

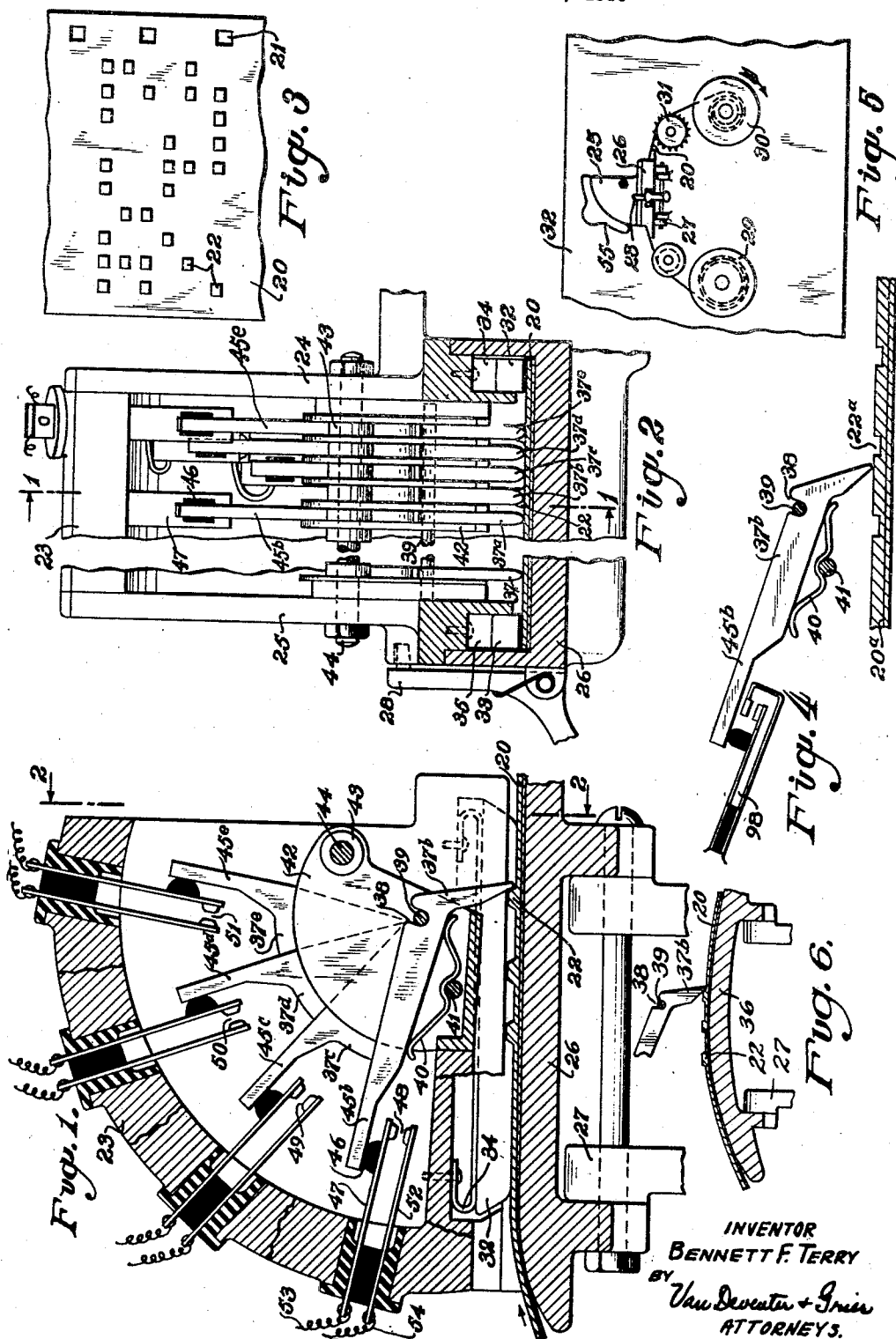
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SENSING MEANS

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SENSING MEANS

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6 Claims. (Cl. 235—61.11)

This invention relates to improvements in sensing means, and has for an object the provision of a record having a normal thickness and carrying data, the thickness of the data portions of the record being different in thickness from the normal thickness of said record, and the provision of circuit closing means including feelers engaging said record and controlling said circuit closing means in accordance with data on said record feeding medium.

