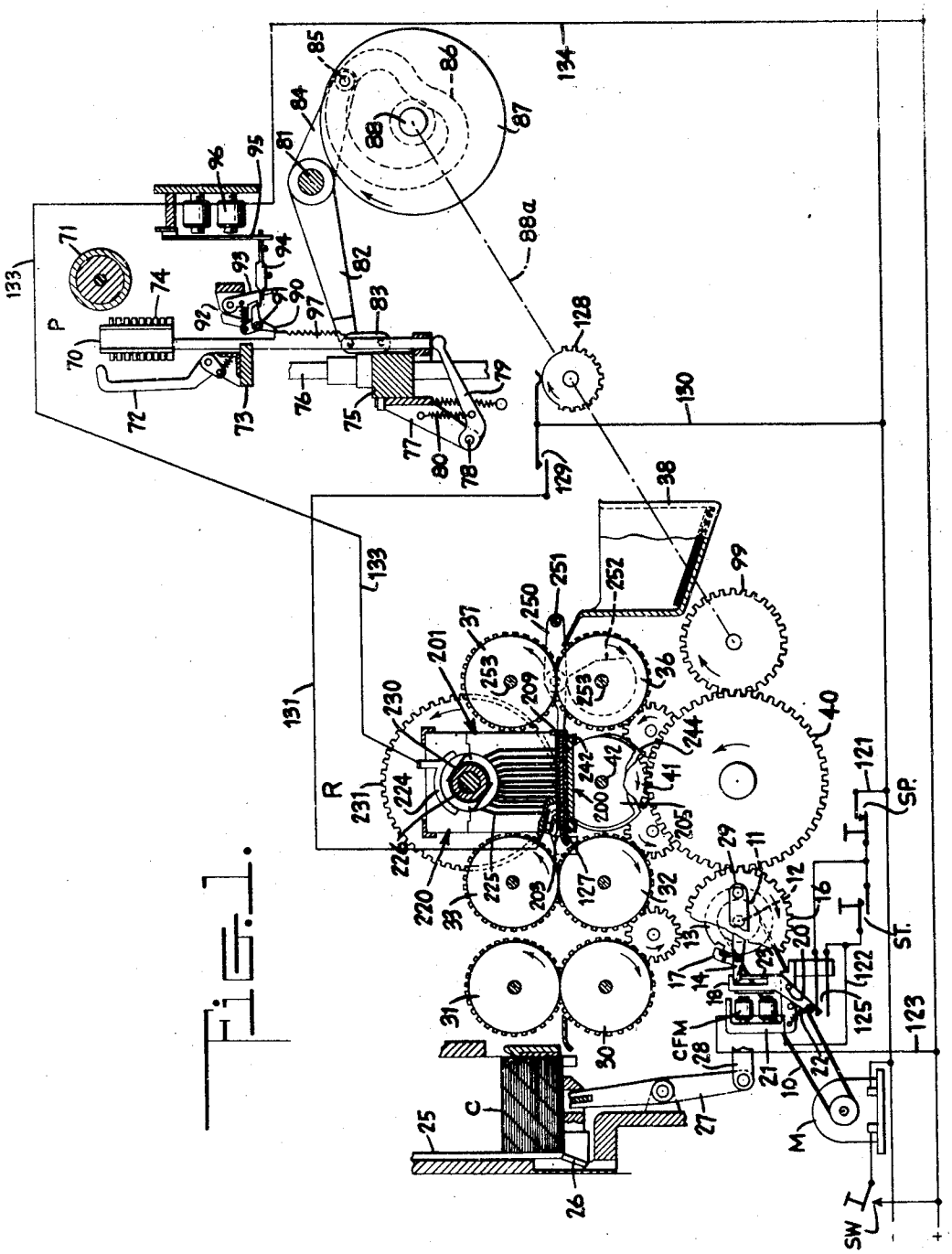
July 5, 1949. R. E. PARIS 2,475,335

ELECTRICAL CONTACT DEVICE WITH LIQUID CONTACT MEANS

Filed Jan. 9, 1948 6 Sheets-Sheet 1



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ELECTRICAL CONTACT DEVICE WITH LIQUID CONTACT MEANS

Filed Jan. 9, 1948 6 Sheets-Sheet 2

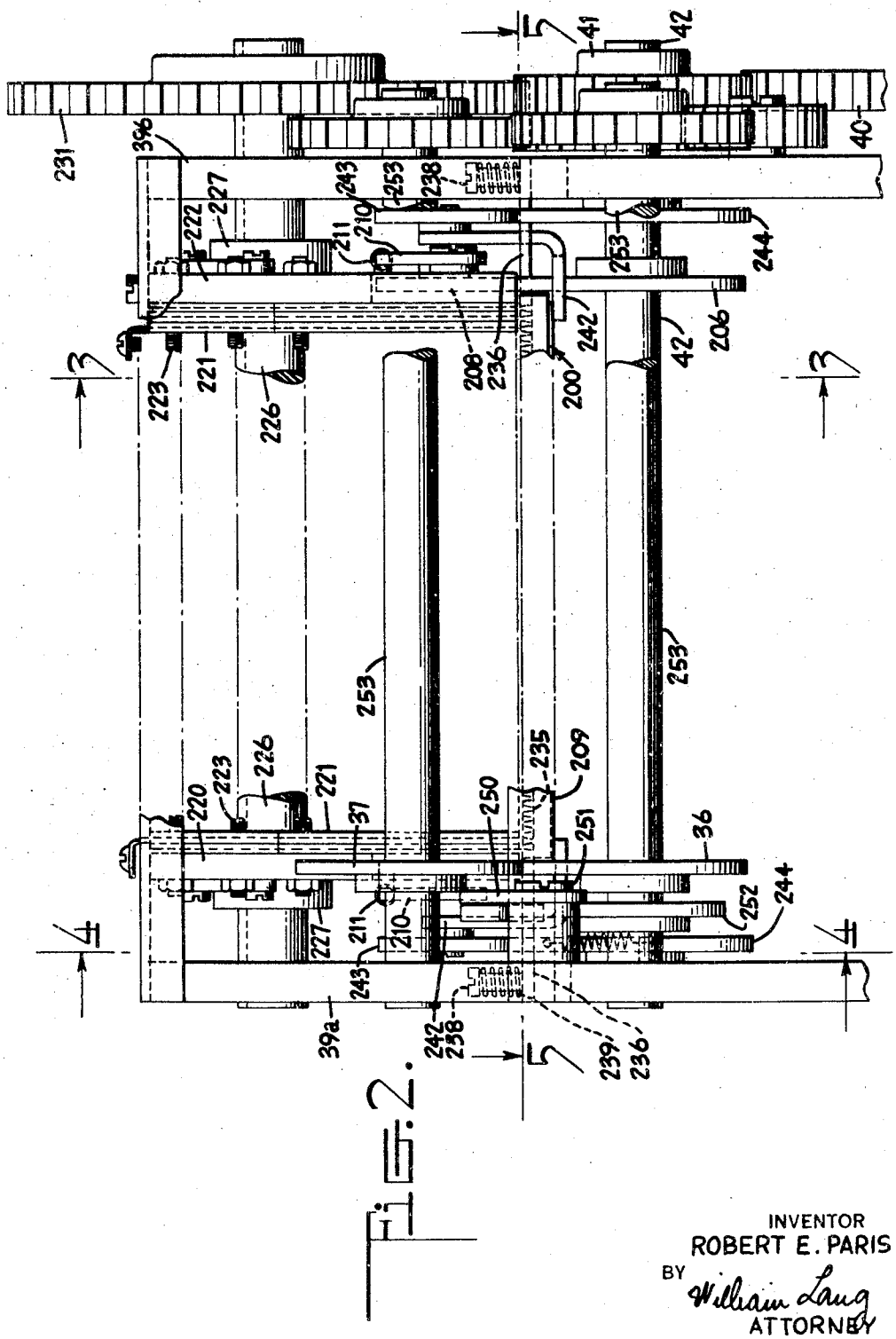


FIG. 2.

