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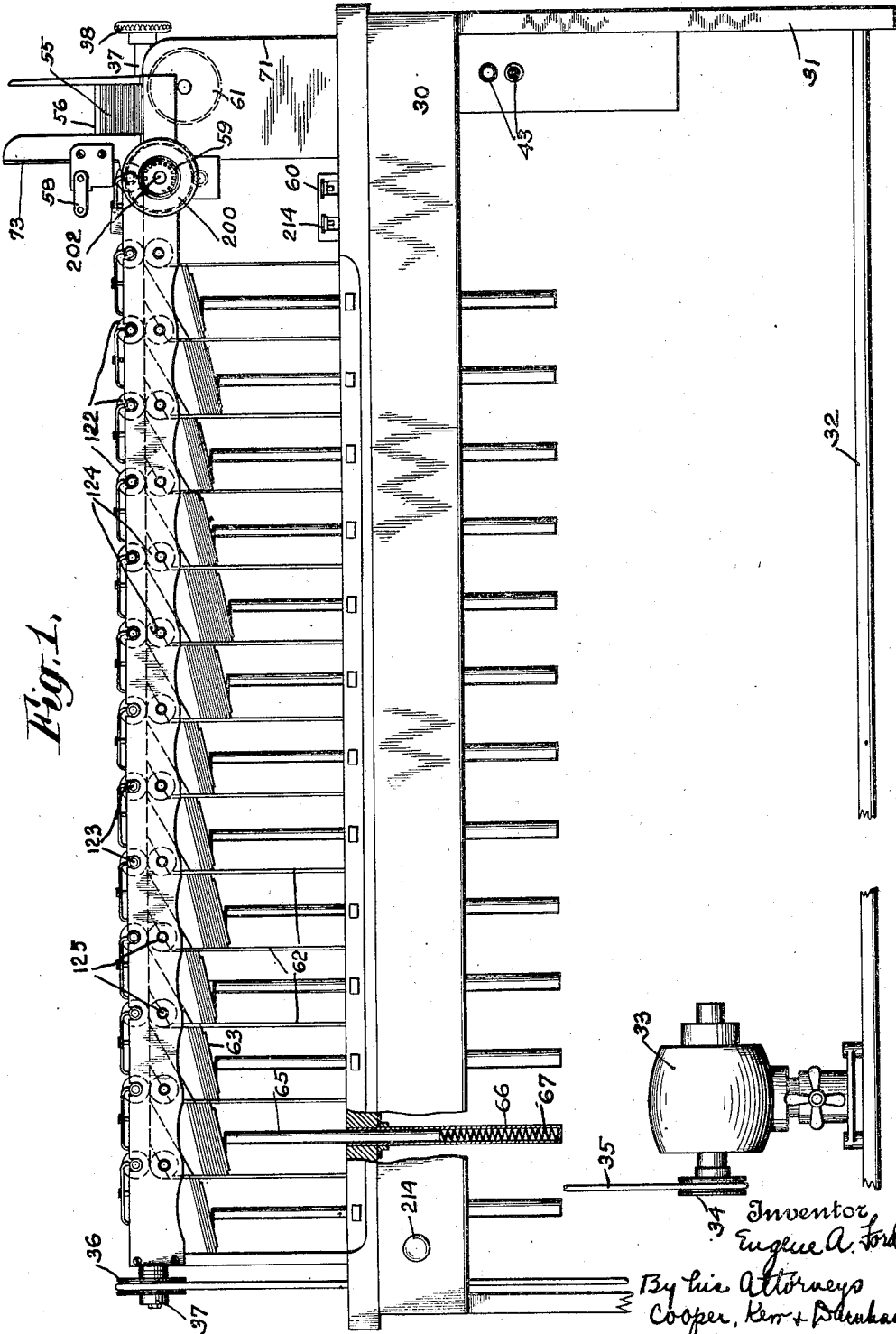
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E. A. FORD

