March 17, 1936. A. THOMAS 2,034,010

MACHINE FOR SORTING STATISTICAL CARDS

Filed Jan. 11, 1933 5 Sheets-Sheet 1

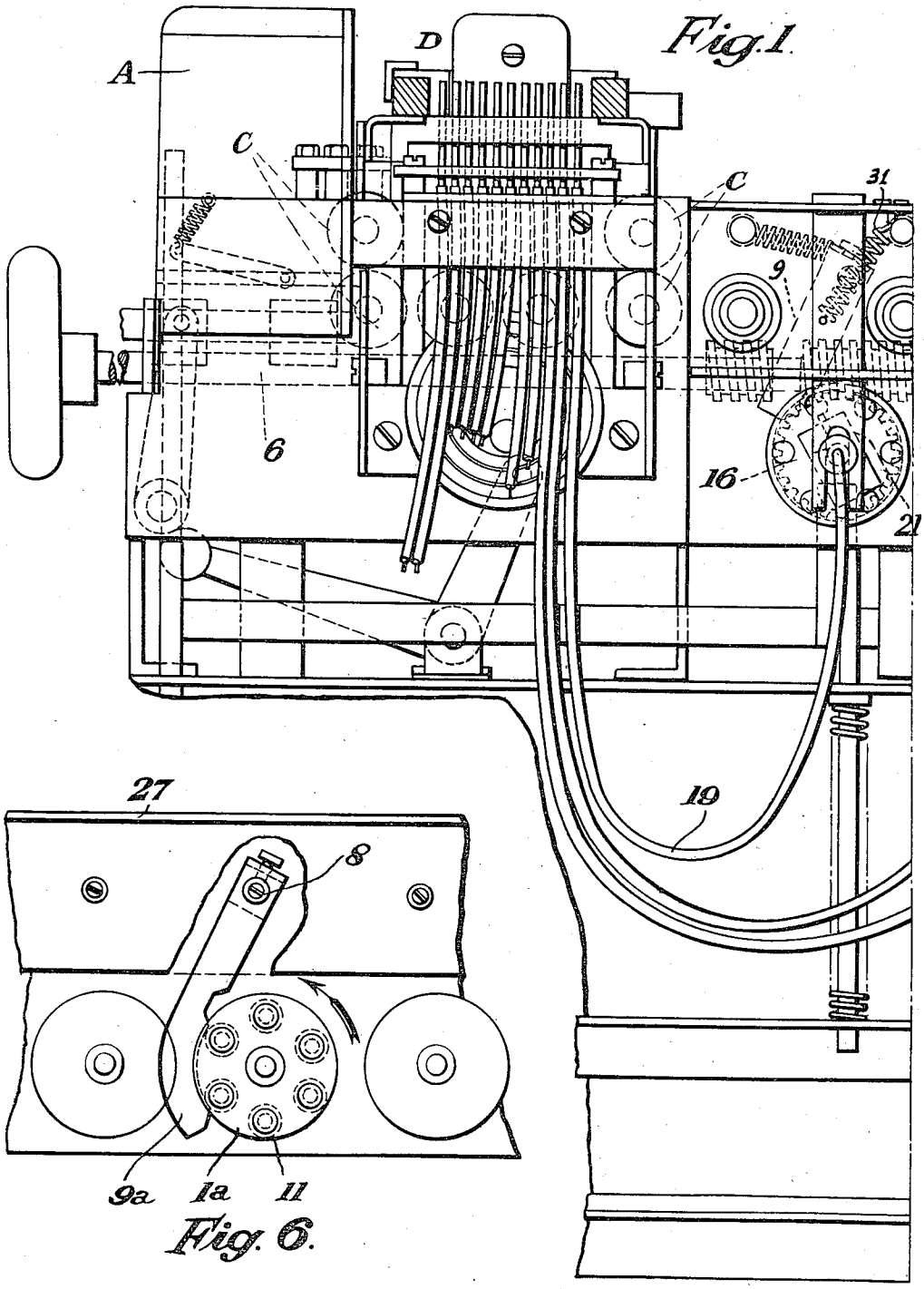

Fig. 1.

Fig. 6.

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MACHINE FOR SORTING STATISTICAL CARDS