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ELECTRICAL CONTACT DEVICE WITH LIQUID CONTACT MEANS

Filed Jan. 9, 1948 6 Sheets-Sheet 3

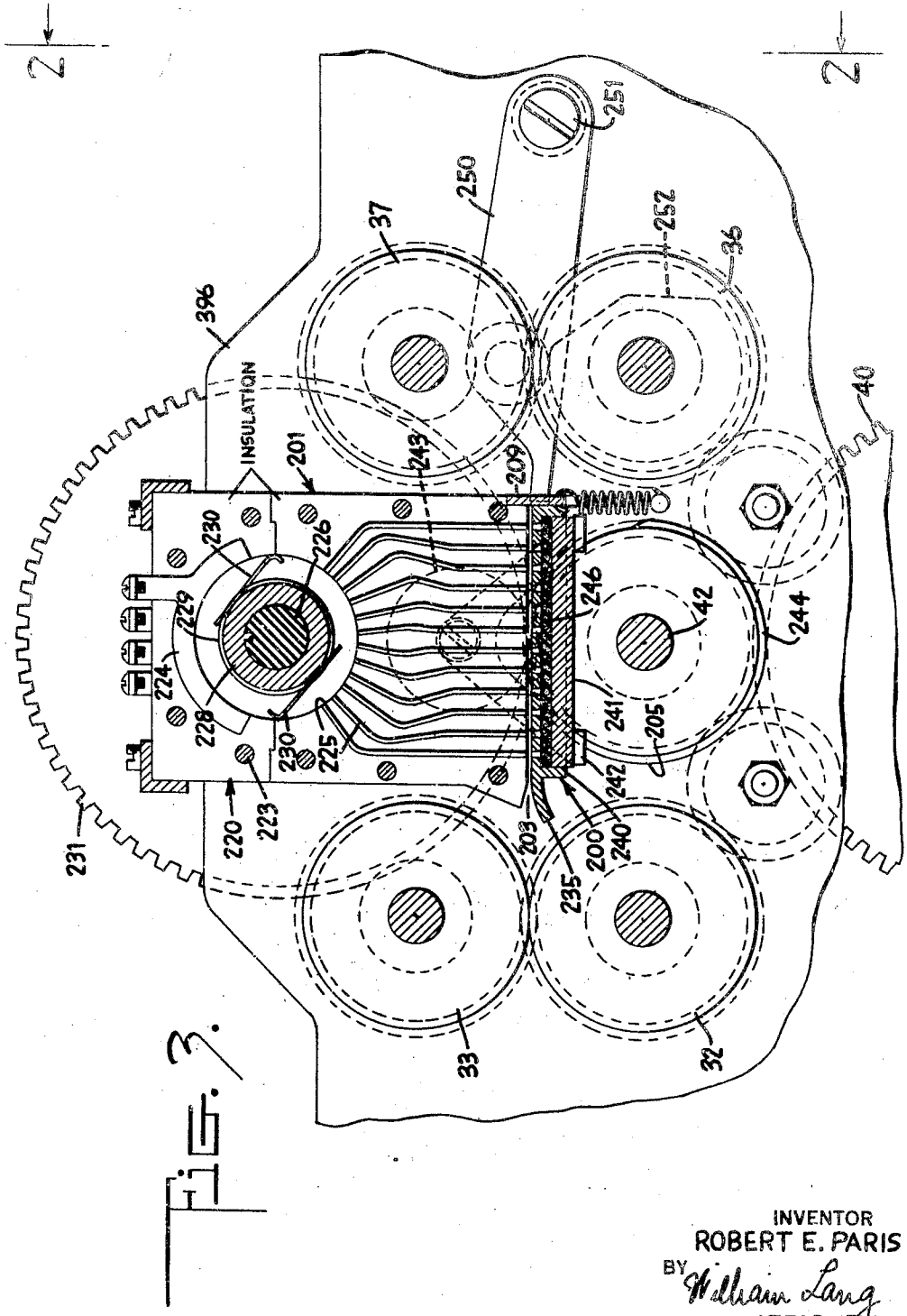


FIG. 3.

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ELECTRICAL CONTACT DEVICE WITH LIQUID CONTACT MEANS

Filed Jan. 9, 1948 6 Sheets-Sheet 4

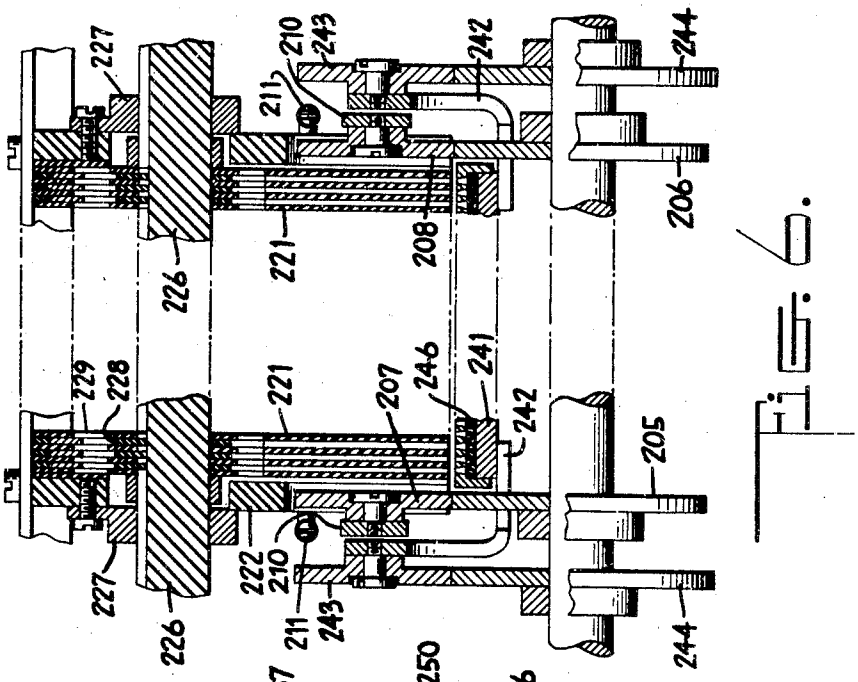


Fig. 6.