SORTING MACHINE

Filed Nov. 13, 1924

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5 Sheets-Sheet 3

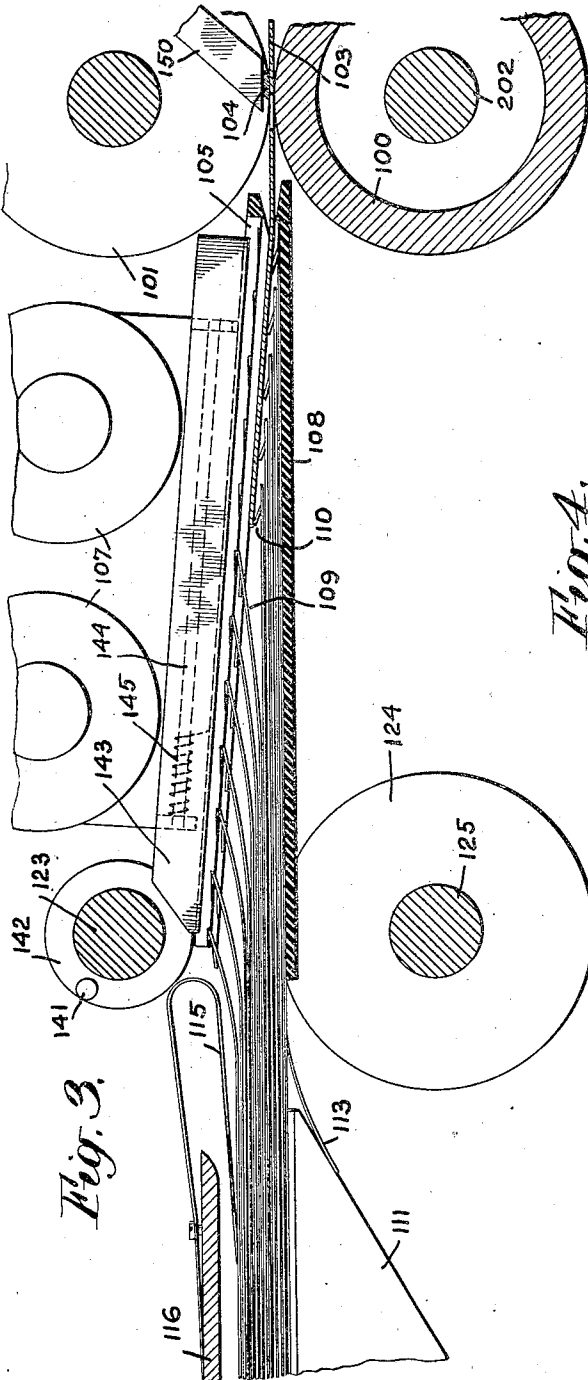
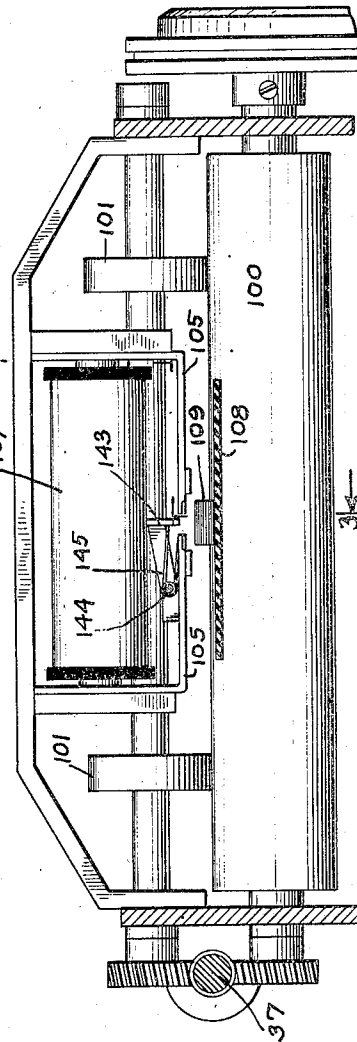


Fig. 3.

Fig. 4.



