July 21, 1936. W. W. LASKER 2,048,397

SORTING MECHANISM

Filed Oct. 31, 1934 4 Sheets-Sheet 1

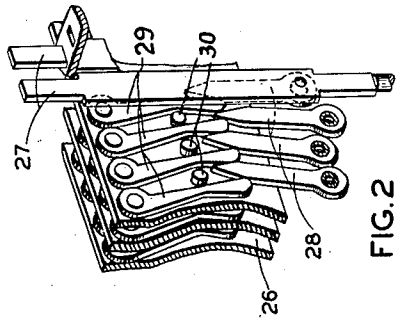

FIG. 2

FIG. 1

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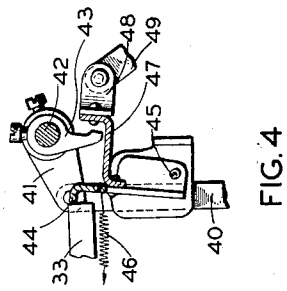

FIG. 4

FIG. 3

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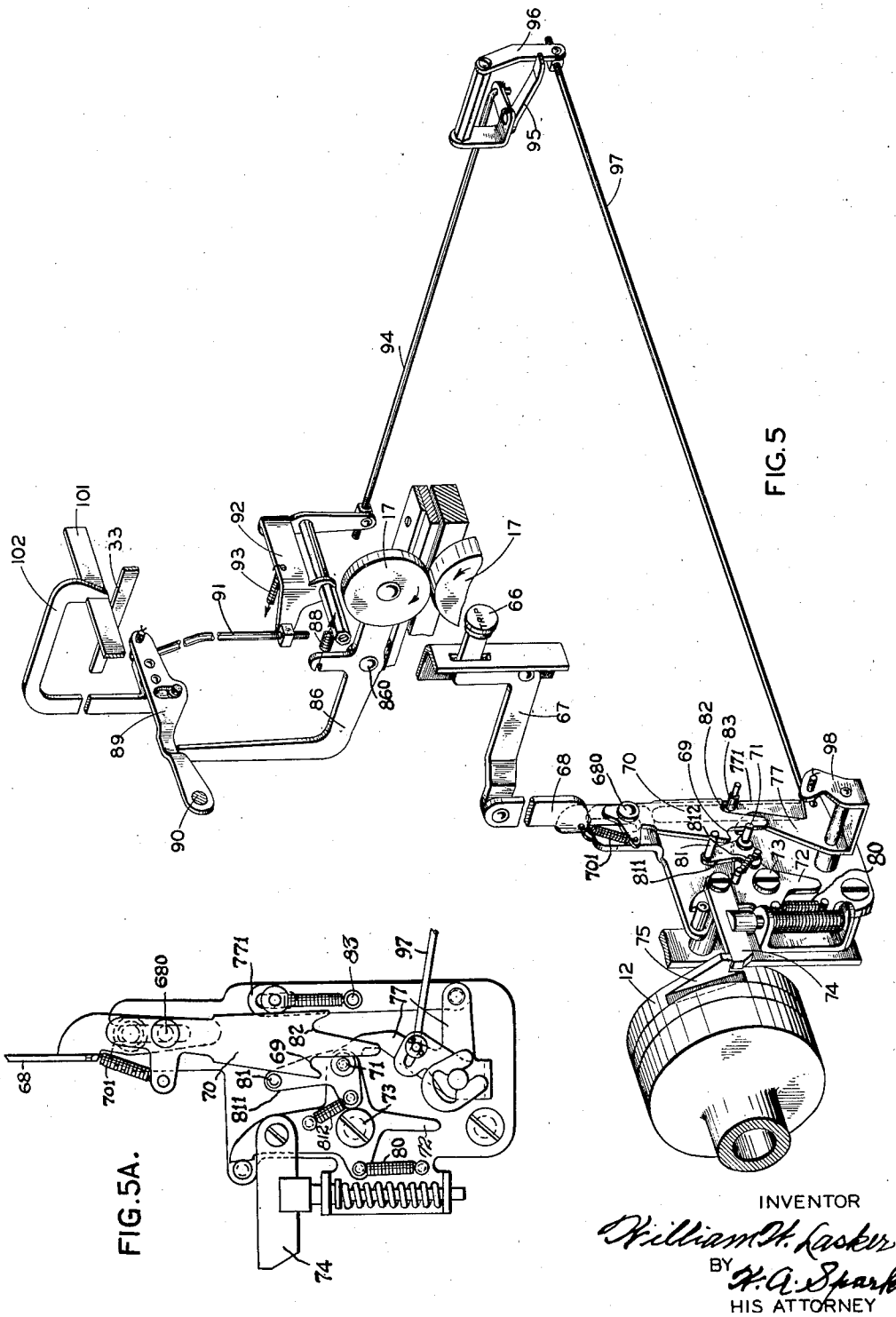