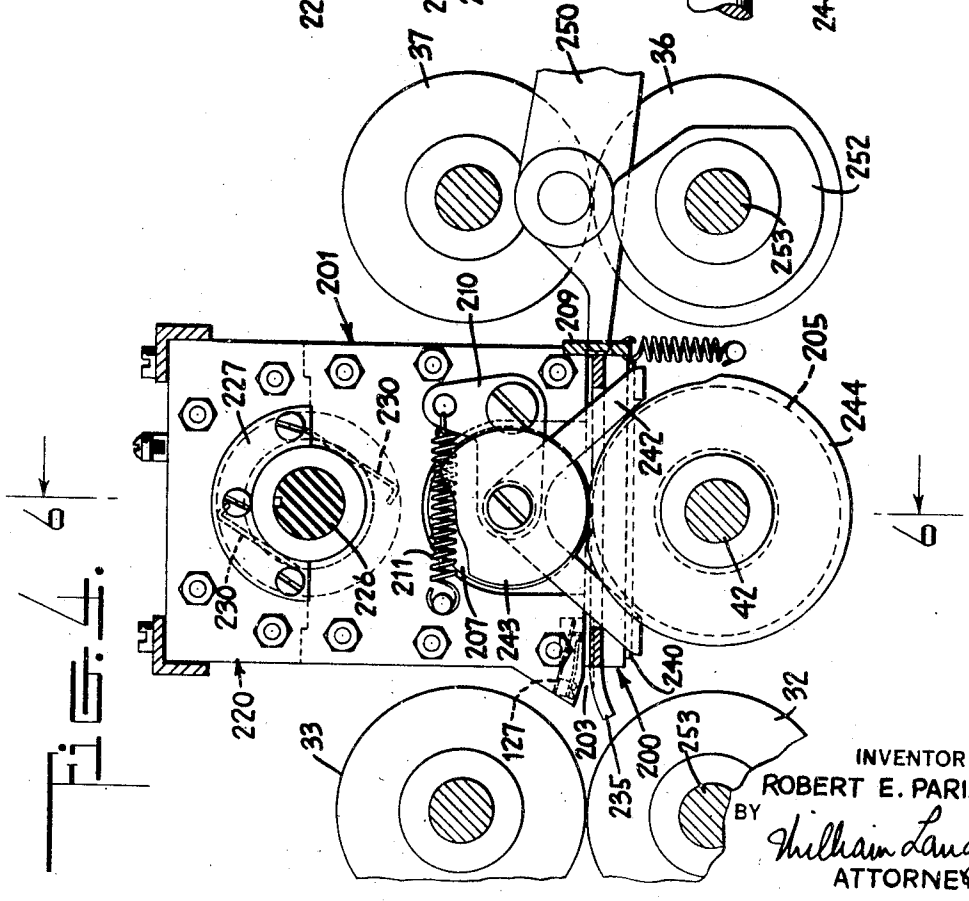


Fig. 4.

