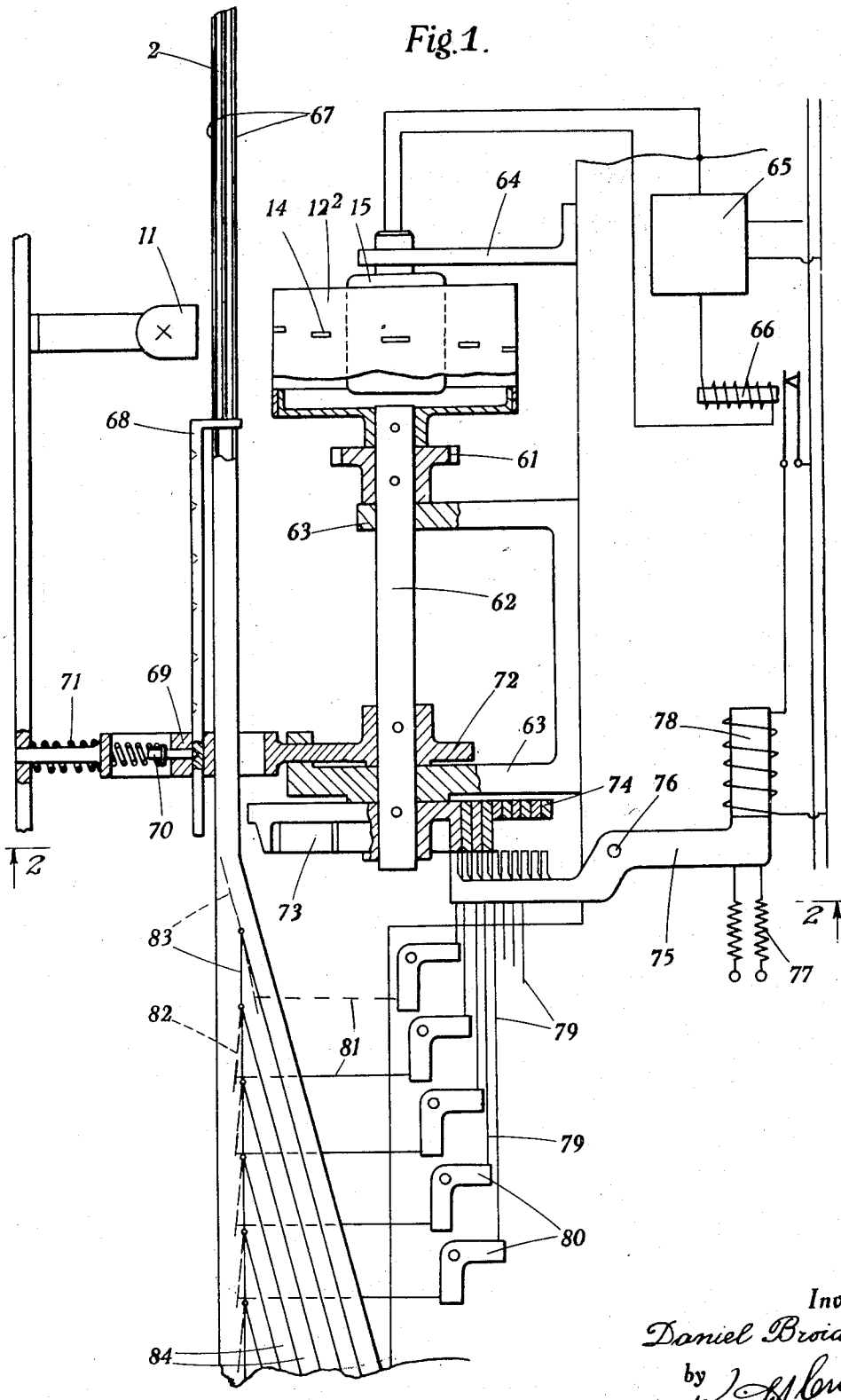
June 3, 1941. D. BROIDO 2,244,647

RECORD CONTROLLED STATISTICAL MACHINE

Original Filed March 8, 1938 2 Sheets-Sheet 1

Fig. 1.



