Aug. 4, 1931. E. A. FORD 1,817,511

CARD SORTING MACHINE

Filed May 4, 1928 4 Sheets-Sheet 1

FIG. 1.

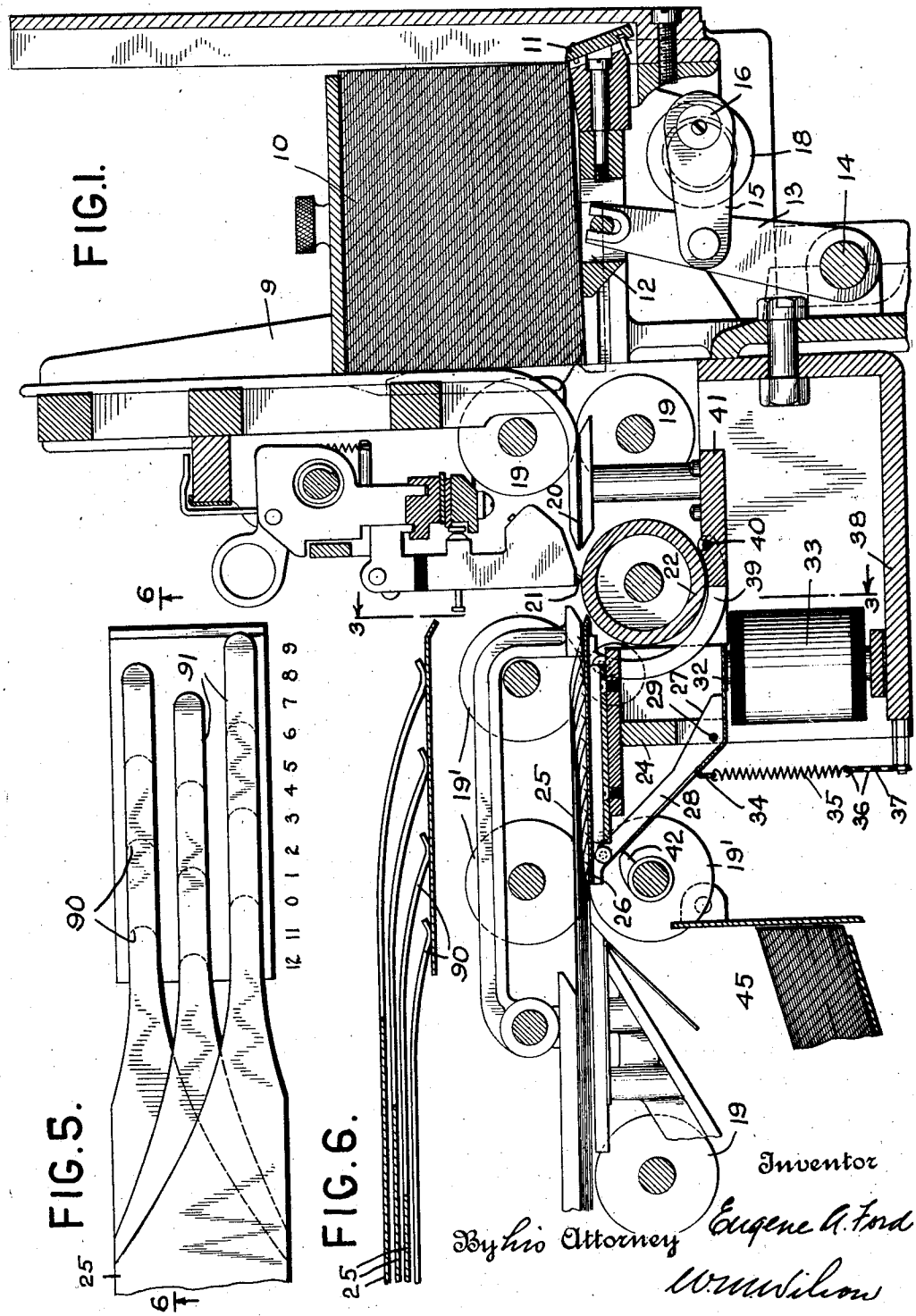


FIG. 5.

