiding members for the cards a device is provided, consisting of a rotating part with one or more series of steel pins, each series having as many steel pins as there are sorting pockets in the machine, the steel pins sliding on a stationary guide-way but being capable of falling below the said guide way under the action of an electromagnet connected to the card contact and of closing a circuit there during their further forward movement in the machine, which circuit sets the guiding members at the moment at which the card is in front of its correct pocket.

The invention is illustrated in the accompanying drawings, in which

Fig. 1 is a diagrammatic view of the arrangement for conveying the cards to the various pockets.

Fig. 2 shows partly in section the device provided between the card contact device and the guiding members for transmitting the impulses from the former to the latter.

Figs. 3 and 4 are plan views of the arrangement shown in Fig. 2, various parts being omitted in Fig. 4.

Figs. 5 and 6 show respectively one contact of each of two series of contacts arranged in connection with the device shown in Figs. 2, 3 and 4.

Fig. 7 shows a fragmentary detail on an enlarged scale of the device shown in Fig. 4, viewed from the inside.

Fig. 8 is a fragmentary perspective detail on an enlarged scale of an operating mechanism for the guiding members.

The cards to be dealt with are piled up on the board 1 and are conveyed from there one by one in a known manner by means of a pushing member 2 between rollers 3—3 past a contact device 4. After the rollers 3 have released the card, the latter is caught by a conveyor, which conveys it along in front of the flaps f_9, f_8, f_7, . . ., which guide the cards to their respective pockets. The conveyor may be constructed in various ways, for instance, as shown in the drawing, it may consist of a flexible band 5 with projecting parts 6, which catch the card and support it. In the drawing only one conveying band is shown. A number of such bands may of course be disposed next to one another. On this band several cards (in the present example six) will lie at the same time, all of which are on the way to their respective pockets. The setting of the flaps or guiding members, which remove the card from the conveyer, must therefore take place at a definite time after the card has passed the contact device 4. Supposing a card is intended for the pocket t_1 and the following card for the pocket t_9, it will be seen that the guiding member for the latter card must be set sooner than the guiding member for the former card.

For this purpose means are introduced between the contact device 4 and the guiding members f_9 . . . f_0, which receive the impulses from the contact device and transmit them at the correct moment to the guiding members for the cards.

The said means consist of a stationary annulus 30, which is attached by means of uprights 31 to a base plate 32. The annulus 30 has a short gap (Figs. 3, 4 and 7), which is filled partly by the tooth 33 on the armature of the electromagnet 34 and partly by an inclined surface 35, which is located in front of the tooth 33 (in the direction of the arrow in Fig. 4), and the lowest part of which lies below the annulus 30, while its highest point lies in the plane of the upper edge of the tooth 33. Within the annulus 30 and keyed on a shaft 36 is a cylinder 37, in which several series of radial resilient steel pins i are fixed, in the example shown six such series. Each series is provided with as many steel pins as there are sorting pockets for the cards, in the example shown ten pins $i_0 \ldots i_9$. The ends of these steel pins rest normally on the inner edge of the annulus 30 (Figs. 2 and 3), against which they are pressed by their own resilience. The pins are at an equal distance apart and the rotation of the cylinder 37 with the steel pins i is caused to take place in such a manner that ten pins pass one point of the annulus 30 synchronously with the forward movement of the card past a contact brush. On the armature of the magnet 34 being attracted, when a hole in the card passes the contact brush, the tooth 33 will be withdrawn and the steel pin, which at this moment rests on the tooth will fall down. During the further rotation of the cylinder 37 this steel pin will move along below the annulus 30, while the remaining pins will slide along its upper side. (Figs. 5 and 6.)