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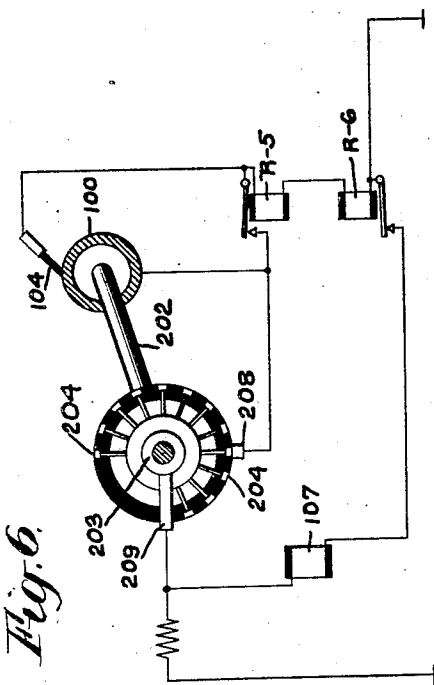
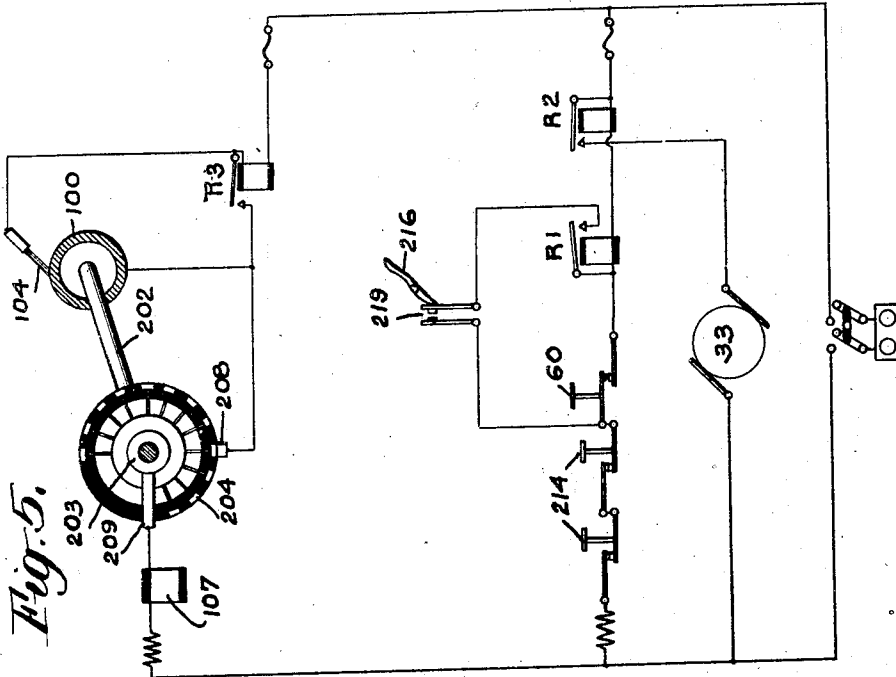
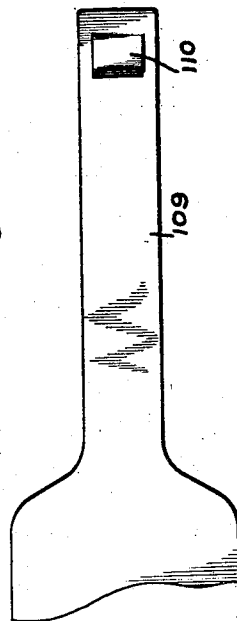


Fig. 7.