Inventor
Daniel Broido
by A. Wright Elwood
Attorney

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Fig. 2.

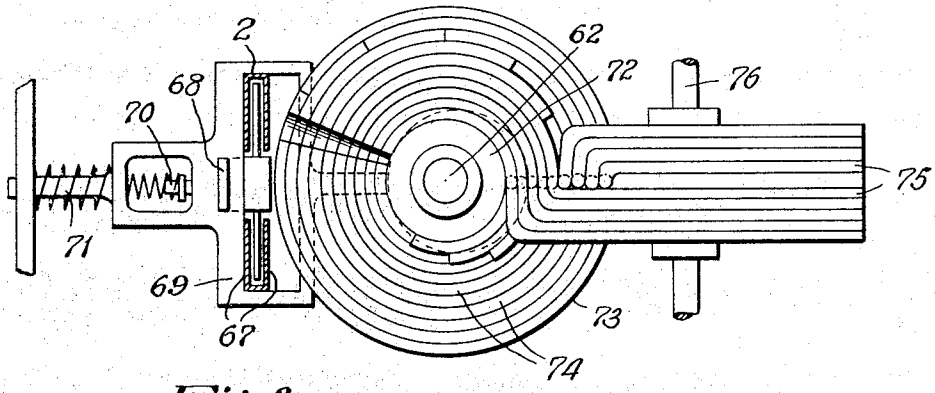


Fig. 3.

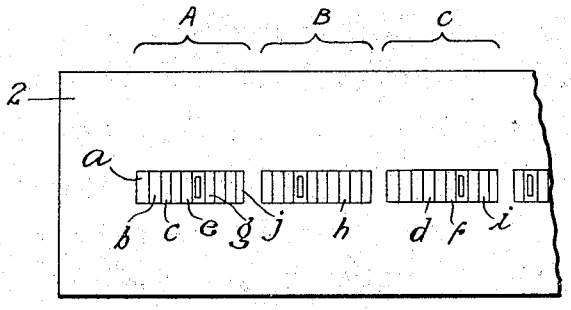


Fig. 4.

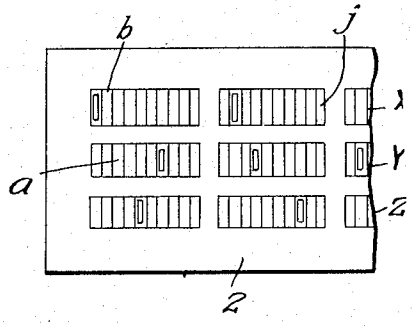
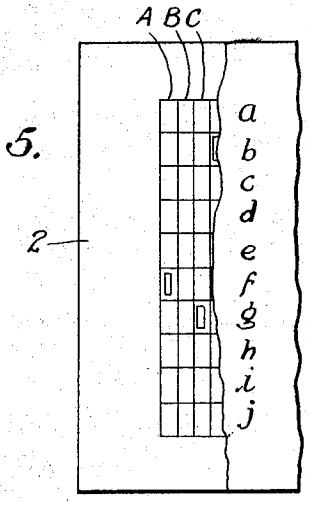


Fig. 5.



Inventor.
Daniel Broido

By A. Knight Croad
Attorney.

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UNITED STATES PATENT OFFICE

2,244,647

RECORD CONTROLLED STATISTICAL MACHINE

Daniel Broido, London, England

Original application March 8, 1938, Serial No. 194,543. Divided and this application February 17, 1939, Serial No. 256,939. In Great Britain March 10, 1937

6 Claims. (Cl. 209—111)

This invention relates to record controlled statistical machines.

In my pending patent application Serial No. 194,543 (from which pending application the present application is divided out) I have described and claimed a record controlled tabulating machine comprising in combination a source of radiant energy, a device sensitive to radiant energy, means for feeding a record into the path of a beam projected from said source upon said sensitive device, means for causing said beam to analyse in succession each area on said record likely to contain an indication, and a plurality of mechanisms, one for each area analysed, controlled by the device sensitive to radiant energy according to the instant during an analysing cycle at which said beam coincides with each indication on said record.