FIG. 5

FIG. 5A.

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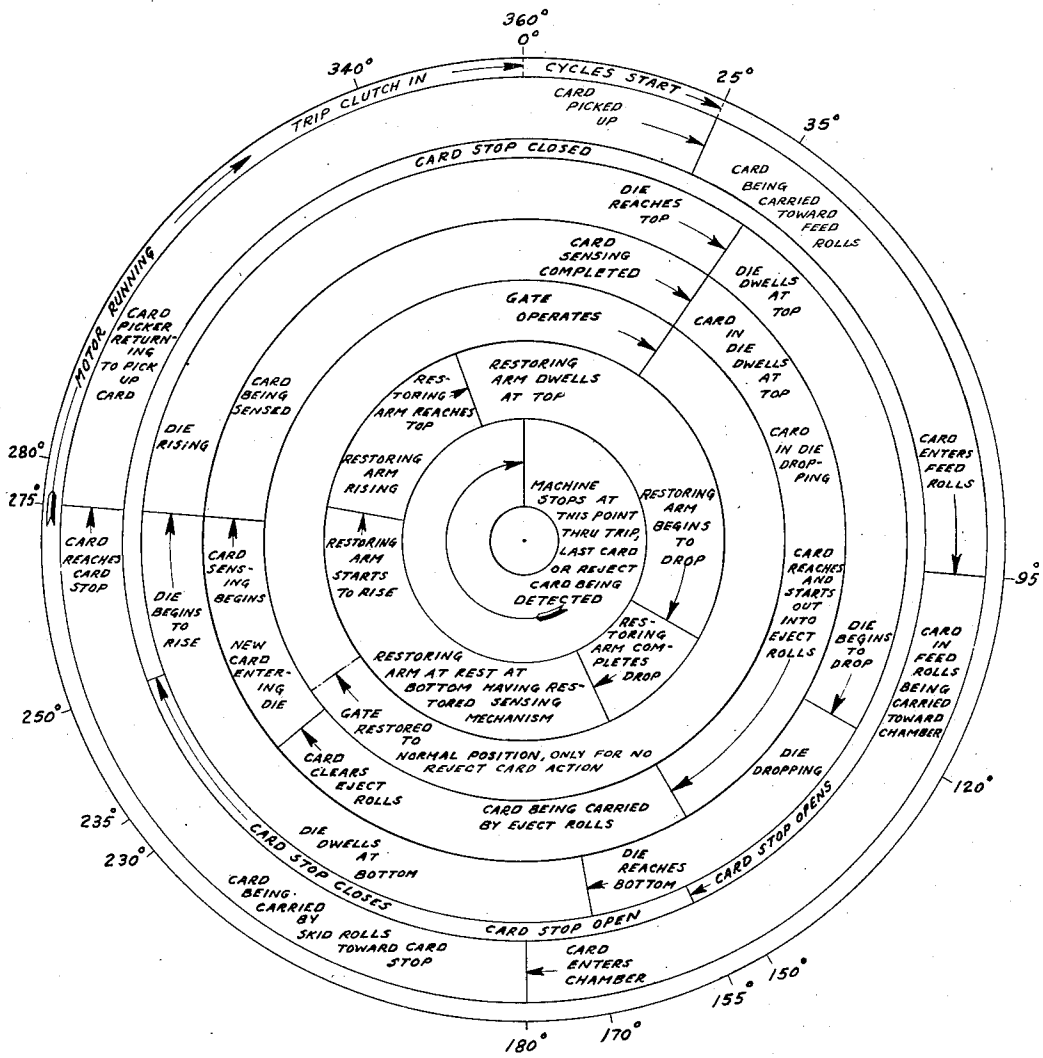

FIG. 6

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Patented July 21, 1936 2,048,397

UNITED STATES PATENT OFFICE

2,048,397

SORTING MECHANISM

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Application October 31, 1934, Serial No. 750,755

3 Claims. (Cl. 209—110)

This invention relates broadly to tabulating machinery and particularly to that form of tabulating machinery designed for the automatic sorting of perforated code cards.