FIG. 6.

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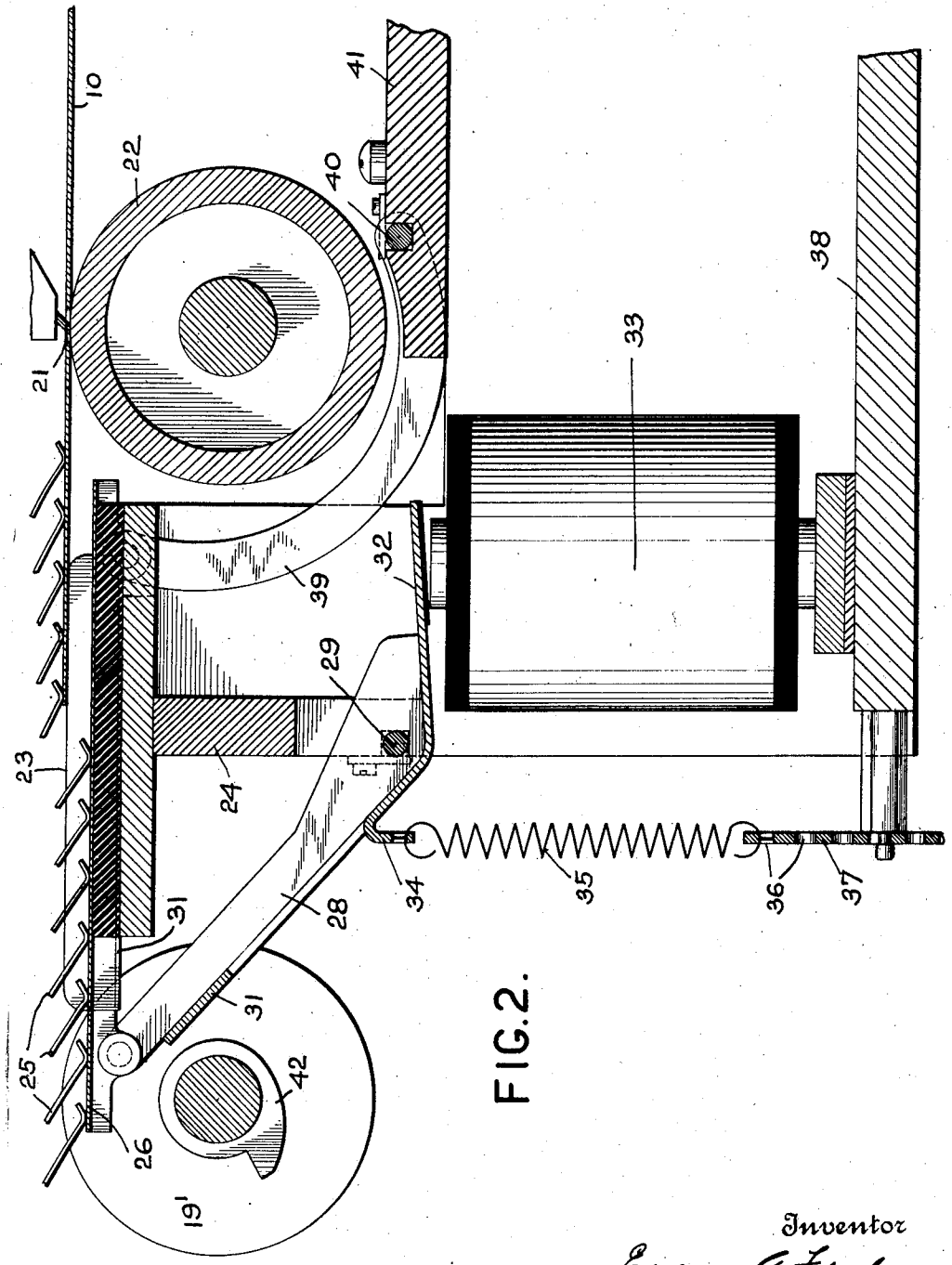


FIG. 2.