Filed Jan. 11, 1933 5 Sheets-Sheet 2

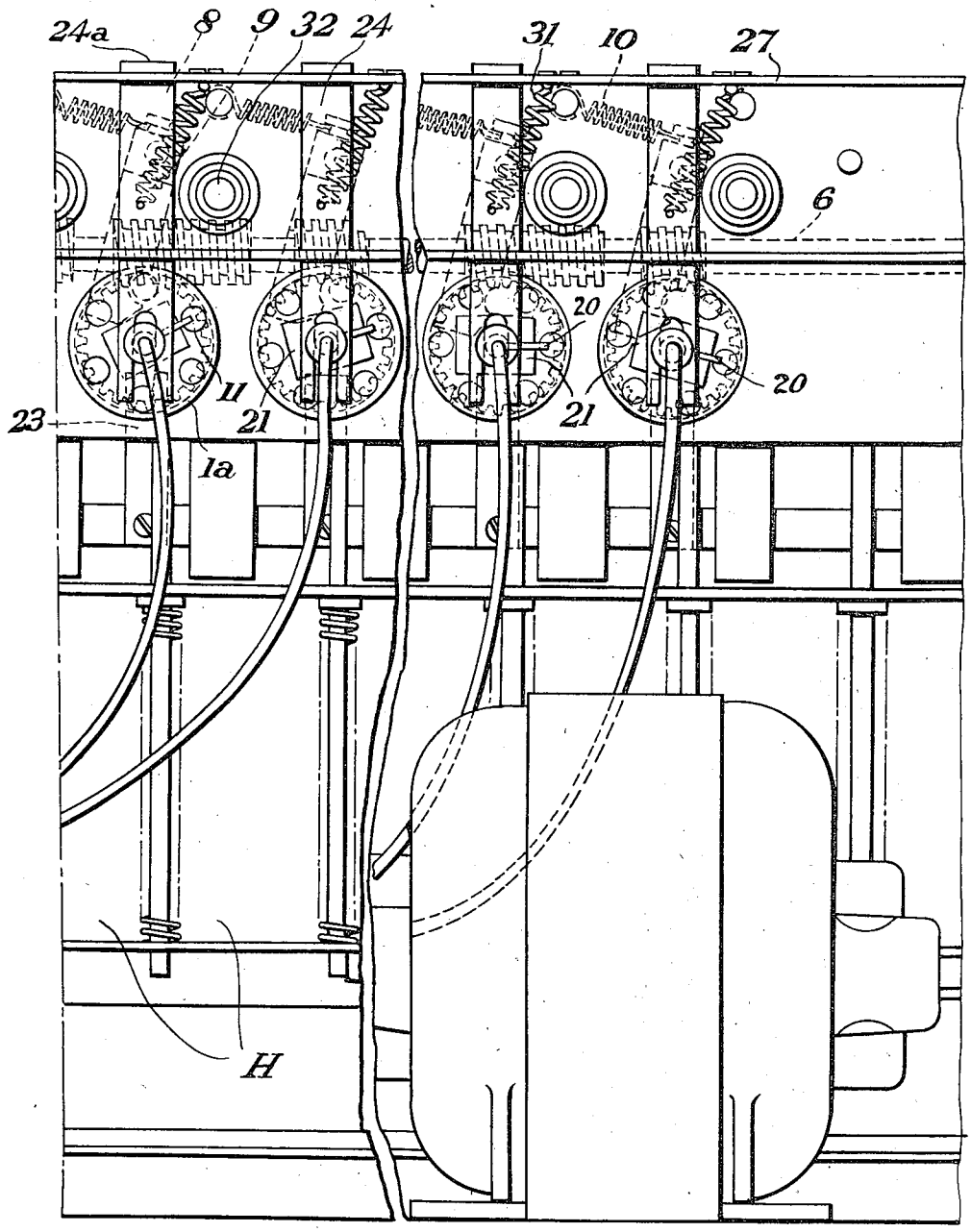

Fig. 1a

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MACHINE FOR SORTING STATISTICAL CARDS