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5 Sheets-Sheet 5

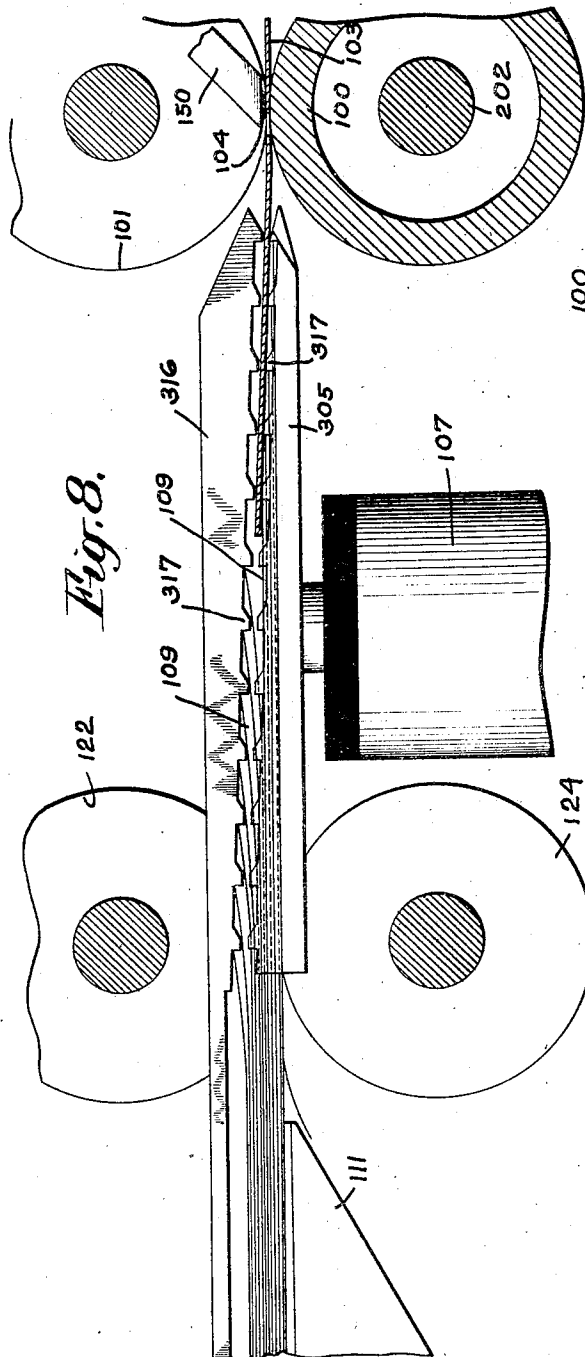
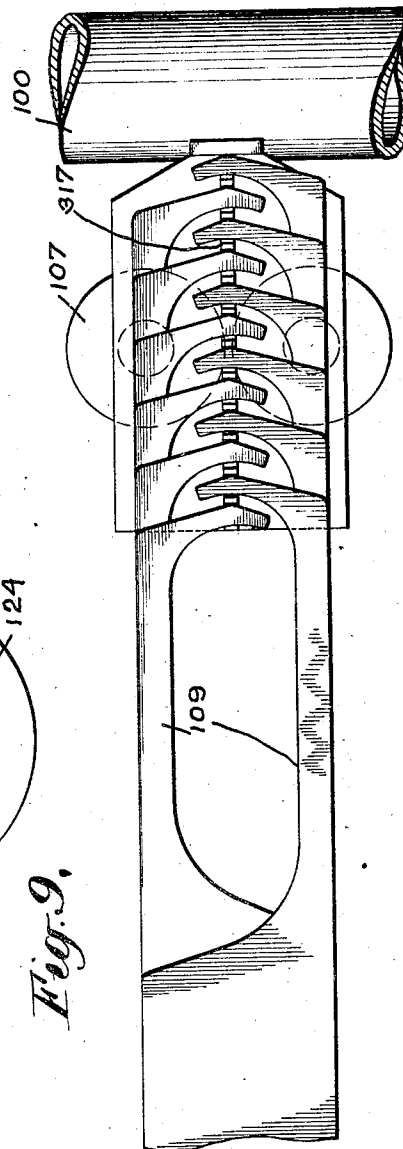


Fig. 8.

Fig. 9.



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UNITED STATES PATENT OFFICE.

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SORTING MACHINE.

Application filed November 13, 1924. Serial No. 749,531.

This invention relates to machines especially adapted for sorting cards used in tabulating systems, such, for instance, as the Hollerith.

6 Index points are formed by punching holes through the cards, the value and character of the information conveyed by each hole being dependent on its exact location on the card. The index points are arranged
10 in vertical columns and certain columns contain punched index holes designating the kind or class to which the card belongs.

As it would be a tedious task to sort out the cards by hand, into desired classes or
15 groups before running them through the tabulating machines, sorting machines have been designed to do the classifying automatically, and that is the class of machine to which my present invention belongs, be-
20 ing an improvement on the machine described in detail in my copending application Serial No. 748,347, which discloses a sorter of the horizontal type designed to sort the cards electrically and deposit each
25 class in a certain station.