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ELECTRICAL CONTACT DEVICE WITH LIQUID CONTACT MEANS

Filed Jan. 9, 1948 6 Sheets-Sheet 5

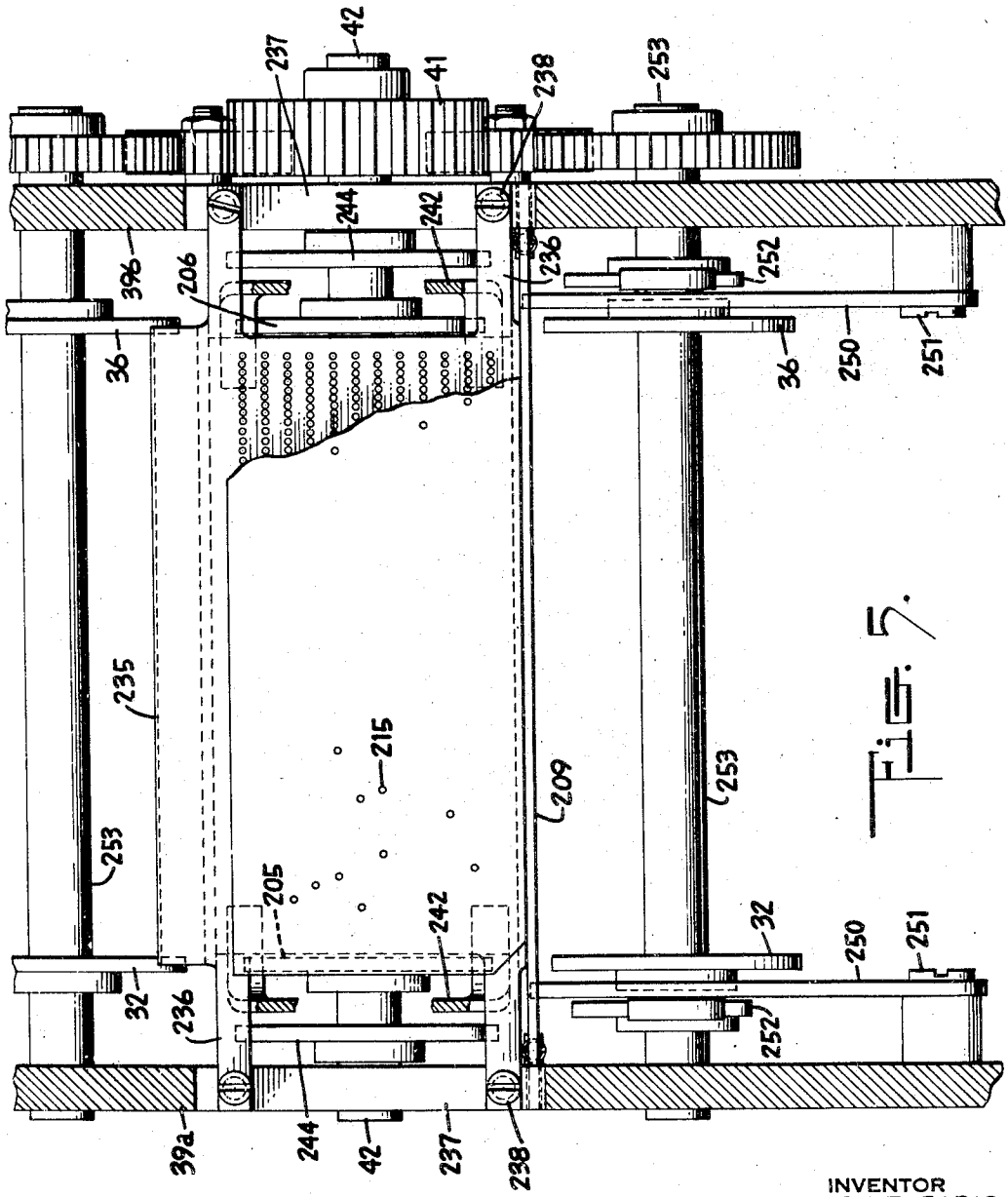


Fig. 5.

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July 5, 1949. R. E. PARIS 2,475,335

ELECTRICAL CONTACT DEVICE WITH LIQUID CONTACT MEANS

Filed Jan. 9, 1948 6 Sheets-Sheet 6

Fig. 8.

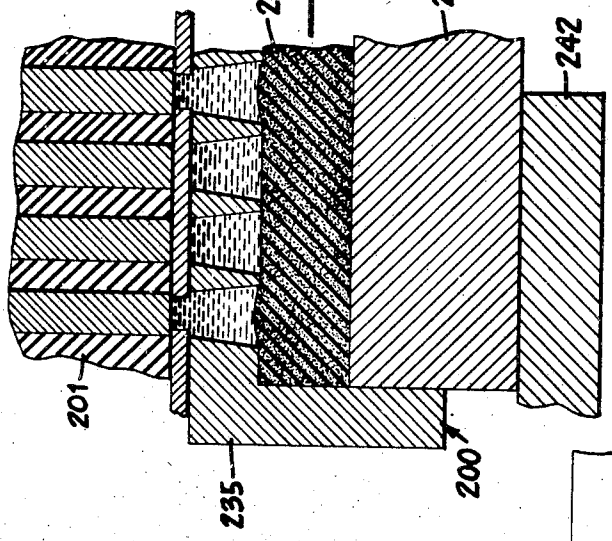


Fig. 9.

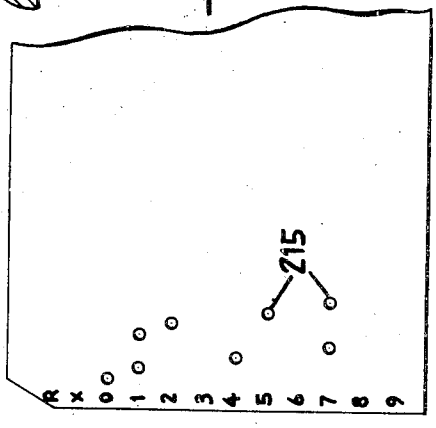
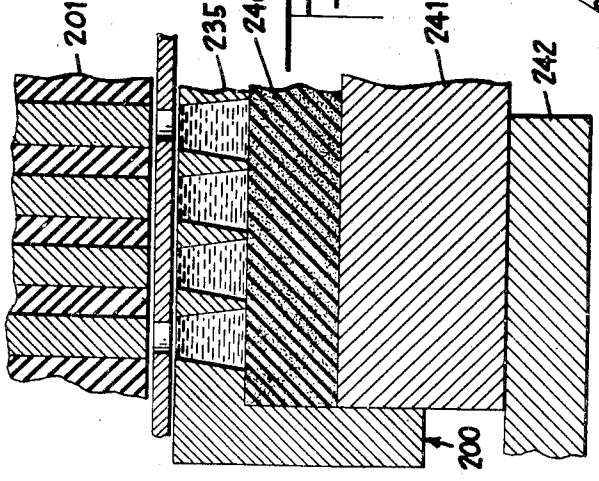


Fig. 7.



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Patented July 5, 1949

2,475,335

UNITED STATES PATENT OFFICE

2,475,335

ELECTRICAL CONTACT DEVICE WITH LIQUID CONTACT MEANS

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Application January 9, 1948, Serial No. 1,374

4 Claims. (Cl. 235—61.11)

1

This invention relates to an electrical contact device. While the contact device has certain characteristics which make it particularly suited for sensing perforated records, it is also useful for other applications.

One object of the invention is to provide an improved contact device of the type shown in my co-pending application, Serial No. 505,687, now Patent No. 2,435,725, filed October 9, 1943.

Another object is to provide an electrical contact device embodying a conductive liquid, in which the liquid is more effectively controlled than heretofore.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose, by way of example, the principle of the invention and the best mode, which has been contemplated, of applying that principle.

In the drawings:

Fig. 1 is a partly diagrammatic vertical sectional view showing a tabulating machine embodying a sensing mechanism in accordance with the invention.

Fig. 2 is an elevation of the sensing mechanism looking in the direction of the arrows 2 in Fig. 3.

Fig. 3 is a vertical section on the line 3—3 of Fig. 2.