The primary object of the present invention is to provide a sorting machine in which sliding contacts of all kinds are avoided.

A further object of the invention is to provide a simple and reliable sorting machine for sorting marked records in which no rubbing contact takes place on the surface of the record card.

Yet a further object of the invention is to provide a sorting machine in which any inaccuracy in analysing due to sparking and consequently deterioration of electric contacts is avoided.

One form of sorting machine fulfilling these objects, and record cards suitable for use therewith, are illustrated in the accompanying drawings, wherein—

Figure 1 is a central vertical section of the machine, and Figure 2 is a section on the line II—II, Figure 1.

Figure 3, drawn to an enlarged scale illustrates a portion of one kind of record card suitable for use with the machine of Figures 1 and 2, and

Figures 4 and 5, likewise drawn to an enlarged scale, illustrate, respectively, other kinds of record card suitable for use with the machine.

In the type of record card shown in Figure 3 the denominational areas A, B, C, etc., corresponding to the columns of standard record cards, are arranged end to end along a line. Each denominational area A, B, C, etc., is divided into a plurality of numeral areas *a*, *b*, *c*, etc., one for each possible numeral or value of the denomination. A number is recorded on the card by marking or perforating the appropriate division *a*, *b*, *c*, etc., of each denominational area so that when the card is placed in a beam of light, said beam is modified in accordance with the positions of the marks or perforations. This type of record card may be referred to as "single-dimensional" since the markings extend in a single line.

If the number of digits to be recorded on a single-dimensional record of the type shown in Figure 3 is very large, the length of such a record would be excessive, and it is therefore suggested, according to Figure 4, to subdivide the recorded information into a plurality of groups X, Y, Z of approximately equal length and to place them one underneath the other in parallel rows. This type of record may be referred to as "multiple singe-dimensional."

In the type of record card shown in Figure 5, the denominations A, B, C . . . and the digital values *a*, *b*, *c*, . . . of the denominations, instead of extending in one or more horizontal lines are arranged in vertical columns. This type of record card is the better known, and may be referred to as "standard."

All three types of records may be used on the sorting machine of Figures 1 and 2 now to be described. In these figures a scanning cylinder 12^2 is rigidly secured, together with a pinion 61, to the upper end of a vertical shaft 62 revolubly mounted in bearings 63. A photo-electric cell 15 is suspended centrally within the scanning cylinder 12^2 by means of a bracket 64 and is shown connected through an amplifier unit 65 to the winding of a relay device 66. Two vertical guides 67 are provided to receive the longer edges of a single-dimensional (Fig. 3) record card 2 which is supported upon a trigger device 68 vertically slidable in a frame 69 but retained in any one of a number of predetermined positions by means of a spring pressed detent 70. The frame 69 is itself slidably mounted in a horizontal direction at one end in a fixed frame member and at the other in an extension of the lower bearing 63, a spring 71 being provided to maintain said frame 69 against an edge cam 72 secured upon the vertical shaft 62. The relative arrangement of frame 69 with respect to cam 72 is shown in dotted lines in Fig. 2. A light source 11 is adapted to project a beam of light through the record 2 on to the scanning cylinder 12^2, the section of the beam being equal to one denominational area A or B or C etc. and is disposed vertically as are the said denominational areas. On the lower end of the shaft 62 is secured a face cam 73 consisting of a plurality of concentric tracks 74, one for each of the helically arranged slots 14 on the scanning cylinder 12^2, each of which slots corresponds to an area *a* or *b* or *c*,

etc., in any one denominational area. Adapted to coact with each track 74 is a double-armed lever 75 pivotally mounted on a shaft 76, the further ends of said levers being normally held up, against the action of springs 77, by an electro-magnet 78, the circuit of which is normally closed by the contacts of the relay device 66. Each of the double-armed levers 75 is connected by a link 79, bell crank 80 and further link 81, to an arm 82 of a hinged flap 83, adapted when operated to deflect a record descending between the guides 67 into a respective chute 84.