Along the lower edge of the annulus 30 at the marks p_0, p_1, $p_2 \ldots p_9$ small springs 38 are provided (shown in Fig. 5), which are acted on by the steel pins i, which have fallen down. During the further rotation of the pins the pin i, which is below the annulus 30, will move a piece of steel (steel ball) 39, which is fixed to the end of the spring 38, against a stop member on the upper side of the contact making spring 40 (Fig. 5), the spring 40 being depressed and making contact with a screw 41 in the base plate 32.

The plate 42 (Fig. 2) rotates together with the cylinder 37 and the steel pins i, the lower side of which plate is provided with as many contact making knobs 43 (Figs. 2 and 6) as there are series of steel pins, in the case shown in the drawing six such series. These knobs 43 lie under the first steel pin of each series, in the example shown under the pin i_9. The knobs 43 coact with spring contacts 44, in the example shown ten such contacts, which are mounted on the base plate 32 at the marks p'_0, p'_1, $p'_2 \ldots p'_9$ (Fig. 4). The ten spring contacts 44 are connected in pairs in series with the ten contacts 40 at the marks p_0, p_1, $p_2 \ldots$ p_9 under the annulus 30 and are for instance so disposed relatively to the latter contacts that the first contact at p'_9 is mounted radially on the annulus at p_9 with respect to the first contact, while the next contact at p'_8 is displaced slightly forward in the direction of motion with respect to the contact at p_8 on the annulus. The displacement corresponds to the space between two steel pins. The next contact at p'_7 is displaced by a further space and so on, as is shown in Fig. 4. Owing to this displacement the steel pins, which have fallen below the annulus 30, close the corresponding contact on the annulus during their forward movement in the apparatus, while at the same time the contact connected in series therewith is closed by the knob 43.

If, for instance, the steel pin i_8 of one of the six series of pins has come under the annulus and the forward motion continues, the knob 43 for this series of steel pins will already have closed and opened the contact at p'_9 when the pin arrives at the contact at p_9 on the annulus, because the knob 43 for each series of pins lies below the pin i_9. As already stated, these two contacts are connected in series, for which reason there will be no current impulse

On the steel pin arriving at the contact at p_8, the knob 43, which is under the pin i_9, will at the same moment close the contact p'_8 and, as the latter is connected in series with the contact at p_8, a current impulse will be received, which sets the guiding member for the card in such a manner that the said card will fall into its pocket t_8.

Figs. 5 and 6 show a relative position of the rotating part and of the outer and inner contacts shortly before the steel pin i_8 is to close the contact.

When the pin i_8 arrives at the contact at p_7 on the annulus, the knob 43 will not yet have reached the contact at p'_7 owing to the relative displacement between these two series of contacts. The same will be the case when the pins pass the other contacts on the annulus.

Thus, the steel pin i_8 only causes a current impulse to take place when it reaches the contact p_8 of the annulus.

The position of the contacts —40— and —44— depends on the construction of the conveyer band and the rate of travel of the same relative to the steel pins and the position of the card pockets. The position is fixed during the mounting of the machine, as a card, in which the numeral —9— is perforated first passes the machine. At the same moment as the numeral 9 stands opposite the contact brush —4— (Fig. 1) the position of the steel pins is as shown in Figure 3 with the pin i_9 on the tooth —33— of the electro-magnet —34—. Then the machine is slowly rotated until the card stands

opposite the guiding member f_9 (Fig. 1). The pin which earlier lay on the tooth —33— of the electromagnet (Fig. 3) has then arrived at the mark p_9 (Fig. 4). Thus the position of this contact is fixed. If the same operation is undertaken with a card in which the numeral 0 is perforated, the position of p_0 can be fixed, the pin i_0 moving from the tooth of the electromagnet to the proper position for this contact, at the same time as the card moves from its position with the numeral 0 under the contact brush —4— (Fig. 1) to the position opposite the guiding member f_0 (Fig. 1). The position of the other contacts p_1—p_8 (Fig. 4) is then found by dividing the arc of circle between p_0 and p_9 in nine parts of the same size. The position of the contacts p'_0—p'_9 is found by marking out angles from p'_9, which angles are equal to the angular distance between p_9 and p_8 plus the angular distance between two steel pins.