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FIG. 7.

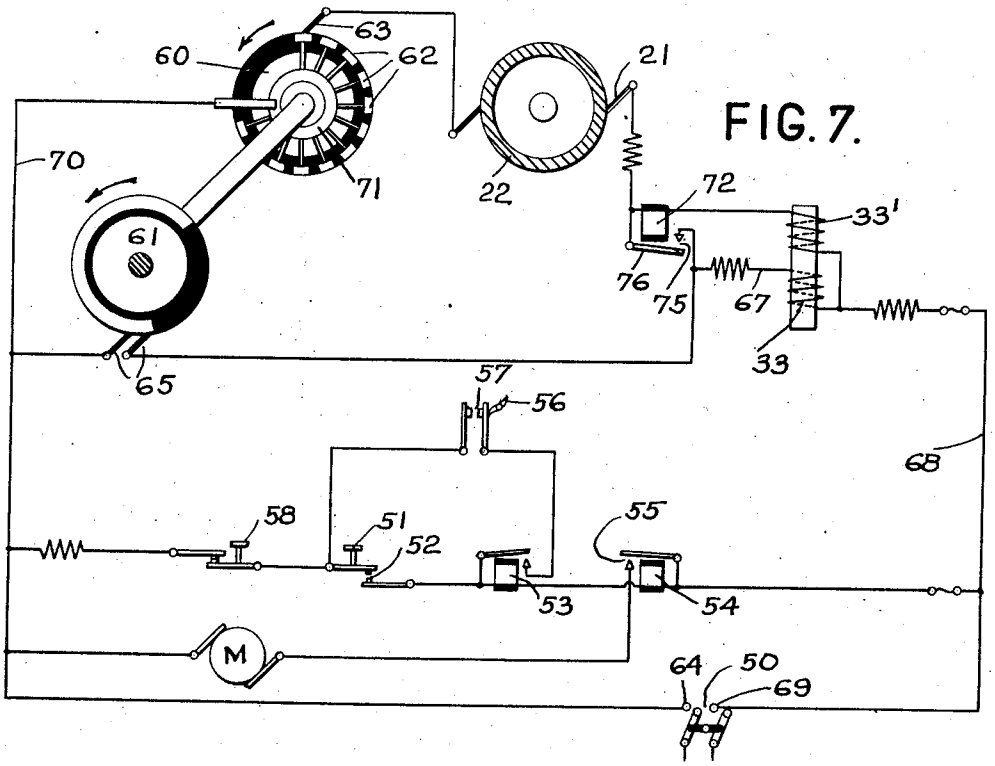
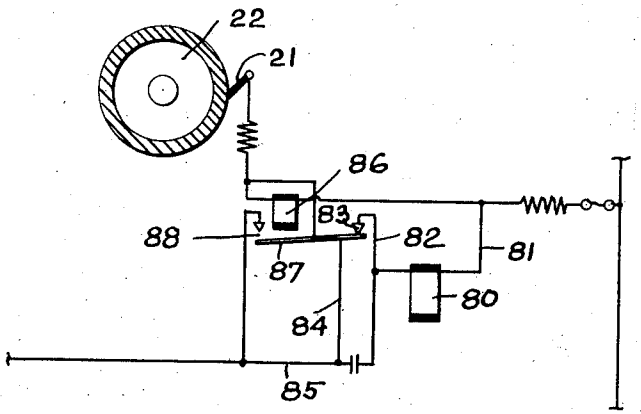


FIG. 8.



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CARD SORTING MACHINE

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FIG. 3.