Filed Jan. 11, 1933 5 Sheets-Sheet 3

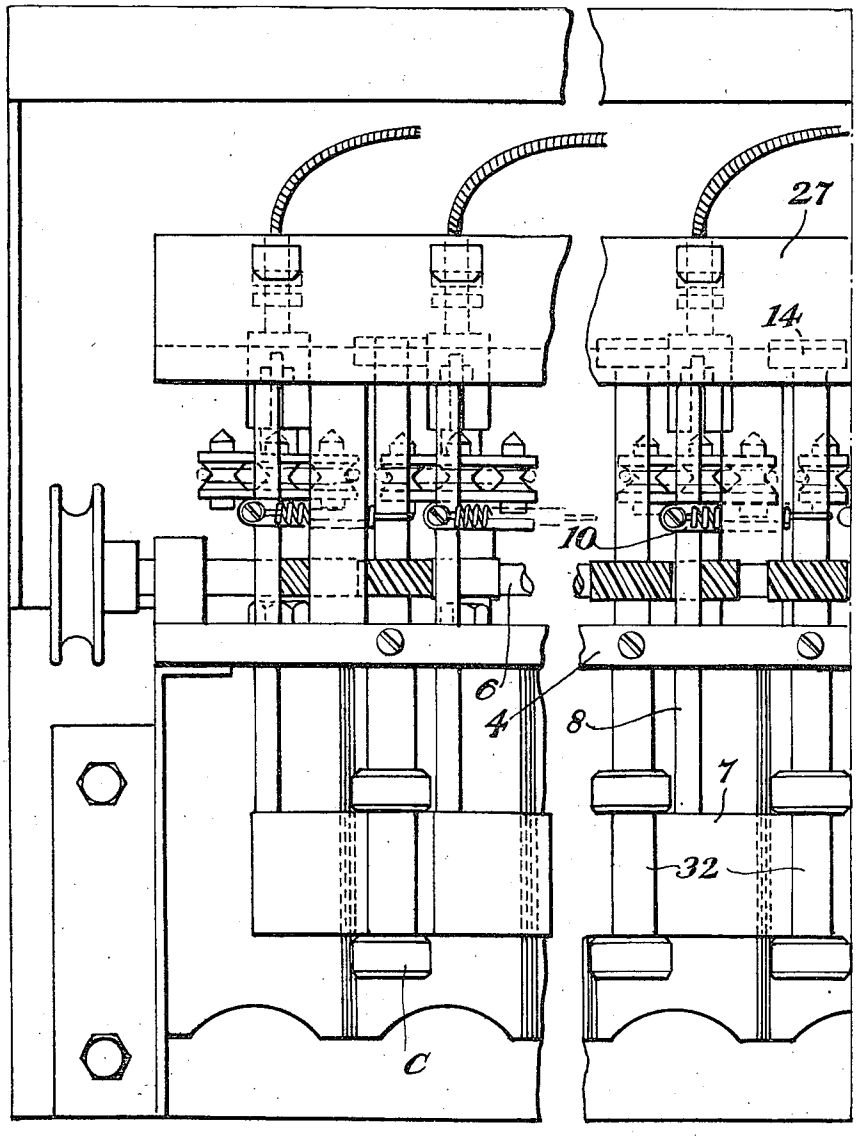

Fig. 2.

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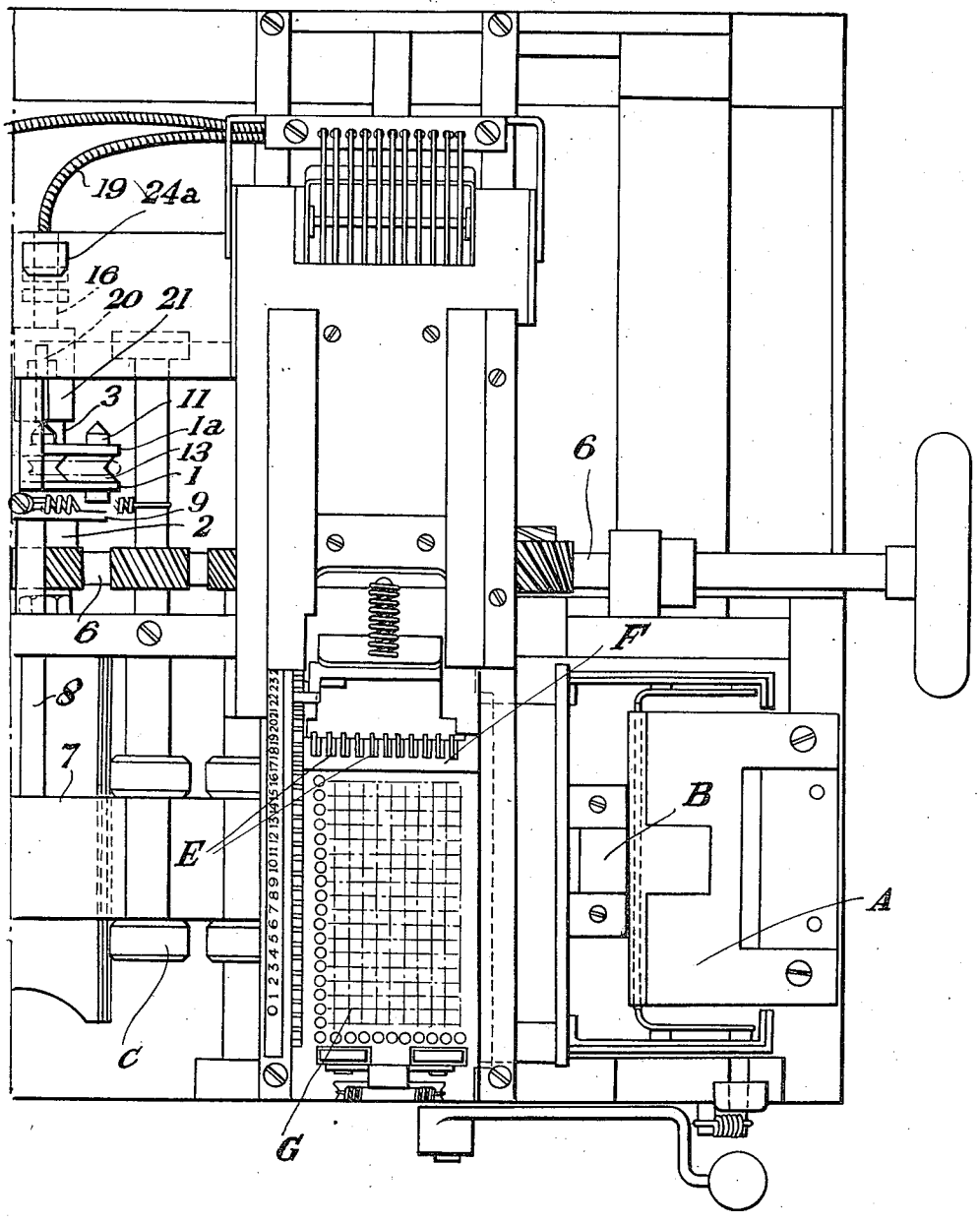
MACHINE FOR SORTING STATISTICAL CARDS

Filed Jan. 11, 1933 5 Sheets-Sheet 4

Fig. 2a.