The invention consists of a mechanism designed for the specific functions of automatically segregating cards having two holes punched in any one column, an automatic clutch control device for stopping the operation of said mechanism upon the segregation of each of said two-hole cards and a manually settable device for rendering inoperative that part of the segregating mechanism applicable to any particular column.

The complete embodiment of the invention requires, and makes use of, card picker, feed, stop and sensing devices, machine driving, starting and stopping mechanisms, and a suitable frame with base or floor stand. Such devices are well known in the art and are herewith disclosed in whole or in part only where such disclosure facilitates the description of the invention. However, references may be made to such mechanisms as the well known Powers card punch and to disclosures in such patents as Lasker 1,287,706, Lasker 1,305,557, and Lasker 1,810,317, and in Lasker pending applications S. N. 616,926, filed June 13, 1932, and S. N. 680,922, filed July 18, 1933.

The application of the invention will be better understood by explaining the practical problems involved. A 45-column card is one having forty-five columns of twelve possible punch positions, representing respectively the digits zero to nine and two extra positions known as the eleven and twelve positions, the last two being frequently used for "control holes". There are two types of tabulators on the market which may utilize "45-column" cards, in one of which, if two digit holes are punched in a single column, the hole of higher value will control. In the other type of tabulator, the well known Powers type—the hole of lower value will control. It sometimes occurs that a corporation, using tabulators of one type, will wish to change to tabulators of the other type. In such a case, any card, having two digital punchings in any one column, will be incorrect for the new tabulator. Hence, all of these cards must be searched out and new, properly punched, cards inserted for them. For such a concern as an insurance company, having several million cards, to do this by hand is a Herculean task; and the present machine has been devised to do the work automatically, and will handle approximately forty thousand cards per day, allowing for time idle during refilling of card magazine and other delays.

The offset punching of perforated record cards for the purpose of verification is well known in the art. Briefly, the operation by which such verification is accomplished is to alter the setting of the card stop, so that when cards are run through a second time, the new holes are offset from the former holes by a small fraction of an inch. In case an error has been made, either in the first or in the second run, it is obvious that two distinct holes instead of one elongated hole will appear in the column in which the error has been made. A machine of the character contemplated in the present invention affords then a ready means of segregating those cards which have been erroneously punched.

The above illustrations are merely indicative of two of the uses to which such a machine as that of the present invention may be put. Other uses and will readily suggest themselves to those skilled in the use of such equipment.

It may be that some cards, having only a single digit punching, will have also a "control hole" punched in the eleven or twelve position, which condition would normally cause the card to be rejected. However, the machine is provided with manually settable means for rendering such rejection ineffective in any desired column.

Many companies keep their cards in serial order, and normally the machine would reject the double punched cards and keep on feeding, thereby destroying the serial arrangement. To prevent this undesirable condition means are provided, which may be utilized to stop the machine at each rejection, so that the rejected card may have its correct data punched in a new card, and the new card may be inserted in its proper place in the receiving box, after which the machine may again be started by the operator.

Hence, one object of the invention is to automatically segregate perforated code cards having two holes in any one column.

Another object of the invention is to automatically stop said automatic code card segregating mechanism at the completion of the segregation of each code card having two holes in any one column.

Still another object of the invention is to render ineffective that part of said segregating mechanism, applicable to any particular column, by means of a manually settable device.

Another object of the invention is to provide a complete automatic machine for the segregation, modification of said segregation, and detection of said segregation of one or a plurality of perfo-

rated code cards having two holes in any one column.

The present invention contemplates a record card segregating device, comprising sensing means, plural card receptacles, means associated with the first named means to control the alternative selection of the second named means, and means associated with both the sensing means and the selecting means to cause a cessation of the operation of the device.