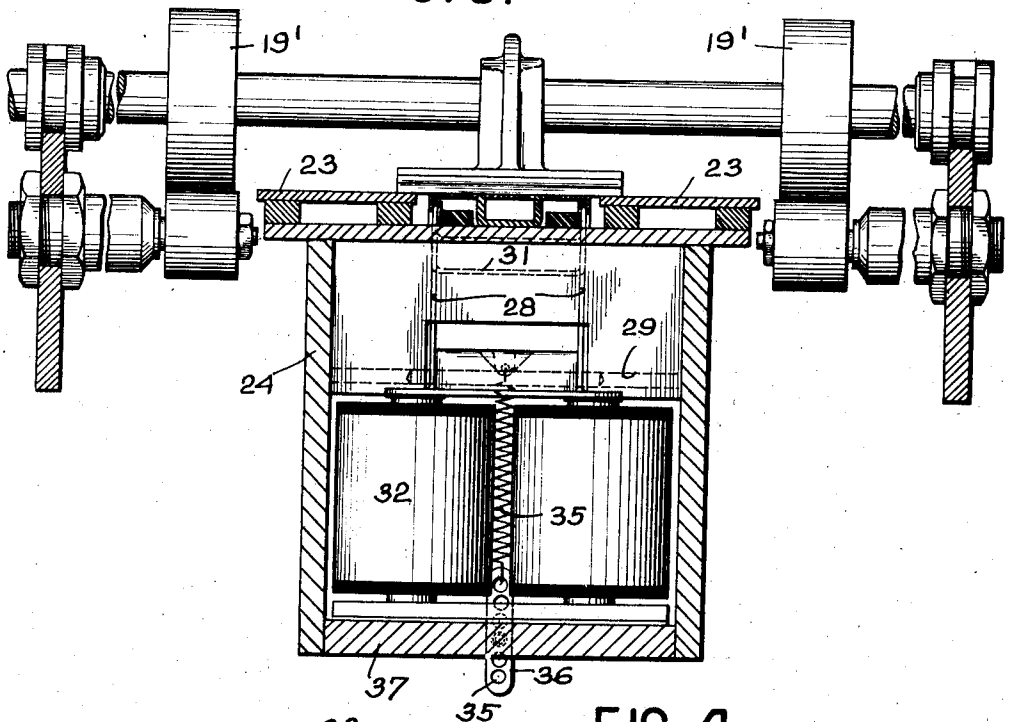
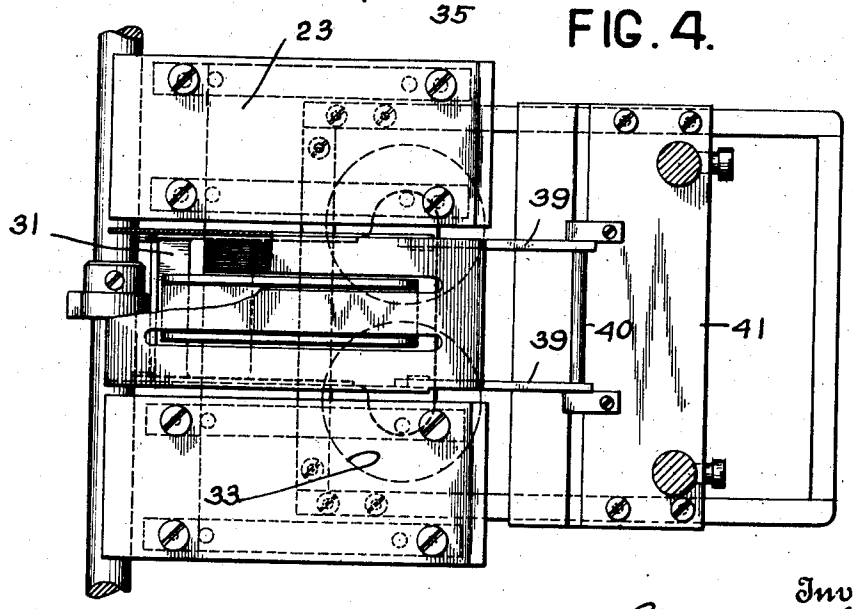


FIG. 4.



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UNITED STATES PATENT OFFICE

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CARD SORTING MACHINE

Application filed May 4, 1928. Serial No. 274,990.

This invention relates to accounting machines, particularly for sorting records in accordance with their index point designations.