Fig. 4 is a vertical section on the line 4—4 of Fig. 2.

Fig. 5 is a horizontal section on the line 5—5 in Fig. 2.

Fig. 6 is a detail vertical section on the line 6—6 of Fig. 4.

Figs. 7 and 8 are enlarged sectional views illustrating the action of the card sensing device.

Fig. 9 is a fragmentary view of a record card of the type which the device is adapted to sense.

Background structure of the illustrative embodiment

The machine partially shown in Fig. 1 is a tabulating machine designed to feed record cards in sequence through a reading mechanism R, which analyzes the cards and controls a printing mechanism P, whereby the data from the record cards is listed. Such a machine ordinarily includes accumulators for totalizing statistical data, but these are not shown in the drawing since the printing mechanism will sufficiently illustrate the manner in which the record reading mechanism controls another mechanism. The printing mechanism would ordinarily be positioned beside the card feeding mechanism,

2

but has been moved to the right in Fig. 1, to make it visible in the same view.

The driving mechanism

The drive of the machine is taken from an electric motor M, the shaft of which is connected by a belt 10 to a pulley 11 on a shaft 12. This shaft has fixed to it a notched disk 13 and revolvably mounted on it a unit comprising an arm 14 fastened to a gear 16. The arm 14 has pivoted to it a dog 17 adapted to engage the notch of the disk 13. When the machine is not feeding cards, the arm 14 is latched by a latch 18 which also engages an arm of the dog 17 and retracts the dog from the notch, against the pull of a spring (not shown). The latch 18 is pivoted at 20 on a magnet frame 21 and normally pulled clockwise by a spring 22. A detent 23 pivoted to the latch 18 and biased by a spring (not shown) engages behind the arm 14 when the latter is stopped by the latch and locks the unit comprising the arm 14 and gear 16 in a fixed position. The latch 18 can be released from the arm 14 by a magnet CFM. When the latch 18 releases the arm 14 and the dog 17, the dog drops onto the disk 13 and engages the notch thereof, setting the arm 14 and gear 16 in rotation. The rotation will continue as long as the magnet CFM remains energized.

The card feeding mechanism

The card feeding mechanism is of a well known type shown in Carroll Patent No. 1,791,883. The cards C are stacked in a hopper 25 and fed singly from the bottom of the stack by a reciprocating picker 26 operated by a lever 27. The lever is driven by a link 28 connected to an eccentric pin 29 on gear 16. The picker feeds a card for each revolution of the gear 16. The cards, on emerging from the hopper, are engaged by a first pair of feed rollers 30 and 31, by which they are fed to a second pair of feed rollers 32 and 33. The latter feed the cards to the sensing mechanism, which comprises a lower contact member 200 and an upper contact member 201, the construction of which will be described in detail presently.

The contact members 200 and 201 are separated by a slot 203 (Fig. 3) to receive the perforated record member. The record member is fed into the slot by lower skid rolls 205 and 206 (Figs. 4, 5 and 6) and upper skid rolls 207 and 208, being stopped in sensing position by a gate 209. After the sensing operation the gate is dropped to allow the record member to be fed

to feed rolls 36 and 37, which deliver it to a hopper 38. The feed rollers are all journalled in side plates 39a and 39b (Figs. 2 and 3). The drive of the feed rollers is taken from the gear 16 through a large gear 40, which meshes with a wide gear 41 on the shaft 42 of the lower skid rollers 205 and 206. From the gear 41 all of the feed rollers, with the exception of the upper skid rolls 207 and 208, are driven by the gearing shown in the drawing, at such a rate that they make one revolution for each revolution of the clutch gear 16. The upper skid rolls 207 and 208 are not positively driven, but are mounted on pivoted brackets 210 urged by springs 211 in the direction to press the upper skid rolls toward the lower skid rolls 205 and 206.

The embodiment of the invention shown in the drawing is designed to handle cards of the type used with International record controlled machines. Fig. 9 shows the left end of such a card. The card is divided vertically into columns and horizontally into index point positions, which are designated, respectively, R, X, 0, 1, —9.

The holes 215 in the card shown in Fig. 9 are smaller than the holes of standard tabulating cards, illustrating the fact that a sensing mechanism in accordance with the present invention is capable of sensing small holes. They may, in fact, be as small as pin holes, or holes made by perforating the card by means of a high tension spark.

The sensing mechanism

The upper sensing member 201 is a laminated block 220 composed of commutator laminations 221 and end plates 222, all tied together by tie bolts 223. There is one commutator lamination for each card column. The commutator laminations are divided horizontally into the upper and lower halves, the upper half containing an insert 224 forming a common contact for all index point positions and the lower half containing 12 inserts 225 for the 12 different index point positions of the card. The laminations are cut out to form a circular opening through which extends a shaft 226 of insulating material journalled in bearings 227 on the end plates. The shaft has mounted on it an alternating series of metallic washers 228 and insulating spacers 229. Each metallic washer has attached to it a pair of brushes 230, 180° apart, and is keyed to the shaft, as shown in Fig. 3. The shaft 226 is driven by a gear 231 meshing with the broad gear 41, and makes one half revolution for each revolution of the gear 41. In the course of one machine cycle, represented by a revolution of the gear 41, each of the inserts 225 in the lower half of each commutator lamination is connected in turn, by the brushes 230, to the related common insert 224.