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MACHINE FOR SORTING STATISTICAL CARDS

Filed Jan. 11, 1933 5 Sheets-Sheet 5

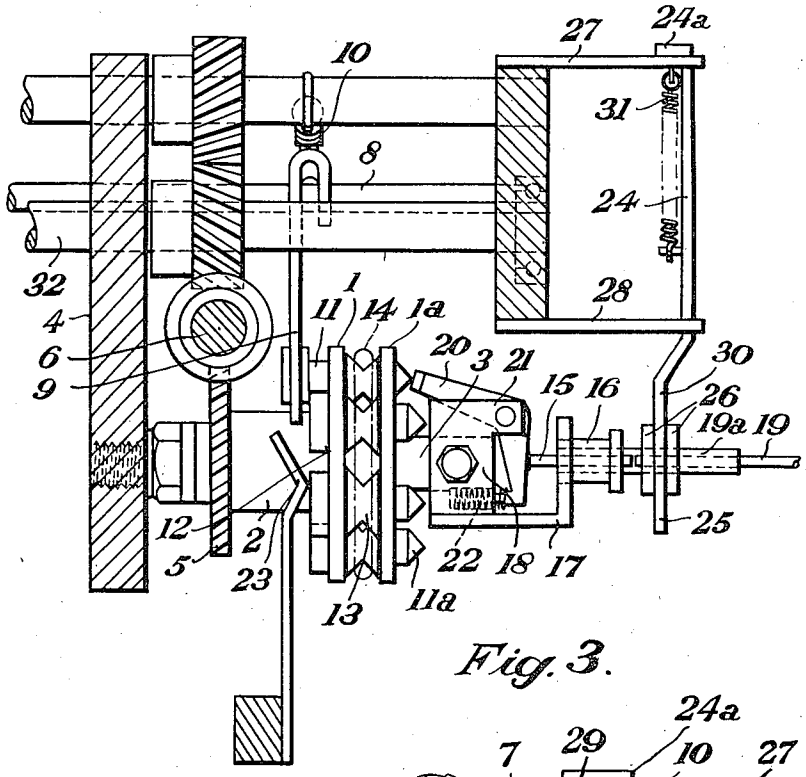

Fig. 3.

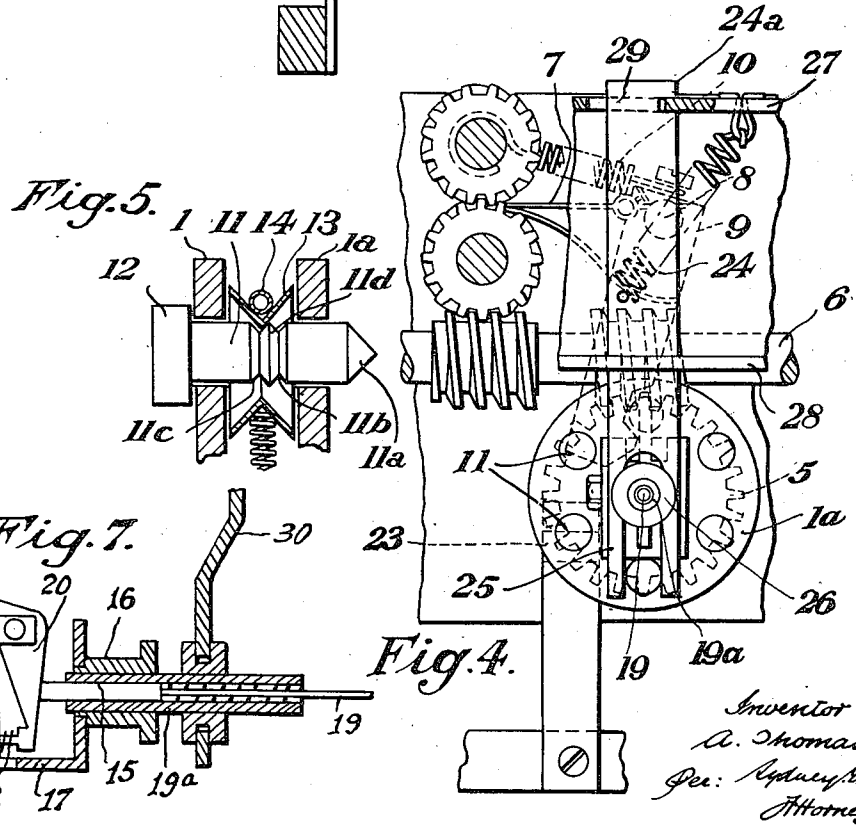

Fig. 4.

Fig. 5.

Fig. 7.

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Patented Mar. 17, 1936 2,034,010

UNITED STATES PATENT OFFICE

2,034,010

MACHINE FOR SORTING STATISTICAL CARDS

Arthur Thomas, Wallington, England, assignor to The Accounting & Tabulating Corporation of Great Britain Limited

Application January 11, 1933, Serial No. 651,207
In Great Britain February 12, 1932

10 Claims. (Cl. 209—110)

This invention relates to machines for sorting statistical cards and more particularly to mechanism for controlling the sorting compartments in such machines.

In card sorting machines the cards are analyzed or read by an analyzing device comprising a number of individual analyzing members arranged in one or more columns, each analyzing member being appropriated to a particular hole position on the card. Thus in the case of a card having twelve hole positions in each column there will be twelve analyzing members in each column in the analyzing device.

Compartments are provided to receive the cards and each compartment is associated with a particular analyzing member which controls it, conveniently by controlling the actuation of a shutter which normally serves to close the entrance to the compartment. When an analyzing member senses or reads a hole in a card, the corresponding shutter is opened thereby permitting the card to enter the compartment.