Sorting machines, in general, comprise a magazine for holding a stack of records which are fed one at a time to an analyzing device. The latter usually controls an electro-magnetic device for operating guide blades to open a passage for a record to a card pocket corresponding to the designation on the analyzed card. In known machines, the magnetic device includes one or more magnets called sorting magnets, which are normally deenergized, and which are energized upon the encountering of a perforation in the card by the analyzing device. The sorting magnets upon energization attract their armature which operates to open a passage for the card between two adjacent guide blades leading to a card pocket. The speed of operation of a sorting machine depends to a great extent on the rapidity with which the armature is attracted by the sorting magnet. In attracting the armature, the magnet upon energization builds up its magnetic force gradually. The gap between the magnet and the armature is at its widest point at the beginning so that the magnet is called upon to do its greatest work when it has the least power and for this reason lags in attracting the armature. The speed of operation of the sorter must be slowed up appreciably to take care of the lag of the magnet in operating the armature.

According to the present invention, instead of the perforation in the card causing energization of the sorting magnet, the latter is normally energized and the analysis of a perforation opens the circuit to the magnet to cause its deenergization or neutralization. A constantly operating cam moves the armature into cooperation with the magnet and the magnet then holds it. When by reason of a perforation in the card, the magnet is rendered ineffective, a spring moves the armature out of contact with the magnet and controls the guiding mechanism to determine the disposition of the card. This reverse action of the magnet and associated elements permits greater speed of operation in sorting by reason of the fact that the magnet releases its armature more rapidly than it can attract it.

This is due to the fact that the armature being moved by mechanical means into cooperation with the magnet from a point where the force exerted by the magnet is least to a point where the force exerted by the magnet is greatest, a weaker magnet may be employed to hold the armature in position and when the magnet is neutralized or deenergized, the spring can very quickly move the armature away from the magnet. The strength of the magnet need be just sufficient to hold the armature in attracted position and it is then apparent that upon the setting up of a slight gap between the armature and the magnet upon deenergization of the latter, that the magnetic force will be insufficient to overcome the action of the spring. The force exerted by the spring is always constant and the electrical lag in the neutralization or deenergization of the magnet in view of the decreased current is almost negligible so that the combined effect of a constant force exerted by the spring and the decreased electrical lag results in practically instantaneous release of the armature.

The object of this invention is to provide an improved record sorting machine for the purpose set forth.

The object is further to provide a normally energized magnet for controlling accounting mechanism which is rendered ineffective upon analysis of a perforation.

Another object is to provide an improved armature structure for coacting with said magnet.

Still another object is to improve the construction of the record guiding mechanism, particularly the chute blades leading to the card pockets.

Various other objects and advantages of my invention will be obvious from the following particular description of one form of mechanism embodying the invention or from an inspection of the accompanying drawings; and the invention also constitutes certain new and novel features of construction and combination of parts hereinafter set forth and claimed.

Fig. 1 is a side section through the rear portion of the sorting machine,

Fig. 2 is a detail of the sorting magnet and related elements,

Fig. 3 is a section on line 3—3 of Fig. 1,

Fig. 4 is a plan view of the sorting magnet and related elements,

Fig. 5 is a plan view of the chute blades at their card entrance ends,

Fig. 6 is a section on line 6—6 of Fig. 5,

Fig. 7 is a circuit diagram of one form of the invention and

Fig. 8 is a circuit diagram of another form of the invention.

While the invention is hereinafter disclosed as applied to a sorting machine wherein the cards are analyzed while in motion, it is equally applicable to other types of sorting machines and to other classes of accounting machines where the analysis of a perforation changes the status of a control magnet.