The lower contact member comprises a sensing plate 235 (Fig. 3) provided with four laterally extending ears 236, which normally rest upon horizontal surfaces 237 of the side plates 39a and 39b. The ears are guided by bolts 238 and are yieldingly held down by springs 239. The plate 235 has flanges 240 forming a four-sided downwardly opening box. Within this box fits a pressure plate 241 supported at each end by brackets 242 and rollers 243 journalled thereon, upon cams 244 fixedly mounted upon the shaft 42. Between the pressure plate 241 and the sensing plate 235 is a space completely filled by a spongy rubber mat 246, or similar resilient material.

Opposite the end of each commutator insert 225 of the upper contact member, the sensing plate 235 is perforated, to provide a receptacle for a contact mass having particular characteristics, in accordance with the principle of the present invention. This contact mass is composed of an electrically conductive liquid absorbed in a spongy substance, from which the liquid can be expressed, but which will immediately re-absorb the liquid when the pressure is removed. While a number of different combinations of materials can be used for this purpose, such as gelatin and aqueous solution of sodium chloride and glycerine, the best material which I have found for the purpose is a sponge of silver amalgam in which mercury, as the conductive liquid, is absorbed. This combination has the advantage that, being metallic in nature, its conductivity is high, and it is also free from such disadvantages as evaporation loss and oxidation.

The printing mechanism

By way of illustration, the record sensing mechanism is shown in Fig. 1 as controlling a printing mechanism of conventional type, disclosed for example, in Lake Patent No. 1,822,594. This printing mechanism comprises a set of type bars, only one of which appears in the drawing at 70. These type bars are mounted so as to be movable up and down in relation to a platen 71, on which a sheet of paper to receive the printed record is supported. A hammer 72 is pivotally mounted on a stationary bracket 73 so that its head is positioned in line with the printing line of the platen. There is a hammer for each type bar. The type bars can be raised to positions independently determined for each type bar, so that a selected one of the type members 74 is between the related printing hammer and the platen, at the end of the setting operation. A cross head 75, mounted for vertical movement on two bars, one of which is shown at 76, carries a bracket 77 having a cross rod 78 on which are mounted a number of arms 79, one for each type bar 70. The arms 79 are biased upward by springs 80 to engage the bottom ends of their respective type bars. On one end of a rock shaft 81 is fixed an arm 82 carrying a link 83 pivotally connected to the adjacent end of the cross head 75. This mechanism is duplicated at the opposite end of the rock shaft 81, which shaft also has fixed to it an arm 84 carrying a roller 85 traveling in a groove 86 of a cam 87 fixedly mounted on a shaft 88. When the cam revolves, the cross head is raised and moves the type bars upward. The type bars are differentially stopped in the course of their upward movement by individual dogs 90 pivoted on a stationary rod 91, each dog being biased in a clockwise direction by a spring 92 connected to an individual pivoted latch 93. The latch is connected by link 94 to an armature 95 of an electro-magnet 96. When the electro-magnet is energized the latch releases the dog 90, which engages a particular tooth of a set of teeth 97 on the type bar. The upward movement of the type bars by cam 87 is synchronized with the rotation of shaft 226, so that as the inserts 225 are successively engaged by the brushes 230, the teeth 97 of the type bars successively come into position to be stopped by the dogs 90, if the magnet 96 should be energized at that time. For the purpose of synchronizing the printing mechanism with the card sensing mechanism, the shaft 88 (indicated by dot and dash line 88a) is provided with a driving gear 99 having the same number of teeth as the gear 16 and meshing with the gear 40.

The manner in which the record sensing mechanism operates will now be described. Referring first to Fig. 1, when the switch SW is closed, the motor runs and drives the notched disc 13. The start key contact ST is manually closed, completing a circuit from the negative side of the line through wire 121, normally closed stop key contact SP, start key contact ST, wire 122, magnet CFM, and wire 123, to the positive side of the line, energizing said magnet. The armature latch 18 is rocked to the left and its lower arm closes a contact 125, extending a holding circuit to the magnet CFM around the start key contact, which can now be allowed to open. When the latch 18 is rocked the dog 17 engages the notched disk 13 and the gear 16 is connected to the continuously running drive. Through the linkage 27, 28, 29, the picker 26 is operated to feed a card from the bottom of the stack C, between the feed rolls 30, 31. The feed of the card continues through feed rolls 32, 33, to a position in front of the card chamber or slot 203. During the first quarter of the next cycle the card feeds into the card chamber, by the action of the rollers 32, 33 and the skid rollers 205, 206 and 207, 208. The card is stopped by the gate 209, which is elevated by two levers 250 pivoted to the frame at 251 and operated by cams 252 on the shaft 253 of feed rolls 36.