My present invention pertains especially to the method of controlling the receiving ends of the blades which conduct each card to its station after the selecting or analyzing
30 device indicates to which station it should go.

Fig. 1 is a front elevation of my sorting machine complete.

Fig. 2 is a section through the feeding and analyzing portion of the machine.

35 Fig. 3 is an enlarged view, partly in section on line 3—3 of Fig. 4, of that portion of the distributing mechanism covered by my present invention.

40 Fig. 4 is an end view of Fig. 3, partly in section on line 4—4 of Fig. 2.

Fig. 5 is a diagram of electric circuits applying to Figs. 3 and 4.

Fig. 6 is a diagram of electric circuit applying to Figs. 8 and 9.

45 Fig. 7 is a top view of receiving end of distributing blade.

Figs. 8 and 9 are views of an alternative arrangement of magnets and blade control.

Referring to Fig. 1, the frame 30 is
50 mounted on legs 31.

Underneath the main frame and carried by the legs, is a shelf or subframe 32 supporting the motor 33 which drives the machine by pulley 34 by belt 35 to pulley 36
55 secured to shaft 37 which runs the full

length of the machine, in the rear, pulley 36 being on one end of it and handwheel 38 on the other. Motor 33 is shown slightly displaced from its true position in order to save space in the drawing.

In operation, a stack of cards to be sorted is placed in the feed magazines as at 55 with plate 56 on top of the stack. The operator, by means of crank 58, moves the contact brush so it will traverse the desired
60 index column on the cards as they pass under it, and if desired he arranges the selector buttons 59 to give the kind of sort he wants. He then starts the machine by pressing button 60. Driven by the motor, picker
65 drum 61, geared to shaft 37, rotates, and feeds the cards one by one from the bottom of the stack into the analyzer, whence passage of each card is directed between succeeding pairs of rolls into one of the thirteen receiving stations 9, 8, 7, 6, 5, 4, 3, 2,
70 1, 0, X, E, R.

Each receiving station consists of a compartment formed by the vertical walls 62, in which is an inclined tray 63 having vertical
80 fingers 64 extending upwardly from its lower edge. Each tray is carried by a vertical plunger 65 which extends downwardly into a cylinder 66, wherein the plunger is supported by a coil spring 67 of such resiliency as to gradually sink as its load of cards increases, always maintaining the top
85 of its stack at or near the top of its compartment so that newly arriving cards will have only a slight distance to drop and consequently will have no chance to turn
90 over or become otherwise deranged.

The feed mechanism consists of the rotary picker drum 61, mounted on shaft 61A and turning with it. Drum 61 carries in its rim
95 a number of picker blades 69 extending lengthwise of the drum and projecting from the drum a distance slightly less than the thickness of a card. This mechanism is enclosed in the housing 71. As the drum re-
100 volves each blade in turn picks a card from the bottom of the stack 55 and feeds it through the micrometer openings 72 provided between the fixed plate 73 and rollers 74, into control of the analyzing and dis-
105 tributing system.

The principle of my distributing system may be readily understood from Figs. 3 and 4, in which 100 is a brass cylinder extending
110 crosswise of the machine, 101 being a pair

of rollers pressed downwardly against contact cylinder 100. 103 represents a card passing between cylinder and rollers, and 104 is the brush carrying the electric current which operates the control magnets. 105 are armatures in contact with both ends of the magnet cores, and having their lower portions bent underneath the magnets so their ends are in close proximity, substantially as shown. These armatures are magnetized whenever the magnets 107 are energized.

A sheet of nonconducting material 108 extends horizontally underneath the magnets to support the steel distributing blades 109 of magnetic material and which, while the magnets are not energized, lie flat, one on top of the other, each being shorter than the one below it. Each blade end has an upturned lip 110 to assist in guiding the cards. The receiving ends of these blades are narrowed relatively to the main portion of the blades as shown in Fig. 7. The other ends of the blades are successively attached to brackets 111, one above each receiving station, the lowest blade going to station 9, the second from the bottom going to station 8, the third to station 7, and so on to stations X, E, and R. A lip 113 is punched downwardly from the center of each blade and placed underneath its bracket 111. 115 is a guide supported by plate 116 to assist in properly directing cards which pass above all the blades on their way to the reject, or R, station.