Referring to the drawings in detail, Fig. 1 shows a sorting machine provided with a magazine 9 for holding a stack of record cards 10 to be sorted. The bottom card of the stack is engaged at its rear edge by picker blades 11 attached to the ends of slidably guided arms 12 having a pin and slot connection with links 13 fixed to a shaft 14 journaled in the machine frame. One of the links 13 is connected to one end of an arm 15, the other end of which is freely mounted on the crank pin 16 of a crank arm (not shown) rotated by a feeding shaft journaled in bearings 18. The feeding shaft is driven by a motor M (Fig. 7). The feeding shaft through crank pin 16 oscillates arm 15 and links 13 to effect reciprocation of the arms 12 and the picker blades 11. During the forward stroke of the latter, the bottom card is advanced out of the magazine. Any convenient feeding mechanism equivalent to that described may be employed provided it feed a card out of the magazine during the time a previously fed card is being analyzed. The rollers 19 feed the card through a guide passage 20 to the analyzing device comprising an analyzing brush 21, previously adjusted to read a desired card column, and a contact roll 22.

The rollers 19 continue to feed the card past the analyzing brush and a succession of pairs of feed rollers 19′ successively grip the card to feed it to the card pocket. After the forward end of the card leaves the analyzing device, it is fed over a pair of plates 23 (Figs. 2, 3 and 4) which support the card at each side thereof. The plates 23 are mounted on top of a stationary frame 24. In the space between the plates are located the entrance ends of the chute or guide blades 25. These entrance ends rest on a movable plate 26 which is normally held at the same height as the plates 23. The left hand end of plate 26 (as viewed in Figs. 1 and 2) is pivoted to an armature member 27 which is formed as an integral stamping comprising parallel inclined arms 28, the upper ends of which are pivotally connected to the plate 26. At their lower ends, the arms 28 are fixed to a pin 29 journaled in the sides of the stationary frame (Figs. 2 and 3). The arms 28 are integrally joined adjacent their upper ends by a bar 31 and at their lower ends are contiguous with the armature portion 32 which extends beyond the arms 28 and overlies the sorting magnets 33. The armature portion has a lug 34 formed at its left hand end to which is attached the upper hook of a coil spring 35. The lower hook of the spring is engaged in one of the apertures 36 of an element 37 fixed to the bottom plate 38 of frame 24. A plurality of apertures 36 are provided so that the tension of the spring may be adjusted by attaching the lower hook thereof to a selected one of the apertures.

The right hand end of plate 26 is pivoted to the upper ends of a pair of parallel curved links 39, the lower ends of which are fixed to a pin 40 rotatably mounted in the plate 41 of the stationary frame (see Figs. 2 and 4). The pivot pins 29 and 40 are the same distance apart as the pivotal connections of arms 28 and links 39 to plate 26. The effective radial length of the arms 28 and the links 39 is also the same. The result is that rocking of the arms and links on their pivot pins will move the plate 26 parallel to itself.

At the side of bar 31, a cam 42 is fixed to the shaft of one of the lower feed rollers 19′ which is in continuous rotation. At the end of each card cycle, the cam 42 is adapted to engage bar 31 to rock the arms 28 clockwise. The plate 26 will thereby be moved to its normal uppermost position and the armature portion 32 will be rocked down against the resistance of spring 35 into cooperation with magnets 33. The magnet being normally energized by a circuit to be described hereinafter will hold the armature portion 32 in attracted position until a perforation is sensed by the analyzing device in the next card whereupon the magnet will be neutralized or deenergized and the armature be rocked counterclockwise by spring 35. The

plate 26 will thereby be lowered until the cam 42 again replaces the armature in attracted cooperating relation with the magnets. Since the entrance ends of the guide blades 25 are supported on plate 26, they will drop with the plate when the latter is lowered unless prevented from so doing by the surface of the record card itself.

Referring to Fig. 2, it is seen that card 10 which is continuously advancing over contact roll 22 has a perforation in the 4 index point position. By the time said perforation reaches the analyzing brush 21, the card has advanced on top of plates 23 and beneath the curved entrance ends of the five right hand guide blades 25. As soon as the analyzing brush encounters the perforation, it contacts therethrough with roll 22 effecting neutralization or deenergization of magnets 33 in a manner to be further described hereinafter. The deenergization of the magnets permits spring 35 to rock armature 27 counterclockwise, thereby lowering plate 26. All the guide blade ends except those five resting on the card at the time the perforation is sensed move down with plate 26, thus leaving a passage open to the advancing card between the fifth and sixth blades from the right. The card moves into this passage and rolls 19′ feed it to that card pocket 45 which corresponds to the 4 perforation and to which said passage leads. In a similar manner, depending on the position of any other perforation, a passage is opened to the card pocket corresponding to the perforation.