Since, however, the compartments are situated at varying distances from the analyzing device, it is necessary to provide means for delaying the opening of a compartment for a time equivalent to that taken by a card to reach the compartment from the analyzing device in which it has been sensed for the purpose of determining the particular compartment which is to receive it.

To this end card sorting machines have hitherto been provided with a settable device associated with each compartment to open the shutter thereof and mechanism controlled from the associated analyzing member for setting this device. The setting mechanisms were fixed and spaced with relation to their respective shutters by distances proportional to the distance between the analyzing device and the particular compartment concerned.

The settable shutter operating devices were caused to move after being set and the arrangement was such that by the time the settable device had moved from the setting mechanism to the shutter, the card had passed from the analyzing device to the compartment in question and could, therefore, enter the compartment immediately on the opening of the shutter.

Such constructions necessitated each setting device being individually positioned to give the required timing for the shutter operation and consequently when it was required to effect any repair or replacement of a setting device the original adjustment was disturbed and had to be performed again, thus involving loss of time. In timed sorters of the type to which this invention relates, a reciprocating picker feeds the cards from a stack one at a time at regular intervals, so that the successive cards, after being sensed, are fed along a path above the series of compartments, one card following another, but with a certain definite space between cards. The well known requirements as to timing may be illustrated by the following example. If of three successive cards the first and third go to compartments more remote from the sensing chamber than the second, then the shutter for the second card must not open until the first has safely passed it, it must open in time to deflect the second card, and it must close before the third card reaches it. In short, each shutter must open and close in the between-card intervals immediately preceding and following the arrival of the respective card at said shutter.

The present invention has for one of its objects to provide improved timing means for controlling the compartments for sorting machines which will obviate this disadvantage, and to provide a simplified and much cheaper form of mechanism. A particular object of the invention is to provide timing mechanism in which corresponding parts and connections in each of the sets of mechanism of which there is one associated with each sorting compartment, are exactly similar thereby cheapening the cost of production and assembly.

A further object of the invention is to provide a form of such mechanism which can be easily cut out of operation at will.

According to the present invention, controlling mechanism for the shutters or other controlling members of a sorting compartment in a statistical card sorting machine comprises a settable shutter operating member carried on a rotatable disc or the like, a setting member preferably adapted to move in the direction of the axis of rotation of the disc to set the shutter operating member, and an intermediate member disposed to transmit movement from the setting member to the settable shutter operating member. The intermediate member comprises a portion passing through the axis of rotation of the disc and also a second portion having an operating end or nose disposed at a point on the circumference of the disc angularly spaced from the shutter to an extent such that the time taken for the settable member to move round from the nose of the intermediate member to the shutter is equal to the time taken for the card to pass from the analyzing device to the particular compartment concerned.

Since all the setting members move in the direction of the axis of rotation of their associated

discs it is unnecessary to carry out any adjustment of the setting members to a particular position.

Preferably, the intermediate member is carried on a fixed support which is initially set or adjusted to a position which will bring the nose of the intermediate member into the required relation to the shutter, and the connection of the intermediate member to its support is such that the intermediate member can be removed without disturbing the adjustment of the support.

Thus the support may be first adjusted to the desired position and connection subsequently made to the associated sensing element without disturbing the adjustment necessary to secure the proper timing.

One construction according to the invention is diagrammatically illustrated by way of example in the accompanying drawings, in which:—

Figures 1 and 1*a* illustrate a sorting machine according to the invention in side elevation;

Figures 2 and 2*a* illustrate the machine in plan;

Figures 3, 4 and 5 illustrate the timing gear in detail, and

Figure 6 shows a modification of the timing gear for dealing with paired cards.

In order that the invention may be fully understood a brief description of the operation of the machine will now be given.

The cards to be sorted are stacked in a magazine A (Figs. 1 and 2*a*) from which they are fed by means of a picker B and feed rolls C to the analyzing mechanism indicated generally at D. The analyzing mechanism comprises a column of sensing pins E carried in a frame F which can be set over any column of the card in the usual way. Beneath the pins are disposed the usual perforated plates G of which only the upper one is shown in Fig. 2*a*. The sensing pins are reciprocated to sense the card by any suitable mechanism. In the machine illustrated in the drawings, the sensing pin box is of any well known form which may be employed to analyze the cards, such for example as that described in U. S. patent specification of Lasker No. 1,315,370, while the card feeding means may be of the form described in Lasker's U. S. patent specification No. 1,298,971.

Each sensing pin E is connected to means of a Bowden cable 19 to the actuating mechanism of a particular sorting compartment H. In the example shown there are twelve sorting compartments H including a reject compartment and eleven corresponding sensing pins E. Owing to the limitations of space, however, the machine is shown broken away in the middle so that all the sorting compartments do not appear.

Each card is sensed by the pins E at the same moment in the cycle of the machine, but the time in the cycle at which a card arrives at the compartment destined to receive it will depend on the distance of that compartment from the analyzing mechanism. Consequently, mechanism according to the invention is provided to delay the opening of the compartment until a suitable time just before the card has reached it. The sensing of a card only sets the actuating mechanism for opening the compartment, and the timing mechanism according to the invention delays the operation of the actuating mechanism until the card has arrived at the compartment concerned. As already mentioned, such delay mechanism is known and the present invention has for its object to provide an improved form of delay mechanism.