In order to sort a plurality of records according to various values of a particular denomination, the trigger device 68 is firstly adjusted so that it supports a record at such a height that the particular denominational area in question is in the path of the beam of light. Initially the face cam 73 is adapted to lock all the levers 75 in the position shown, but as soon as the shaft 62 is driven (through the pinion 61) the lever 75 connected to the lowermost flap 83, and at equal successive intervals during a revolution each of the remaining levers, is unlocked. Thus as each slot 14 on the scanning cylinder 12^2 passes the denominational area on the record, a corresponding lever 75 is unlocked and the instant one of the said slots 14 coincides with a perforation in the record, or the pencil of light emitted therefrom, the photo-electric cell 15 is activated, the relay 66 energised to open its contacts, the electro-magnet 78 momentarily de-energised and the springs 77 actuate all those flaps 83, from the lowermost upwards, connected to the unlocked levers. For instance, if the perforation on the record is situated within the seventh area to be scanned, the seven lower hinged flaps will be open. At the end of one revolution or cycle of the scanning cylinder the edge cam 72 is adapted to push the frame 69 outwardly against the action of the spring 71 thereby withdrawing the trigger 68 from below the record card and allowing same to drop and be deflected by the uppermost open flap 83 into the corresponding chute, which in the above example is the seventh from the bottom, and thereafter all the levers 75 are restored to their initial positions by means of the cam 73, the electro-magnet being designedly not powerful enough to do so. Another record is then placed between the guides 67, either automatically or by hand, and the cycle of operations repeated.

In order to adapt the above described embodiment for the purpose of sorting multiple single-dimensional records (Figure 4) or standard type records (Figure 5) provision is made for moving the guides 67 bodily sideways in order that the desired column or row may be brought in front of the light source 11. As will be readily understood, in the case of the standard type record no vertical adjustment of the trigger device 68 is required.

It will be readily understood that transparent record cards may be used and indications marked with opaque ink.

Further, the positions of the source of light and the photo-electric cell may be reversed.

The source of light and the photo-electric cell may be replaced by any other devices which generate, or are sensitive to, radiant energy respectively.

What I claim is:

1. In a record-controlled statistical machine employing a scanning device comprising a source of radiant energy, a device sensitive to said radiant energy and a slotted scanning element adapted to scan marked records, the markings on which are capable of modifying the radiant energy employed, the combination with said scanning device of a flap-controlled sorting device, a plurality of armatures, one associated with each slot on the scanning element, an electromagnet acting commonly on all of said armatures, and controlled by the device sensitive to radiant energy, a plurality of cams, one associated with each slot on the scanning element and with each of said armatures, co-operating with said electromagnet to control the movements of the armatures, means for driving the cams in synchronism with the slotted scanning element, whereby each cam renders its associated armature operable by said electro-magnet as the slot associated therewith passes through the scanning plane, and means controlled by the movement of each armature for controlling the operation of a flap of the sorting device whereby as the record card passes through the machine, it is guided by said flap into one of a plurality of compartments in accordance with a marking on said record card through which radiant energy passed during the scanning operation to actuate the device sensitive to radiant energy.

2. A record controlled statistical machine comprising in combination a source of light, means for feeding records one by one to a position in front of said source, means for releasably retaining a record in said position, means for adjusting the height of the record retaining means to select a desired denominational area, a scanning cylinder provided with a series of helically arranged slots for scanning the selected denominational area, a photo-electric cell disposed within the scanning cylinder, a cam mounted on the shaft of the scanning cylinder adapted to coact with the record retaining means and release same at the end of a scanning cycle, a further cam mounted on the shaft of the scanning cylinder provided with a plurality of tracks, one for each numeral, a plurality of spring actuated devices each adapted to coact with one of said tracks and each operatively connected to one of a plurality of sorting flaps and an electro-magnet under the influence of the said sensitive device for controlling all of the spring actuated devices.