This application is a division of application Serial Number 256,608, filed February 15, 1939, now U. S. Patent Number 2,273,740, dated February 17, 1942.

Another object of the invention is the provision in a sensing mechanism for records, of means to receive and locate a record of predetermined general thickness, circuit controlling devices associated with said means, and means responsive to local differences in thickness of said record for selectively actuating said devices.

Yet another object of the invention is the provision in a sensing device for records of a plurality of sensing levers, switches associated with said levers, means to move a record film of predetermined general thickness past said levers, said record having thereon recordings comprising local areas, the thicknesses of which are different from said general thickness of the record, and adapted to actuate said levers and thereby control said switches.

Another object of the invention is to provide records of the character described and sensing means for reading said records whereby record-controlled devices such as tabulating machines may be controlled thereby.

Other objects and advantages of the invention will appear during the course of the following description in connection with the attached drawing, in which:

Figure 1 is a vertical sectional view of a sensing means for use on tabulating machines and the like;

Figure 2 is an end sectional view of the same in the plane 2—2 of Figure 1;

Figure 3 is a plan view of a portion of record film;

Figure 4 is a detail view of an alternative form of sensing switch and lever arrangement;

Figure 5 is a fragmental front view illustrating the sensing device mounted on a tabulating machine; and

Figure 6 is a fragmental view of an alternative shape of platen for the sensing means.

Referring to Figure 3, the numeral 20 indi-

cates a short section of film which may be provided with the usual sprocket perforations 21 either on one or both borders. The film 20 carries data recordings generally denoted by the numeral 22, which recordings may be in the form of protrusions as shown in profile in Figure 1, or may be in the form of depressions 22^a as shown in Figure 4.

The arrangement of protrusions 22 as shown in Figure 3 is typical of data recordings suitable for use in a tabulating machine, it being understood that while the record is shown with ten rows of protrusions by way of illustration, any desired number of rows may be provided as in the case of present punched card records. It will be further understood that while the protrusions are shown of substantial size for clarity of description, in practice they may be of minute size, permitting a large amount of recorded data to be placed on a small area of film.

Referring to Figures 1 and 2, which show in detail a sensing means adapted for use with the records on film 20, the numeral 23 indicates an arcuate body or frame which may be mounted on a tabulating machine 32 as illustrated diagrammatically in Figure 5. The body 23 is provided with inner and outer end members 24 and 25. A channeled platen 26 is hinged at 27 below the body 23 and is provided with a latch 28 which normally holds the upturned edges of the platen 26 accurately in engagement with the end members 24 and 25.

The platen 26 is adapted to support and guide the film 20, which may be fed thereover by any suitable mechanism such as the reels 29 and 30 and sprocket 31, Figure 5. Shoes 32 and 33 secured to springs 34 and 35, which in turn are secured to the members 24 and 25, resiliently engage the borders of the film 20 to hold the latter flat on the platen 26. As an alternative arrangement, the platen may be slightly curved as represented by numeral 36, Figure 6, in which case the curvature of the film in tension on the platen ensures lateral flatness of the film and permits the spring-pressed shoes to be dispensed with.

Referring again to Figures 1 and 2, a plurality of contact levers 37, 37^a, 37^b, 37^c, etc., have notches 38 in their upper side, the notches 38 being pressed upward into pivotal engagement with a common cross pin 39 by curved leaf springs 40 backed by a second cross pin 41. Plates 42, clamped between spacer washers 43 on a cross bolt 44, act as separators between the levers 37, 37^a, etc., and also retain the springs 40 laterally in position.

The contact lever 37^b shown in Figure 1, has a rearwardly extending arm 45^b engaging an insulating block 46 on the upper resilient member 47 of a normally open switch or contactor 48. The two sides 47 and 52 of the contactor 48 are provided with leads 53 and 54 for connection in the proper control circuit of the tabulating machine 32, all the other contactors being provided with similar leads. A conduit box or cover 55, Figure 5, may be provided to protect the wiring in place on the machine 32.