In passing to the several receiving stations the card is drawn between succeeding upper and lower pairs of rolls spaced so that each set of rollers receives the card before it has passed from control of the preceeding set. All rolls are driven at the same speed. Upper rolls are 122, fast on shafts 123, while the lower rolls are designated 124 and are fast on shafts 125.

While the machine is sorting a promiscuous stack of cards, each card as it comes from the feed mechanism, passes over the contact cylinder 100, with brush 104 bearing on the top surface of the card. If the brush finds no hole in the card, that card will pass along above all the blades 109 with their upturned lips 110, underneath guide 115 and will be conducted by the rollers, above all the blades to the furthest station, which is R.

If, however, the brush 104 finds a hole in a card it will complete the control circuit by making contact through the holes with cylinder 100, relay R-3 will be energized, also magnets 107 will be energized, armature 105 will be magnetized and will draw up against itself all blade ends 109 which are not already underneath the advancing card 103, and we have the card as shown in Fig. 3 wherein it is evident that further progress

of the card to the left will direct it into the passage above the fifth and below the sixth blades (counting from the right). In its further progress between the rollers it will be confined to that particular passage, which ends in station 4.

It is evident that the destination of each card depends on how far the card has traveled above the blades 109 at the instant the magnet is energized, and that depends on the location of the hole in the column of the card being analyzed.

The cards are fed bottom first and the brush passes over the index positions in any column in the order 9, 8, 7, 6, 5, 4, 3, 2, 1, 0, followed by the two extra positions, which correspond to stations X and E respectively.

Ends of ribbons 109 are so positioned relatively to the brush 104 that if the brush finds a hole at index position 9 the magnet will have acted before the advancing edge of the card has reached the first blade end, the card will pass underneath all the blades and will be conducted by the rollers into the nearest station, which is No. 9. If the brush does not find a hole in the card until index point 8 is reached, the card will have advanced far enough to prevent the end of the first blade being raised when the magnet is energized, but all the others will have been drawn up by the magnets and the card will pass between the first and second blades into station 8, and so on. It will be understood that the thickness of the blades is much less than indicated by the drawings, so they must bend only slightly in order to permit the cards to travel in the plane between the rollers.

Restoring pin 141 in disk 142 revolving synchronously with the balance of the mechanism strikes restoring bar 143 and restores the blades 109 to their dormant position after the passage of each card. Bar 143 is pivoted on the armature at 144 and is held normally in raised position by spring 145.

Brush 104 is carried by brush holder 150, which in turn is carried by suitable mechanism, and adapted to be manually moved crosswise of the machine by screw 159, actuated by its hand crank 58, in order to position the brush to traverse the desired column on the cards passing under it.

In order to adapt my sorter to the varied kinds of sorting it is called upon to do, I provide it with a device termed a "selector", 200 which is fast to shaft 202 which also carries the contact cylinder 100. My selector and its uses are fully described in my copending application above referred to. Its principle is shown in diagram Fig. 5, wherein it will be noticed that it is necessary to have contact concurrently by brush 104 on cylinder 100, and by shoe 208 on a button 204 in order to energize magnet 107.

There is a contact button 204 for each

receiving station, which means one for each index position on the card. Each contact 204 is controlled by a manually operated button 59 (Fig. 1) and may be adjusted in operative or non-operative position as desired by the operator. As shown, however, contact is made between shoe 208 and button 204 for every index position on the card passing under brush 104. This is the setting for straight sorting.

In ordinary service the operator starts the machine by pressing button 60, thus engaging relays R—1 and R—2 and stops it by pressing either of the stop buttons 214, one at each end of the machine. In addition to the above stopping means there is an additional stop switch which serves to stop the motor automatically if the supply of cards is exhausted, and which also keeps the motor 33 in current after button 60 is released.