The operation of the machine may be understood with reference to the circuit diagram, Fig. 7. The machine is started by first closing line switch 50 and then depressing start key 51 to close contacts 52. A circuit is thereby established through magnets 53 and 54. The latter attracts its armature to close contacts 55 which completes a circuit through the sorter motor M setting the latter in motion. The motor M thereupon effects rotation of the feeding shaft which causes a card to be fed out of magazine 9 by picker blades 11. In advance of the analyzing device is located the usual card lever 56 which is actuated by the advancing card to close card lever contacts 57. A circuit is thereby established which shunts the start key contacts 52 and passes through magnets 53 and 54 to complete a holding circuit through motor M. The start key may then be released and the motor will continue to operate until the card lever contacts open due to failure of cards to feed or until the stop key 58 is depressed to open the motor circuit. The usual rotating commutator 60 and contact breaker roll 61 are provided. Contact lugs 62 are fixed in the periphery of the commutator and are successively sensed by a brush 63 in synchronism with the passage of the index point positions on a card past the analyzing brush 21. During the passage of the index point positions of the record card under the analyzing brush, a circuit is operative to energize magnets 33. This circuit extends from the left hand terminal post 64 through breaker roll brushes 65, line 66, line 67, magnets 33 and back through line 68 to the right hand terminal post 69. The magnets being energized will hold the armature 27 in attracted position and keep plate 26 in its upper position. Wound about the cores of magnets 33 in a reverse direction to the main coils are coils 33′.

When the analyzing brush meets a perforation in the card, a circuit is established from the terminal post 64 through line 70, the common contact ring 71 of the commutator 60, the contact lug 62 which is then under the brush 63, the contact roll 22, analyzing brush 21, magnet 72, magnet coils 33′ and through line 68 to terminal post 69. Since a circuit is now simultaneously established through both coils 33 and 33′ they neutralize each other's magnetic effect so that magnet 33 no longer exerts any force upon armature 27 which thereupon is retracted by spring 35, lowering plate 26 and permitting the guide blade ends not supported by the card to drop, thereby opening a passage for the card to the pocket 45 corresponding to the analyzed perforation. The circuit through magnet coil 33′ is maintained after the analyzing contact is broken by the contacts 75 closed by actuation of armature 76 upon energization of the coacting magnet 72. After the designation bearing portion of the card passes the analyzing brush, the circuits through both magnet coils 33 and 33′ are broken by the roll 61, the non-conducting portion of which has reached the brushes 65. The contacts 75 are thereby separated and both magnet coils 33 and 33′ deenergized, so that the armature 27 will remain released until immediately before the beginning of the next card cycle when cam 42 will return it to cooperating position with the sorting magnets and the conducting portion of the roll 61 will have reached brushes 65, thereby reestablishing the circuit through magnet 33 to hold the armature in its cooperating position.

In Fig. 8 is shown the circuit diagram of an alternative means for carrying out the invention. This construction includes the sorting magnet 80 which is normally energized by a circuit established from one side of the supply through line 81, magnet 80, line 82, contacts 83, line 84 and line 85 to the other side of the supply. Upon the analyzing brush 21 encountering a perforation in an advancing card, a circuit is completed by the analyzing contacts which passes through a magnet 86.

The energization of the latter attracts its armature 87 which results in opening contacts 83 thus breaking the circuit through sorting magnet 80 which thereupon permits the armature to be retracted by the spring 35 in a manner similar to that described with respect to the previous embodiment. In order to prevent the contacts 83 from closing during the remainder of the cycle, the armature 87 upon its attraction, closes contacts 88 which establishes a circuit shunting the analyzing contacts, through magnets 86. The latter thereby remain energized to keep contacts 83 open during the portion of the cycle following the analysis of a perforation. Between successive card cycles, the circuit through the magnet 86 is broken by the roll 61 (Fig. 7) in the usual manner and contacts 83 are permitted to again close.