It will be seen that the location of the second cross pin 41 to the left of the fulcrum pin 39, together with the points of engagement of the spring 40 with the lever 37^b, cause the latter to be urged clockwise, clockwise movement however being prevented by the engagement of the point of lever 37^b with the film 20. As the film 20 moves to the right, a protrusion 22 encountering the point of lever 37^b raises the point, swinging the lever counter-clockwise and causing the arm 45^b to close the contactor 48.

The lever 37^c, adjacent lever 37^b, also has a rear arm 45^c adapted to close a contactor 49 when a protrusion on the film 20 moves under the point of lever 37^c. The arm 45^c, however, is directed angularly above the arm 45^b. Similarly the levers 37^d and 37^e have arms 45^d and 45^e adapted to close contactors 50 and 51 respectively, the arms being directed at different angles above the horizontal.

Thus, the entire bank of levers, while identical in their engaging points, spring and fulcrum arrangement, have their switch closing arms staggered progressively in groups. The present illustration shows the progressive staggering as occurring in groups of four levers, but it is obvious that a group may be made to contain six or other numbers of levers. The purpose of this group staggering is to permit the levers themselves to be very thin and closely spaced while allowing the contactors to be of ample size. While the size of levers and related parts is greatly exaggerated in Figures 1 and 2, as previously noted, it will be evident that by the structures described a large number of levers with engaging points closely spaced may be provided in practice, thereby allowing for operation by minute and closely spaced protrusions on the film but allowing the contactors to be of ample size to transmit the small currents called for in actuating the control mechanisms for instance of tabulating machines.

The positive film is first exposed under the negative, then developed, preferably in a non-tanning developer, fixed and washed in the usual manner. The film is then treated with a solution such as copper sulphate, potassium bromide, potassium bichromate and water, which selectively brings the image into relief. The film is then washed and dried, the unexposed portions remaining as protrusions above the general level of the film surface.

The actual height of the protrusions 22 is dependent on the thickness of the emulsion, and when using the process for record purposes in connection with tabulating machines an emulsion of substantial thickness may be provided in order to avoid the necessity for undue delicacy in the mechanical structure of the sensing means, Figures 1 and 2. It will be noted, however, the arcs of swing of the points of levers 37^b, 37^c, etc., are nearly tangent to the film 20, so that as a protrusion 22 moves to the right and engages the point of lever 37^b, for example, the latter

is moved a distance much greater than the height of the protrusion. In consequence, a comparatively small height of protrusion produces a comparatively large angular motion of the lever imparting ample motion to the end of the long arm 45^b to effectually close the contactor 48.

When the record constitutes the negative itself (after being subjected to the bleaching and tanning process), the sensing means is arranged as shown in Figure 4, wherein the contactor 98 is of the self-closing type and is normally held open by the bar 45 as the point of lever 37^b rides on the upper surface of the film 20^a. When the point of 37^b drops into a depression 22^a forming part of the record, the contactor 98 closes automatically to energize its control circuit. When the negative is used in this manner the wiring of the sensing means is arranged to compensate for the reversal in relative positions of the data markings from that occurring in the positive. From the above it is evident that the invention comprises controlling a sensing means by differences in thickness of the record, the controlling factors being either protrusions or depressions.

While the invention has been set forth in preferred forms, it is not limited to the precise structures and processes described, as various modifications may be made without departing from the scope of the appended claims.

What is claimed is:

1. In a record controlled machine, a sensing device for sensing data recordings in photographic records, a support, a plurality of switches radially spaced on said support, a platen attached to said support and adapted to guide a record film of predetermined general thickness moving between said support and said platen, said record film having thereon data recordings comprising slight protrusions thicker than said general thickness and arranged in predetermined pattern relationship, and a plurality of sensing levers in the form of bellcranks, each having a short arm and a long arm, said long arms having switch controlling ends in cooperative relation with said switches, said short arms carrying record engaging ends the arcs of swing of which are nearly tangent to the surface of the record whereby said protrusions cause greater movement of said ends than the height of the protrusions above the surface of the body of the record and the movement effected by said protrusions is increased by said long arms to effectively actuate said switches.