After a card has passed cylinder 100 and before reaching the first set of conveyor rolls, it passes beneath the block 215, fast to the frame of the machine, thereby depressing lever shoe 216 which is pivoted to the frame at 217, and which by its downwardly extending arm 218 controls the contacts 219. When a card is passing arm 218 presses spring blade 220 to the left and contact is maintained at 219, keeping relay R—1 energized, but if no card is passing, 216 is free to rise sufficiently to allow 218 to move to the right, and spring blade 220 breaks the contact of relay R—1 de-energizing it and motor relay R—2 thus cutting motor 33 off from the supply line. Rollers 122 and 124 immediately adjacent this automatic switch mechanism are grooved to accommodate the heel of shoe 216.

Figs. 8 and 9 illustrate an alternative arrangement of my blade control device, in which the control circuit is normally closed, so that magnets 107 are normally energized and armatures 105 magnetized. Referring to the diagram Fig. 6, relay R—6 is normally deenergized as shown. Upon the passage of an index point perforation under brush 104 relay R—5 becomes energized thereby energizing relay R—6 and breaking the circuit through magnet 107.

In this modification, blades 109 are spring-biased upwards but normally lie flat on armature 305 because they are held thereto magnetically. As card 103 advances and brush 104 finds a hole therein, a circuit is established through the selector, whereby the circuit through magnet 107 is broken, as shown in diagram, Fig. 6. When this occurs, all the blades are released by armature 305 and those not held down by the advancing card, rise, due to their upward spring bias, and the card enters the passage between a pair of blades and is conducted, as previously described, to its proper station.

The end of each blade, in either its normal or raised position, is behind the square shoulder of a projection 317 on either the armature 305 or retaining plate 316. Each of these projections having sloping surface on the side from which the card advances so as to facilitate the passage of the card. The ends of the blades are partly cut away, and formed with hook-shaped tips extending alternately to right and left, substantially as shown in Fig. 9.

What I claim is:

1. A blade distributing system for a card sorting machine comprising a plurality of blades of magnetic material, said blades having ends of different lengths, means for successively advancing cards into co-operation with said blades, means for directing the cards past the ends of the successive blades, card analyzing means, a magnet controlled thereby, means operative upon a change of the energization status of the magnet for moving such blades which are not restrained by the analyzed card against movement to open a distributing passage between the said blades for the analyzed card.

2. A blade distributing system for a card sorting machine comprising a plurality of blades of magnetic material, said blades having ends of different lengths, means for successively advancing cards into co-operation with said blades, means for directing the cards past the ends of the successive blades, card analyzing means, a magnet controlled thereby, said magnet being normally energized and said blades being normally biased to open position but retained in closed position by the magnetic forces acting upon them, means controlled by said analyzing means for de-energizing said magnet and for releasing such blades as are not restrained by a co-operating card co-operating therewith to thereby open a distributing passage between the said blades for the analyzed card.

3. A blade distributing system for a card sorting machine comprising a plurality of blades of magnetic material, said blades having ends of different lengths constructed and arranged to direct a card successively over the tops thereof, means for advancing a card over said blades, index point analyzing means, a magnet operating to exert a magnetic attraction upon the blades, means controlled by the analyzing means for controlling flow of current through said magnet, said magnet operating upon a change of its energization status in co-ordination with the analyzed card overlying certain blades to open a card distributing passage between a certain pair of blades.

4. A blade distributing system for a card sorting machine comprising a plurality of blades of magnetic material, said blades having ends of different lengths constructed

and arranged to direct a card successively over the tops thereof, means for advancing a card over said blades, index point analyzing means, a magnet operating to exert a magnetic attraction upon the blades, means controlled by the analyzing means for controlling flow of current through said magnet, said magnet operating in conjunction with the card depending upon the position of the card to open different card distributing passages through said blades.

5. A blade distributing system for a card sorting machine comprising a plurality of blades of magnetic material, said blades having ends of different lengths, means for successively advancing cards into co-operation with said blades, means for directing the cards past the ends of the successive blades, card analyzing means, a magnet and means controlled by said card analyzing means for changing the energization status thereof upon an analyzation of an index point perforation in said card, said blades normally of themselves lying flat together whereby a passing card will be prevented from entering between any pair thereof, said magnet being so located as to magnetically attract said blades to it upon energization whereby a change in status of its energization results in movement of such blades as are not restrained by the analyzed card to open the proper passage for the card.