With reference to Figure 1 it will be seen that when a hole in the card passes the contact brush —4—, a current will flow from the battery —45— through the contact brush —4—, the magnet —34— and back to the battery. From the battery another conductor leads to the contacts p'_9, p'_8, p'_7 . . . and from the contacts p_9, p_8, p_7, connected in pairs in series with the latter, a conductor leads to the corresponding magnet —46— for the guiding members f_9, f_8, f_7 . . ., from which a common conductor leads back to the battery. In the drawing are only shown the conductors and magnet for the guiding member f_9.

Fig. 8 shows the construction of the guiding members f. The guiding members f are kept in normal position by a tooth on the armature of the electromagnet —46—. When this armature is attracted the spring —47— will cause the guiding members to rock towards the conveyer band —5—, whereby the card standing before the guiding members and supported by the projecting parts —6—, is guided into its proper pocket. The guiding members are then turned back to the normal position, an extending part —48— of the support —6— engaging a curved member —49— keyed on the shaft for the guiding members —f—.

The pins, which have passed under the annulus, will already have run on to the inclined surface 35 (Fig. 7) referred to above, before reaching the electromagnet 34, and will thus return to their normal position on the annulus.

The constructional forms shown in the drawings are given as examples only, which may be modified in various ways without departing from the spirit of the invention.

What I claim is:—

1. An electric sorting machine for perforated cards, having in combination sorting pockets for the cards, a card contact device, guiding members for guiding the cards into the said pockets, a device located between the card contact device and the guiding members and comprising a rotating part, steel pins in the said rotating part, the number of pins corresponding to the number of sorting pockets in the machine, a stationary guide-way, on the upper surface of which the pins are capable of sliding and an electromagnet and armature connected to the card contact device and capable of releasing and permitting the pins to move below the guide-way, said pins being adapted to close a circuit during the further forward movement of the pins, for the purpose of setting the guiding members at the moment, at which the card is in front of its correct pocket, as set forth.

2. An electric sorting machine for perforated cards, having in combination sorting pockets for the cards, a card contact device, guiding members for guiding the cards into the said pockets, a device located between the card contact device and the guiding members and comprising a rotating part, a plurality of series of steel pins in the said rotating part, the number of pins in each series corresponding to the number of sorting pockets in the machine, a stationary annular guide-way, on the upper surface of which the pins are capable of sliding and an electromagnet and armature connected to the card contact device and capable of releasing and permitting the pins to move below the guide-way said pins being adapted to close a circuit during the further forward movement of the pins, for the purpose of setting the guiding members at the moment, at which the card is in front of its correct pocket, as set forth.

3. An electric sorting machine for perforated cards, having in combination sorting pockets for the cards, a card contact device, guiding members for guiding the cards into the said pockets, a device located between the card contact device and the guiding members and comprising a rotating part, a plurality of series of steel pins in the said rotating part, the number of pins in each series corresponding to the number of sorting pockets in the machine, a stationary guiding annulus, on the upper surface of which the pins are capable of sliding, contacts on the under side of the rotating part, one for each series of pins and capable of rotating with the said pins, an electro-magnet connected to the card contact device and capable of releasing and permitting the pins to move below the guide-way said pins being adapted to close a circuit during the further forward movement of the pins, two series of contacts below the stationary annulus, the number of which is the same as that of each series of steel pins and which

are connected in series in such a manner that the contacts of one series are capable of being closed by the pins which have fallen below the annulus, while the contacts of the other series are capable of being closed by the contacts on the under side of the rotating part, the two series of contacts below the stationary annulus being arranged relatively to one another in such a manner, that the angular distance between the contacts of one series is equal to the angular distance between the contacts of the other series plus the angular distance between two steel pins.

In testimony whereof I have signed my name to this specification.

FREDRIK ROSING BULL.