Other objects and structural details of the invention will be apparent from the following description when read in connection with the accompanying drawings, wherein:

Fig. 1 is a vertical sectional view of the segregating mechanism, taken at a characteristic perforated card column line with the setting in position for the segregating of a card having one hole punched in said column.

Fig. 2 is an enlarged fragmentary isometric view of the differentiating device.

Fig. 3 is a view similar to Fig. 1 except that the setting is shown in position for the segregating of a card having two holes punched in a characteristic column.

Fig. 4 is a fragmentary sectional view of the card gate control mechanism.

Fig. 5 is an isometric view of the automatic and manual clutch control mechanism.

Fig. 6 is a timing diagram disclosing the cycle of operation of the complete mechanism.

In the drawings, (Figs. 1 and 3) 10 represents the base and general framework, it being understood that such framework includes suitable supporting means for the mechanism to be described, as well as proper bearings for the shafts. The main operating shaft is indicated at 11, and may be power driven from a motor or other suitable source. The starting and stopping of shaft 11 is controlled by a clutch indicated at 12 (Fig. 5) and of the type shown in my Patent No. 1,810,317.

The usual Powers die plates 13 and 14, forming a sensing chamber 15 are to be understood as reciprocating in the usual well known manner. Feed rolls 16, skid rolls 17, card stop 18, eject rolls 19, card gate 20, pins 21 and pin plate 22 are all precisely as in the Powers punch. There are, of course, a plurality of pins 21 (twelve shown) for each column of the card so that, for example, in a 45-column card there are five hundred and forty pins, though for the purpose of this application only one row of twelve pins has been shown.

Suitably supported above the pins 21 in a frame 25, which carries division plates 26. These plates 26, of which there are forty-five for a 45-column-card, are arranged to flank a like number of sets of spring urged interponent pins 27. Frame 25 is of a generally well known type of construction having rectangular holes in both its upper and lower plates for guiding each interponent pin 27. Each interponent 27 carries an extrusion upon which is pivoted a finger 28 which is formed as a double wedge at its upper end. Each plate 26 carries a set of fingers 29, which extend downwardly from their respective pivots. Fingers 29 are constrained to remain in their approximate region of activity by reason of pins 30, which are fast in plate 26. The position of fingers 28 and 29 in combination determines the setting of the card gate 20.

Mechanism for actuating the card gate 20 is provided. Bell crank 33, mounted on shaft 34, is urged against the forwardmost finger 29 by a spring 35. Fixedly mounted on shaft 11 is a cam 36. A follower 37 is carried on the forward end of lever 38. The rearward end of lever 38 supports a link 40 which extends vertically to arm 41. Arm 41 is fixedly mounted on shaft 42, which shaft also carries arm 43, fixedly mounted thereon. A universal bail 44 has its two ends pivoted to the frame at 45, and is urged forwardly by a spring 46. A connection piece 47 joins bail 44 to a lug 48. Connection piece 47 is shaped to provide a surface upon which arm 43 may act when so urged by the above described mechanism under control of cam 36. Lug 48 has pivoted thereto a link 49, which extends downwardly and rearwardly and is pivoted at its lower end to arm 50. Arm 50 is fixedly mounted on shaft 51. Shaft 51 is journaled in a suitable bracket and carries card gate 20, which is fixedly attached to said shaft.

Since bell cranks 33 are spring urged, it is necessary that they be restored, the following mechanism being provided for the purpose. A cam 55, fixedly mounted on shaft 11, cooperates with a follower mounted on lever 56, which lever has an upturned projection for supporting a stud 57. A link 58 is pivoted at its upper end to lever 59 and at its lower end is guided by a slot in the frame. A spring 60 maintains a step on the lower end of link 58 in contact with stud 57. An arm (not shown) is fixedly mounted on shaft 34 and, together with the rearwardly extending end of lever 59, forms support for bail bar 61.

An adjustable rider 65 is provided. This rider may be set over any desired bell crank 33 to render it ineffective and nullify the action of the sensing means. It is apparent that a plurality of these riders may be utilized as the needs of the work may require. Riders 65 are particularly useful when cards are alphabetically perforated in certain columns, since certain letters are usually represented by plural perforations, and the segregation of such cards may not be desired.