2. In a record controlled device, in combination, a body, a plurality of switches in said body, a plurality of sensing members associated with said switches and adapted to actuate the same, said record comprising a photographic film having thereon areas differing in thickness slightly from the general thickness of said film, said areas comprising data recordings arranged in a predetermined pattern, and means to guide said film in registry with said body whereby said areas may individually engage said members to actuate said switches in accordance with said pattern, said sensing members being comprised of bellcranks mounted on a common axis extending laterally of the path of said film, and said switches being mounted on said body in circumferentially staggered relationship about said axis whereby said bellcranks may be of small thickness and close lateral spacing, said bellcranks each being comprised of a long arm and a short arm, the ends of said short arms being nearly tangent to the surface of and adapted to engage the record and to be moved by said data recordings a distance

greater than the difference between the thickness of the body of the record and the thickness in said areas, and the ends of said long arms being adapted to engage and actuate said switches with substantially greater motion than that imparted to said bellcranks by said record.

3. In a record sensing device, in combination, a frame, a plurality of switches carried on said frame, a plurality of levers each having record engaging ends or feelers identical with and parallel to each other and also having switch controlling ends each angularly disposed with respect to its neighbor and engaging one of said switching means for controlling the same, said levers having a common axis extending laterally of the path of the record and the leverage between the axis and the feeler ends being less than the leverage between said axis and the switch controlling ends, a sensing stage on said frame adjacent to said feelers, and means to pass said record through said sensing stage, the arcs of swing of said feelers being nearly tangent to the surface of the record, said record comprising a photographic strip having thereon areas different in thickness from the general thickness of said strip and representing data recordings which, due to their slight difference in thickness with respect to said general thickness, cause said feelers to move during the transit of the record through said sensing stage a distance greater than the difference in thickness between the general thickness of the record and the thickness of the record and the recordings in said areas, and control the switches associated with said feelers.

4. In a record controlled device, in combination, a frame, a plurality of switches radially spaced on said frame, a plurality of sensing members pivotally carried on a common axis on said frame, means comprising arms formed integral with said members for connecting said members to said switches whereby said members may actuate the latter, said arms having effective lengths substantially greater than the length of said sensing members whereby slight movements of the latter cause greater movement of the movable elements of said switches, a sensing stage adjacent to the free ends of said members, said record comprising a photographic film having thereon areas differing in thickness from the general thickness of said film and comprising data recordings arranged thereon and adapted to move said members on their pivots and thereby actuate said switches, said common axis being so positioned relative to said sensing stage that the

free ends of said members have arcs of swing which are nearly tangent to the surface of the recording whereby the movement of said free ends when encountered by a data recording is substantially greater than said difference in thickness and means for moving said record through said sensing stage.

5. In a record controlled machine, a sensing device for sensing data recordings in photographic records, wherein said recordings are different in thickness from the thickness of the body of the record, including; a plurality of bell cranks, pivot means common to all said bell cranks, each of said bell cranks having an arm carrying a record engaging end identical with and parallel to the others, the arcs of swing of said ends being nearly tangent to the surface of the record, whereby said ends when engaged by recordings are caused to move a distance greater than the difference between the thickness of the body of the record and portions of the record where recordings occur, and a switch controlling arm substantially longer than said first arm and angularly disposed with respect to its neighbor, and a switch for each of said levers adapted to be controlled thereby when the record engaging ends of its levers is sensing data on the record.

6. In a record controlled machine, a sensing device for sensing data recordings in photographic records, wherein said recordings are different in thickness from the thickness of the body of the record, including; a plurality of bell cranks each of which has an arm carrying an engaging or feeling end identical with and parallel to the others, each of said bell cranks also having a second arm angularly disposed with respect to its neighbor and carrying a switch controlling end, said last arms being substantially longer than said first arms, thereby providing greater motion than the motion imparted to said first arms by the recordings on said record, a sensing station including means to support and move a record past the ends of said first arms, said bell cranks having fulcrums so positioned with respect to said record that the arcs of swing of said ends are nearly tangent to the surface of the record whereby the difference between the thickness of the body of the record and the thickness of the recordings themselves cause said ends to move an amount substantially greater than said difference and switching means controlled by said second arms.

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