In the construction illustrated in the drawings, the controlling mechanism for one compartment, comprises a pair of discs 1 and 1*a*, secured to a sleeve 2, rotatably mounted on a spindle 3 fixed in the machine frame 4 and carrying a gear wheel 5, by means of which it is rotated from the main shaft 6 of the machine.

The compartment is provided with a closure member in the form of a shutter 7, secured to a spindle 8 freely mounted in the machine frame 4, and carrying a depending actuating arm 9, of which the lower end is disposed beside the disc 1. A spring 10 is provided to maintain the shutter 7 normally closed.

The discs 1 and 1*a* carry six settable pins 11, equally spaced apart and disposed parallel to the axis of rotation of the discs. These pins are mounted to slide axially in holes disposed opposite to one another in the discs. Each pin has a head 12 formed on it at one end, the heads of the pins projecting outwardly from the disc 1 adjacent which the depending shutter actuating arm 9 is located. At their opposite ends the pins 11 terminate in a conical formation, 11*a* (Fig. 5) the apex of the cone preferably constituting an angle of approximately 90°. The central portion of each pin lying between the two discs is formed with two grooves 11*b* and 11*c* separated by a rib 11*d*, and freely surrounding each pin is a member 13 of double conical form having its concave surface disposed outwardly. These double conical members will be hereinafter referred to for the sake of brevity, as diabolo members. The smallest internal diameter of each diabolo member 13 is larger than the diameter of the pin 11 by an amount sufficient to permit free movement of the diabolo member transversely with respect to the pin.

Surrounding all the diabolo members 13 is a bracelet spring 14 which is thus substantially in the form of a circle concentric with the discs.

It will be understood that the diabolo members 13 are V-shaped in cross section and the bracelet spring 14 forces the apex of the V into one or other of the grooves 11*b*, 11*c*, in the pin, thereby locating the pin in one or other of two positions. When the diabolo member 13 engages with one groove 11*b* the pin 11 is in the operative position in which its head 12 will engage with the depending shutter actuating arm 9 and operate it to open the shutter 7 during rotation of the discs 1 and 1*a*. On the other hand, when the diabolo member 13 engages with the other groove 11*c*, the pin is in the inoperative position with its head withdrawn out of range of the shutter actuating arm 9 and abutting against the adjacent disc 1 which acts as a stop for the pin. When the pin is moved axially from one position to another the rib 11*d*, between the grooves 11*b*, 11*c*, in the pin forces the diabolo member 13 outwardly against the action of the bracelet spring 14 so that it leaves one groove and drops back into the adjacent groove. By means of this construction the single spring 14 acts to retain all the pins in the position to which they have been set, although any pin can be moved without disturbing the other pins.

In order to set one or other of the pins 11 into the operative position in which the head 12 can engage with the shutter operating arm 9, a setting member is provided in the form of a plunger 15 mounted to slide in a tubular gude 16 carried on a bracket 17 secured to a boss 18 fixed to the

spindle 3 carrying the sleeve on which the discs are mounted, this spindle being, as already stated, fixed in the frame of the machine. The guide 16 for the setting plunger 15 is disposed so that the plunger slides in the direction of the axis of rotation of the discs 1 and 1a.

The setting plunger 15 is operated from a particular sensing pin E in the pin box by any suitable means, such means forming no part of the present invention. Preferably, however, the setting plunger is connected to a Bowden cable 19, of which the other end is attached to a plunger which is actuated when the associated sensing pin passes through a hole in a card.

In order to transmit movement from the setting plunger 15 to set the pin 11 an intermediate member in the form of a bell crank 20 is provided. This bell crank is pivoted on a lug 21 projecting from the boss 18, carrying the bracket 17 which supports the guide 16 for the setting plunger 15, this boss 18, therefore, also serving as a support for the intermediate bell crank member.

One arm of this bell crank 20 projects into the path of the setting plunger 15 and is forced against the plunger by means of a spring 22, the other arm being normally disposed just out of the path of the conical ends 11a of the pins 11 carried by the discs 1 and 1a. When the setting plunger 15 is moved by the associated sensing pin E passing through a hole in a card, the setting plunger 15 pushes one arm of the bell crank 20 against the action of its spring 22 and brings its other arm into the path of the pins 11, (as shown in Fig. 3).

Consequently, as the discs 1 and 1a rotate the conical end 11a of one of the pins 11 will strike the arm of the bell crank 20 and the pin 11 will hence be moved axially unto its operative position by the camming action of its conical end, the diabolo member 13 acting as already described, to locate it in the set position. In this operation, the pressure of the pin comes entirely on the setting member 20 and its pivot, and not at all on the Bowden wire 19, so that the latter is not required to exert any force beyond what is necessary to turn the lever 20 against its returning spring 22.

As the discs 1 and 1a rotate, the projecting head 12 of the pin 11 which has been set, will sooner or later engage with the depending shutter operating arm 9 and open the shutter 7, which after the pin 11 has moved past the operating arm 9, will be closed again by its spring 10.