Mechanism is provided to manually start and stop the machine. This mechanism is disclosed in my application S. N. 680,922, filed July 18, 1933, and is illustrated in Fig. 5. Its operation will be described hereinafter.

In addition to the mechanism for manually stopping the machine, as indicated above, there are two other controlling mechanisms—that which is associated with the segregation of the last card, and that associated with the segregation of two-hole cards.

Mechanism for stopping the machine, after the last card has been segregated, comprises a bent lever 86 upon which the upper of the rearmost skid rolls 17 is mounted, arm 89 which is pivoted to the frame of the machine at 90, an adjustable rod 91 pivoted at its upper end to arm 89 and at its lower end to a U-shaped bell crank 92 which is under the tension of spring 93, adjustable rod 94 which is pivoted at its rearward end to an arm of bell crank 92 and at its forward end to a bell crank 95, a downwardly extending arm 96 pivotally connected at its lower end to an adjustable rod 97 which at its other end is pivoted to the upwardly extending arm 98 of catch 77.

The mechanism for stopping the machine when a two-hole card is segregated comprises, in addition to the above, a universal bar 101 which is fixedly attached to a support 102, which support is mounted upon arm 89.

Description of machine operation

Pressure upon trip key 66 rocks bell crank 67

and forces rod 68 downwardly. Notch 69 of member 70 then engages pin 71 of member 72, swinging it clockwise about its pivot 73 and thus withdrawing the latch 74 from the path of lug 75 on clutch 12 and tensioning spring 80. Pin 71 engages catch 77 and latch 74 is retained in its ineffective position. Pivotally mounted on pin 71 is member 811, which supports pin 81 and is resiliently maintained in its relation to member 72 by spring 812. As member 70 moves pin 71 downwardly, pin 81 is forced against the side of member 70 and spring 812 is thereby tensioned. This tensioning of spring 812 is sufficient to cause pin 81 to throw member 70 to the right, thereby tensioning spring 701, and positioning notch 82 above pin 83 when the pressure is removed from trip key 66.

A card from the magazine is picked up by regular picker mechanism (not shown) and is conveyed in this manner to engage with feed rolls 16, which feed it into the sensing chamber 15, where skid rolls 17 position it against card stop 18. The dies 13 and 14 then close upon each other and rise as a unit lifting all pins 21 for which there are no corresponding holes in the card and leaving in place any pins 21 which have penetrated holes in the card. The rising non-penetrating pins 21 lift interponents 27 into position shown in Figs. 1, 2, and 3.

The interponents 27, some of which are up and others down, carry fingers 28 spaced between fingers 29. The action of these two groups of elements in combination causes a varying degree of contracting motion when all are closed together through the tension of spring 35 acting on the lower arm of bell crank 33.

Figs. 1 and 3 illustrate the two different degrees of contraction necessary to distinguish between cards having one hole per column and those having two holes per column. It will be seen that the position of the horizontal arm of bell crank 33 will be controlled by this contraction. When a two-hole card is sensed, the horizontal arm of 33 will be in position to block the return action of bail 44, since two fingers 28 are in their lower position and permit fingers 29 to close up sufficiently to allow such positioning. When a one-hole card is sensed, this same arm will be below the position for blocking bail 44, thereby permitting it to return its full distance.

As follower 37 rolls off of the high dwell of cam 36, lever 38 will act upon link 40, arm 41, shaft 42 and arm 43 to cause bail 44 to operate once for each card. Each rotation of cam 36 will then result in the oscillation of bail 44 and its associated elements. If then bell crank 33 is elevated, due to sensing of a two-hole card, bail 44, contacting end of bell crank 33, cannot return, thereby causing card gate 20 to remain open to receive the card and to guide the card to its proper destination after die 14 has been lowered and the card released.

Each rotation of cam 55 causes the operation of the mechanism for restoring bell cranks 33. The mechanism will not, however, perform its function except when said bell cranks have been released by the mechanism associated with sensing two perforations.