6. In a machine of the character described, in combination, card analyzing means comprising devices for causing electric current to flow through holes in the card, a plurality of blades forming passages for cards, said blades being of magnetic material, a magnet controlled by the analyzing means, a fixed armature therefor, said magnet being operable in conjunction with the controlling effect of the card upon the blades to open a passage for the card between the blades.

7. In a machine of the character described, in combination, card analyzing means comprising devices for causing electric current to flow through holes in the card, a plurality of blades forming passages for cards, said blades being of magnetic material, a magnet, a fixed armature therefor, said armature being adjacent the receiving ends of the blades and adapted to act magnetically thereupon, and said magnet being operable in conjunction with the controlling effect of the card upon the blades to open the proper passage for the card between the blades.

8. In a machine of the character described, in combination, card analyzing means comprising devices for causing electric current to flow through holes in the card, a plurality of superimposed blades forming distributing passages for cards, means for directing a card over the ends of said blades, said blades being of magnetic material and having their receiving ends differentially spaced

longitudinally, a magnet controlled by the analyzing means, and adapted when energized to magnetically attract said blades, and so placed that the card emerging from the analyzing means passes between the magnet and the receiving ends of the blades when the blades are in unattracted position, the magnet and the card acting in conjunction to open a passage for the card between the blades.

9. In a machine of the character described, in combination, card analyzing means comprising devices for causing electric current to flow through holes in the card, a magnet controlled by the analyzing means, said magnet being normally energized, a plurality of superimposed blades forming distributing passages for cards, said blades being of magnetic material, with their receiving ends differentially spaced longitudinally and spring biased upwards, but normally held magnetically against the armature, the magnet and card acting in conjunction upon the blades to open a passage for the card between the blades.

10. In a machine of the character described, in combination, card analyzing means comprising devices for causing electric current to flow through holes in the card, a plurality of superimposed blades forming distributing passages for cards, said blades being of magnetic material and having their receiving ends differentially spaced longitudinally, a magnet controlled by the analyzing means and so placed that the card emerging from the analyzing means passes between the magnet and the receiving ends of the blades when the blades are in unattracted position, said magnet when energized drawing to it all the blade ends, said blades being displaced solely by magnetic attraction of the magnet, and said blades on moving in response to a change of energization status of the magnet opening a passage for the card, the particular passage opened depending on the position of the card at the instant of operation.

11. In a machine of the character described, in combination card analyzing means comprising devices for causing electric current to flow through holes in the card, a magnet controlled by the analyzing means, said magnet being normally energized, a plurality of superimposed blades forming distributing passages for cards, said blades being of magnetic material with their receiving ends differentially spaced longitudinally and spring biased upwards but normally held magnetically against the armature; said magnet, armature and blade ends being so disposed that the card while emerging from the analyzing device passes successively over the blade ends until the magnet is deenergized under the control of the analyzing means, whereupon all blade

ends not prevented by the card are permitted to rise, thereby opening a passage for the card, the particular passage opened depending on the position of the card at the instant of operation.

12. A distributing system for sorting machines including card feeding means and card analyzing means, a magnet and means for changing its energization status on card analysis, a plurality of armatures for said magnet movable across the path of a card being fed in a direction substantially normal thereto on change of energization status of said magnet, said armatures having normally closed card guiding passages therebetween adapted to be opened on relative motion between adjacent armatures, and said armatures overlapping the path of card travel to different extents during analysis whereby a card being analyzed may effect

relative movement between adjacent armatures and select a passage for itself between them.

13. A distributing system for card sorting machines including a magnet, superimposed armatures therefor with differentially located ends, card analyzing means for analyzing index point positions of a card, a card being analyzed having one of its edges between differentially located ends of two adjacent armatures, means controlled by said analyzing means for changing the energizing status of the magnet on encountering an index point on a card whereby said card may select a passage for itself between predetermined adjacent armatures.

In testimony whereof I hereto affix my signature.

EUGENE A. FORD.