Referring to Figs. 5 and 6, it is noted that the guide blades 25, hereinabove mentioned are of novel structure and arrangement. The card entrance ends 90 of the guide blades terminate in narrow portions, located in three laterally spaced groups 91. The ends in each group are in superimposed relation and all the ends are longitudinally spaced. In former machines, it has been the practice to locate the ends of all the blades in one group with all the ends in superimposed relationship. The ends of the blades are bent upwardly and it was necessary to make a sharp bend to accommodate a blade end beneath the downwardly curved blade directly above it. As a result of the sharp bend, the ends of the blades would often break off in use. By separating the blade ends into three groups, in each of which is an equal number of blade ends, the distance between successive blade terminations in a group is increased threefold. The end of the blade may thereby be curved more gradually since it will not interfere with the adjacent superimposed blade of the group and the danger of breaking off of the blade ends is thereby lessened.

While the invention has been specifically disclosed with respect to a sorting machine operating on Hollerith cards, it may also be utilized in sorting machines operating on combinational hole cards.

I claim:

1. In a machine for sorting cards into different card receiving pockets, guide blades leading to said pockets, said blades terminating in tapered parallel card entrance ends, said ends being located in separate groups laterally spaced from each other, and the entrance ends in each group being superimposed and longitudinally spaced from each other.

2. In a machine for sorting cards into different card receiving pockets, guide blades leading to said pockets, said blades terminating in upwardly bent ends beneath which the card is adapted to pass, said ends being located in separate laterally spaced groups.

3. In a card sorting machine, guide blades of substantially the same width intermediate their ends, said blades terminating in narrowed portions at one end, said ends being located in laterally spaced groups, all of the ends being longitudinally spaced and bent upwardly to permit the cards to pass beneath the end.

4. In a card sorting machine, a plurality of guide blades having their card entrance ends adjacent each other, a plate on which said ends rest, a pair of links pivoted at one of their ends to the said plate, said links being effectively parallel to each other and having the same effective length whereby movement of one link will effect a corresponding movement of the other link and a movement of the said plate parallel to itself, and a magnet for controlling said links.

5. The invention as described in claim 4, wherein one of the links has an armature portion coacting with said magnet.

6. In a card sorting machine, a plurality of guide blades having adjacent card entrance ends, a plate on which said ends normally rest, a normally energized magnet to control the plate, means for rendering the magnet ineffective to permit movement of the plate in one direction, and a cam for moving the plate in an opposite direction.

7. In a card sorting machine, a plurality of guide blades, a plate on which the blades normally rest, a member to operate the plate, a magnet tending to move the member in one direction, and a cam engageable with the member for moving it in the same direction.

8. In a card sorting machine, a plurality of guide blades, a plate on which the blades normally rest, a member for operating the plate, a normally energized magnet for holding the member in a position to keep the plate operated thereby in uppermost position, and a spring for moving said member to effect lowering of the said plate upon deenergization of said magnet.

9. In a card sorting machine, a plurality of guide blades, a plate with which the blades contact, a member for operating the plate, said member including an armature portion, a magnet coacting with said armature when energized to keep the plate uppermost, and means for operating the said member upon deenergization of the magnet to effect lowering of the plate.

10. The invention as described in claim 9, wherein means is provided to engage and restore the armature to attracted position relative to the magnet.

11. The invention as described in claim 9, wherein said member is pivoted to said plate, and said operating means comprises a spring connected to the member.

12. The invention as described in claim 9, wherein said member is pivoted to said plate, said operating means comprises a spring, and a cam is provided to periodically engage and restore the member to attracted position relative to the magnet.

In testimony whereof I hereto affix my signature.

EUGENE A. FORD.