The time which elapses between the setting of the pin 11 and the opening of the shutter 7 must be equal to the time taken for the card to pass from the sensing pin box to the compartment concerned. In order to provide the necessary delay the boss 18 supporting the bell crank 20 is set so that while one arm of the bell crank is in the path of the setting plunger 15, the other arm which engages with the settable pins 11 is so angularly spaced with regard to the shutter operating arm 9 that a pin 11, after being set, will move for the required time before it strikes the shutter operating arm.

Thus, although the bosses 18 supporting the bell cranks 20 for the different compartments all have a different angular setting, the setting plungers 15 are all disposed co-axially with their respective discs 1 and 1a. Further, in spite of the fact that their supporting bosses 18 have to be set to a particular position, the bell cranks 20 are simply pivoted to lugs 21 on their bosses 18 and can be readily removed without disturbing the setting of the bosses.

In order to reset the pin 11 after it has operated the shutter actuating arm 9, a fixed cam member 23 is provided against which the head 12 of the pin strikes, whereby the pin is pushed back into the inoperative position, the diabolo member 13 acting as before to locate it in this position.

It should be explained that although the discs 1 and 1a are described as carrying six setting pins 11, this number is quite arbitrary, but is found to be the most convenient in practice. Whatever the number of pins, however, the speed of the discs must be such that one pin passes the shutter actuating arm at each card cycle. Thus, where six pins are used the discs must make one revolution for every six reciprocations of the sensing pins.

If desired, means may be provided for dealing with one or more unperforated follower cards associated with a perforated key card. In such a case, the compartment is opened by the action of the pin E which sensed the key card, but its closing must be delayed to permit the follower cards to enter also.

To this end the shutter actuating arm 9 may be extended as shown for the arm 9a in Fig. 6, the length of the extension depending on whether it is required to deal with one or more follower cards. In the arrangement shown in Fig. 6, the arm 9a is of a length capable of dealing with one follower card. The extension causes the arm to remain in engagement with the pin 11 until two card cycles have occurred, whereby the compartment is maintained open for the required period.

Conveniently, also means may be provided for cutting out of action any individual compartment so that it remains permanently closed. To this end, according to a further feature of the invention, a manually operable cut-out rod 24 may be provided having its lower end 25 forked and straddling the nipple 19a of the cable 19, this nipple being slidably mounted in the boss 16 (Figs. 3 and 4). The nipple 19a may be provided with two collars 26, one on each side of the fork of the cut-out rod. The cut-out rod may be slidable in slots formed in two fixed frame members 27, 28 of the machine, whereby it may be moved endwise to cut out the associated compartment. The cut-out rod is formed with a notch 29 adapted to engage with the end of one of the slots through which the cut-out member passes in order to hold it in the operative position against the tension of a spring 31 tending to move the rod to its upper position. The movement of the cut-out rod to its upper position causes a cam surface 30 formed thereon to engage a fixed part of the machine, thereby causing the cut-out rod to move bodily laterally taking with it the nipple 19a by reason of the two collars carried by the latter. Such movements of the nipple removes the end of the cable 19 out of range of the intermediate bell crank 20, so that movements of the cable are no longer transmitted to the settable pins 11 carried by the discs 1 and 1a. In a convenient form of this cut-out mechanism, shown in Figs. 3 and 4, the cut-out rod may have its forked portion offset, the inclined portion 30 acting as a cam or wedge to cause the required movement of the nipple.

It will be understood that the fact that the spindles 21 carrying the controlling mechanism

according to the invention are overhung in cantilever manner renders it possible to leave the machine open on one side, it being unnecessary to provide bearings for the ends of the spindles as in previous constructions. Consequently, the fronts of the compartments are left unobstructed and the cards can be readily removed. Further, the card feeding rollers C are also preferably mounted on cantilever spindles **32** for the same purpose.

The cut-out rod **24** for each compartment is preferably mounted to slide vertically and provided with a head **24***a* at its upper end, whereby it is readily accessible to the operator.

The several bearing blocks **18** are set on the spindle **3** in different angular positions and each of them must be adjusted angularly in order to get the right timing. By placing the pin **15** and barrels **16** in the axes of the spindles **3**, these variations of setting and their adjustment are possible without making any change in the relations of the nipples **19***a* to the disabling devices **24**.

In addition the construction of the controlling mechanism according to the invention, is very simple and can be adjusted to the required setting for each compartment with great ease.

What I claim is:

1. Mechanism for controlling the shutter of a sorting compartment in a statistical card sorting machine, comprising a shutter actuating arm, a rotatable disc, a settable shutter operating member carried on said disc, a setting member adapted to move in the direction of the axis of rotation of the disc to set the shutter operating member for engagement with the actuating arm, and an intermediate member disposed to transmit movement from the setting member to the settable shutter operating member, said intermediate member comprising a portion passing through the axis of rotation of the disc and also a second portion having an operating nose disposed opposite a point on the circumference of the disc angularly spaced from the shutter actuating arm to such an extent that the time taken for the settable member to move round from the nose of the intermediate member to the shutter actuating arm is equal to the time taken for the card to pass from the analyzing mechanism of the machine to the particular compartment concerned.

2. Mechanism according to claim 1, wherein the central portion of each pin lying between the discs is formed with two grooves separated by a rib, and each pin is freely surrounded by a hollow member of double conical form having its concave surface disposed outwardly while embracing all the double conical members is a bracelet spring substantially in the form of a circle concentric with the discs, whereby when a pin is in the set position the apex of the respective conical member engages with one groove, whereas when the pin is in the inoperative position, the apex of the cone engages with the other groove, the bracelet spring yielding to permit forcible axial movement of the pin but having sufficient strength to cause the double conical members to hold their pins against accidental displacement.