3. In a record controlled statistical machine employing a scanning device comprising a slotted cylinder, a source of radiant energy and a device sensitive to said radiant energy for scanning record cards, the markings on which are capable of modifying the beam of radiant energy, means for sorting the records according to their markings representing the digit values of a denomination, comprising, in combination, a sorting device having a number of flaps corresponding to the number of digit values of a denomination, a plurality of armatures, each of which is operatively associated with a particular area on the record corresponding to a digit value of a denomination and with a corresponding flap of the sorting device, an electro-magnet acting commonly on all of said armatures, a relay controlled by the device sensitive to radiant energy, and adapted to operate said electro-magnet, a plurality of cams, one of which is associated with each armature, co-operating with said electro-magnet to control the movements of the armatures, a shaft on which the slotted cylinder

and cams are concentrically mounted, means for driving the shaft to perform the scanning operation and to bring the cams successively into operation in synchronism with the scanning cylinder, and means controlled by the movement of each armature for controlling the operation of a flap of the sorting device whereby as the record card passes through the machine, it is guided by said flap into one of a plurality of compartments in accordance with a marking on said record card through which radiant energy passed during the scanning operation to actuate the device sensitive to radiant energy.

4. A record controlled statistical machine according to claim 3 wherein the electromagnet is in a circuit comprising a pair of contacts which are normally closed, and the relay is disposed in the circuit of the sensitive device and is adapted each time the sensitive device is actuated by radiant energy passing through a relevant marking on the card to open temporarily the said contacts and de-energise the said electro-magnet circuit whereupon said armatures are successively permitted by their associated cams to move away from the electro-magnet and actuate the flaps of the sorting device to which they are respectively connected.

5. In a record controlled statistical machine employing a scanning device comprising a slotted cylinder, a source of radiant energy and a device sensitive to said radiant energy for scanning record cards, the markings on which are capable of modifying the beam of radiant energy, means for sorting the records according to their markings representing the digit values of a denomination, comprising, in combination, means for feeding the record cards one at a time into a position between the source of radiant energy and the device sensitive to said radiant energy, a support in this position for the card, a slide carrying said support, a sorting device having a number of flaps corresponding to the number of digit values of a denomination, a plurality of armatures, each of which is operatively associated with a particular area on the record corresponding to a digit value of a denomination and with a corresponding flap of the sorting device, an electromagnet acting commonly on all of said armatures, a relay controlled by the device sensitive to radiant energy, and adapted to operate said electromagnet, a plurality of cams, one of which is associated with each armature, co-operating with said electromagnet to control the movements of the armatures, means controlled by the movement of each armature for controlling the operation of a flap of the sorting device, and a cam driven in synchronism with the scanning element for actuating the slide carrying the support for the record card on the completion of the scanning cycle to remove the support for the card which is then free to fall by gravity, whereupon it is guided by said flap into one of a plurality of compartments in accordance with a marking on said record card through which radiant energy passed during the scanning operation to actuate the device sensitive to radiant energy.

6. In a record controlled statistical machine employing a scanning device comprising a source of radiant energy and a device sensitive to said radiant energy for scanning record cards, the markings on which are capable of modifying the beam of radiant energy, means for sorting the records according to their markings representing the digit values of a denomination, comprising, in combination, means for feeding the record cards one at a time into a position between the source of radiant energy and the device sensitive to said radiant energy, a support in this position for the card, a slide carrying said support, means for adjusting said support in the slide in a vertical direction to permit different areas on the card to be scanned by the scanning device, a sorting device having a number of flaps corresponding to the number of digit values of a denomination, a plurality of armatures, each of which is operatively associated with a particular area on the record corresponding to a digit value of a denomination and with a correspondng flap of the sorting device, an electromagnet acting commonly on all of said armatures, a relay controlled by the device sensitive to radiant energy, and adapted to operate said electromagnet, a plurality of cams, one of which is associated with each armature, co-operating with said electromagnet to control the movements of the armatures, means controlled by the movement of each armature for controlling the operation of a flap of the sorting device, and a cam driven in synchronism with the scanning element for actuating the slide carrying the support for the record and on the completion of the scanning cycle to remove the support for the card which is then free to fall by gravity, whereupon it is guided by said flap into one of a plurality of compartments in accordance with a marking on said record card through which radiant energy passed during the scanning operation to actuate the device sensitive to radiant energy.

DANIEL BROIDO.