Immediately thereafter the cams 244 raise the pressure plate 241, pressing the sensing plate 235 against the bottom of the card. Figs. 7 and 8 illustrate on a large scale the action which occurs when the bottom contact member is moved upward, to press the card against the upper contact member. At the two middle index point positions in these figures, where there is no hole in the card, there is no substantial change of the contact mass within the receptacles. In the two outer index point positions, where holes occur in the card, the sponge rubber mat bulges into the receptacles, compressing the spongy contact material and expressing therefrom some of the mercury. The mercury is forced up through the holes in the card, into contact with the ends of the inserts 225.

The preparatory operations just described occur during approximately one quarter of the cycle between the time when one of the brushes leaves the left end of the common insert 224 and the time when it is about ready to engage the left hand insert 225. Thereafter, for approximately three quarters of a cycle, the brush moves in sequence over the upper ends of the inserts 225. When the brush has made contact with an insert 225 against the lower end of which mercury is pressed, through a hole in the card, in the manner previously described, a circuit extends from the negative side of the line, through a wire 130, a cam contact 129, closed by a cam 128 on shaft 88 during each index point time of the sensing part of the cycle, a wire 131, a card lever contact 127, closed by the card on entering the card chamber 203, the bottom sensing plate 235, through the hole in the card by way of the contact mass, the related insert 225, the brush assembly 230, 228, the common insert 224 pertaining to the column in question, a wire 133, print magnet 96, and a wire 134, to the positive side of the line, energizing the print magnet. In the corresponding column of the printing mechanism the dog 90 is tripped and the type bar is stopped in the correct position to locate in front of the printing hammer 72 the type member corresponding to the index point position of the hole in the

card. The printing occurs in the normal manner, after the sensing part of the cycle, by the action of the hammer 72.

As soon as the brush has left the last insert 225, the cams 244 allow the lower contact member 235, 241, to drop. The mercury which has been expressed through holes in the card is instantly re-absorbed in the amalgam within the receptacle. Shortly thereafter the cams 252 allow the gate 209 to drop and the card is fed out of the card chamber by the skid rolls 205, 208 and forwarded by the feed rolls 36 and 37 to the hopper 38. At the time when the card begins to move out of the card chamber 203 the following card is just in position to enter the card chamber, with a small gap between its leading edge and the trailing edge of the preceding card.

When all of the cards have been fed out of the hopper 25, or at an earlier time when it is necessary to stop the machine, the stop key contact SP is opened, breaking the holding circuit for the magnet CFM and allowing the clutch arm 14 to latch up at the end of the cycle.

The present improvement has the advantage over the contact device shown in my co-pending application, Serial No. 505,687, that the conductive liquid is controlled more effectively, because it is absorbed in the spongy contact substance at all times, except when being pressed out to make the contact.

It also has the advantage that the contact masses are pressed against all of the index point positions of the card with an even pressure, contributing to the uniformity of operation of the device.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a single modification it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention therefore, to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. In an electrical contact device for sensing a hole in a perforated record sheet, two contact members mounted in juxtaposition, with a space between to receive the record sheet, one of said contact members comprising a receptacle open on the side toward the other contact member, a contact mass in said receptacle comprising a spongy material and an electrically conductive liquid wholly absorbed in the spongy material, and means to bring said contact members together on opposite sides of the record sheet and to squeeze said spongy material to express some of the conductive liquid therefrom through a hole in the record sheet and against the other contact member.

2. In an electrical contact device for sensing a hole in a perforated record sheet, two contact members mounted in juxtaposition, with a space between to receive the record sheet, one of said contact members comprising a receptacle open on the side toward the other contact member, and on the opposite side, a contact mass in said receptacle comprising a spongy material and an electrically conductive liquid wholly absorbed in said spongy material, an elastic mat covering said open side of said receptacle remote from said other contact member, and means for pressing on said elastic mat to force said receptacle and the contact mass therein against one side of said

record sheet, whereby a pressure is exerted upon said spongy mass to express the conductive liquid therefrom through a hole in the record sheet and into contact with the other contact member.

3. In an electrical contact device for sensing holes in perforated record sheets, two flat contact members mounted in juxtaposition with a space between to receive the record sheet, one of said contact members comprising a plate perforated to provide receptacles at respective index point positions of the record where holes may appear, contact masses in said receptacles comprising spongy material and electrically conductive liquid wholly absorbed in said spongy material, a pressure plate on the side of said perforated plate remote from the other contact member, an elastic mat between said perforated plate and said pressure plate, and means to move said pressure plate in a direction to press said mat against said perforated plate, whereby the record sheet is pressed between said contact members and the contact masses in said receptacles are compressed, to express the conductive liquid from the spongy mass in any receptacle where a hole appears in the record sheet, so that the liquid passes through said hole into contact with the other contact member.

4. In an electrical contact device for sensing holes in perforated records, a contact mass comprising a spongy material and an electrically conductive liquid wholly absorbed therein, a solid contact member, and means to compress the perforated record between said contact mass and said solid contact member, said last means acting to squeeze said spongy material, so that if there is a hole in the record sheet conductive liquid will be expressed from said spongy material and forced through said hole into contact with said solid contact member.

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The following references are of record in the file of this patent:

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