3. Mechanism for controlling the shutter of a sorting compartment in a statistical card sorting machine, comprising a shutter actuating arm, a pair of rotatable discs, analyzing mechanism for statistical cards, a setting plunger, an operative connection between the setting plunger and a particular analyzing element in the analyzing mechanism, a plurality of settable pins mounted to slide axially in holes disposed opposite to one another in said discs, each of said pins being provided at one end with a head to engage with the shutter actuating arm and at the other end with a cam formation, a bell crank, a support to which said bell crank is removably pivoted in a position such that one arm of the bell crank abuts against the setting plunger whilst the other arm is located adjacent the path of the cam ends of the settable pins at a point in said path spaced angularly from the shutter actuating arm to an extent such that the time taken for a pin to travel from the bell crank arm to the shutter actuating arm is equal to the time taken by a card in passing from the analyzing mechanism to the compartment concerned, whereby when the setting plunger is operated from the analyzing mechanism, the movement of said plunger projects one arm of the bell crank into the path of the cam end of one pin and sets it to cause its head to engage and operate the shutter actuating arm at the correct moment, and locking means to hold the pins in the set position and in the inoperative position.

4. The invention set forth in claim 1, wherein the shutter actuating arm is of a length such that the settable shutter operating member remains in engagement with the shutter actuating arm for a time sufficient to hold the shutter open until a plurality of cards has entered the associated compartment.

5. Mechanism for controlling the shutter of a sorting compartment in a statistical card sorting machine, comprising a shutter actuating arm, a pair of rotatable discs, analyzing mechanism for statistical cards, a setting plunger, an operative connection between the setting plunger and a particular analyzing element in the analyzing mechanism, a plurality of settable pins mounted to slide axially in holes disposed opposite to one another in said discs, each of said pins being provided at one end with a head to engage with the shutter actuating arm and at the other end with a cam formation, a bell crank, a support to which said bell crank is removably pivoted in a position such that one arm of the bell crank abuts against the setting plunger whilst the other arm is located adjacent the path of the cam ends of the settable pins at a point in said path spaced angularly from the shutter actuating arm to an extent such that the time taken for a pin to travel from the bell crank arm to the shutter actuating arm is equal to the time taken by a card in passing from the analyzing mechanism to the compartment concerned, whereby when the setting plunger is operated from the analyzing mechanism, the movement of said plunger projects one arm of the bell crank into the path of the cam end of one pin and sets it to cause its head to engage and operate the shutter actuating arm at the correct moment, locking means to hold the pins in the set position and in the inoperative position, and means for disabling the connection between the analyzing element and the setting member whereby the associated compartment is cut out of operation.

6. In a sorting machine having a series of compartments across which cards travel, deflectors individual to said compartments and means for opening said deflectors selectively in timed relation to the travel of the cards, the combination which includes for each compartment a rotary timing disc having deflector-operating pins settable axially therein, a setting member normally out of the orbit of said pins but movable radially

into said orbit and acting when so moved as a fixed abutment against which the next on-coming pin acts and by its motion cams itself to set position, said setting members being disposed in different angular positions about the axes of their respective discs so as to give in each instance the appropriate timing.

7. The combination of a series of timing discs each having a plurality of settable devices, fixed spindles on which said discs are journaled, a bearing piece fast on the end of each said spindle and rotatively differentially settable thereon, a setting member for said settable devices pivoted in each said piece and having a part thereof lying substantially in the axis of its spindle, and an operating member for each said setting member located in the axis of said spindle, whereby said bearing piece and said setting member may be set rotatively to any desired position without changing the operative relation of the latter to said operating member, the setting of each bearing block and setting member determining the timing.

8. In a card-sorting machine having sensing mechanism, and a compartment controlling shutter, the combination which includes a rotatable timing device having a settable member for operating the shutter, means including a setting member for setting said settable member, a Bowden cable included in connection from said sensing mechanism to said setting member, and means settable by hand to withdraw the end of said Bowden cable endwise from said setting member in order to disable said setting member and thereby to prevent cards from entering the associated compartment.

9. In a card-sorting machine having sensing mechanism, card-receiving compartments, and shutters for said compartments, the combination which includes rotating timing devices associated with the several shutters and each carrying settable members, devices for setting said settable members, each said device adjustable rotatively about the axis of its associated rotating device, a Bowden cable constituting a connection to each setting device from the sensing mechanism, said cable having its end co-axial with the axis of rotation of said rotating device, and individual disabling devices acting on said cables, whereby each said setting device may be adjusted without disturbing its relation to its disabling device.

10. In a shutter-operating mechanism of a sorting machine having sensing mechanism, the combination of a fixed cantilever spindle, a timed rotary disc journaled on said spindle and having settable shutter-controlling members, a setting device mounted on a carrier which carrier is fast on and adjustable rotatively about the end of said spindle, and a Bowden cable controlled by the sensing mechanism of the machine for controlling said setting device, said cable mounted on said carrier acting on said setting device axially of said spindle, whereby adjustment of said carrier does not affect the relation of said cable to said setting device.

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