When a two-hole card is sensed, the rearwardly extending arm of bell crank 33 is elevated, carrying with it bail 101 which is fixedly mounted on support 102, which support is fixedly attached to lever 89. The elevation of the arm of bell crank 33 will then cause lever 89 to rock, thus elevating rod 91, and rocking U-shaped bell crank 92 and tensioning spring 93. The rocking of bell crank 92 pulls rod 94 rearwardly and actuates bell crank 95, which then turns arm 96 in a counter-clockwise direction. The turning of arm 96 pulls rod 97 and rocks arm 98 of catch 77. Thus, the effect of rocking of lever 89 releases pin 71 from engagement with catch 77 and releases member 72 and latch 74, which latter then intercepts lug 75 and causes the machine to stop at the end of the cycle.

When the last card passes out from between the rearmost of the pairs of skid rolls 17, the upper roll of said pair and lever 86, through action of spring 88 (Fig. 5), rock counter-clockwise, about pivot 860. The upwardly extending arm of lever 86 is thus positioned under lever 89. Since bent lever 86 is pivotally mounted in the reciprocating sensing head, lever 89 will be caused to rock when the sensing head rises during the next cycle, thus actuating the clutch latching mechanism in the manner previously described.

It is to be noted that when trip key 66 was pressed to start the machine, latch supporting member 72 was rocked clockwise, spring 80 was tensioned, pin 81 was forced against member 70, notch 82 due to the action of 811 was positioned directly above pin 83, and spring 701 was tensioned. If then, key 66 is again pressed, member 70 acting through notch 82 moves pin 83 and slide 771, in which it is fixed, downwardly. The lower end of slide 771 is pivoted to the horizontally extending arm of catch 77. Hence, the downward motion of slide 771 rocks catch 77 clockwise, and releases pin 71 and latch supporting member 72. Member 72 is now rocked counter-clockwise under action of spring 80, and latch 74 is positioned to intercept lug 75 and thus release clutch 12 at the end of the cycle. As soon as pressure on trip key 66 is removed, tensioned spring 701 rocks member 70 clockwise, and it becomes positioned for again starting the machine.

The timing chart (Fig. 6), the purpose of which is to more clearly disclose the cycles which render this mechanism workable, shows eight concentric rings each of which indicates the complete cycle of one of the major devices embodied in the machine. Starting at the outermost, these rings may be designated as:

1. Cycle of clutch trip.
2. Cycle of card travel from pick-up to card stop.
3. Card stop cycle.
4. Die motion cycle.
5. Cycle of card sensing and card eject.
6. Card gate operating cycle.
7. Restoring arm cycle.
8. Machine stop cycle.

This chart shows clearly the overlapping of these cycles and reference to it readily explains the simultaneous action of the various elements. It will be noted that, while one card is passing out of the sensing device, another card is entering. This and other features of simultaneous action result in increasing the speed with which cards may be passed through the machine.

While I have described what I consider to be a highly desirable embodiment of my invention, it is obvious that many changes in form could be made without departing from the spirit of invention, and I, therefore, do not limit myself to the exact form herein shown and described, nor to anything less than the whole of my invention as hereinbefore set forth and as hereinafter claimed.

I claim and desire to secure by Letters Patent:

1. In a record card segregating device, the

combination of sensing means; interponent members actuated thereby; means comprising a wedge shaped member loosely mounted on each said interponent member and pivotally mounted block members placed alternately to said wedge shaped members; a pair of card receptacles; a card deflector; means associated with said wedge and block member for controlling the position of said deflector and conditioning one or the other of said receptacles for the reception of cards, operating means ineffective with respect to any predetermined column of the card.

2. In a record card segregating device, the combination of a power element, a clutch member associated therewith, card sensing means, interponent members actuated thereby, means comprising a wedge shaped member loosely mounted on each said interponent member and pivotally mounted block members placed alternately to said wedge members, a pair of card receptacles, a card deflector and means associated with said wedge and block members for causing said clutch member to render said power element ineffective when two of said wedge members are withdrawn from between said block members.

3. A device comprising a plurality of sensing elements arranged in columns, said columns being arranged in rows, interponent members, each such member being in position to be actuated by said sensing elements, a wedge-shaped member pivoted on each interponent member, pivoted block members arranged to alternate said wedge-shaped members, means for causing one or more wedge-shaped members to be withdrawn from between their adjacent block members, plural card receptacles, means for the alternative opening of said card receptacles, and means associated with said wedge-shaped and block members to open one said receptacle when a single wedge-shaped member is withdrawn and to open said other receptacle when two wedge-shaped members are withdrawn.

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