Jan. 6, 1953 C. R. MANNING 2,624,511

RECORD PERFORATION ANALYZING MECHANISM

Filed Sept. 13, 1951 2 SHEETS—SHEET 1

FIG. 1

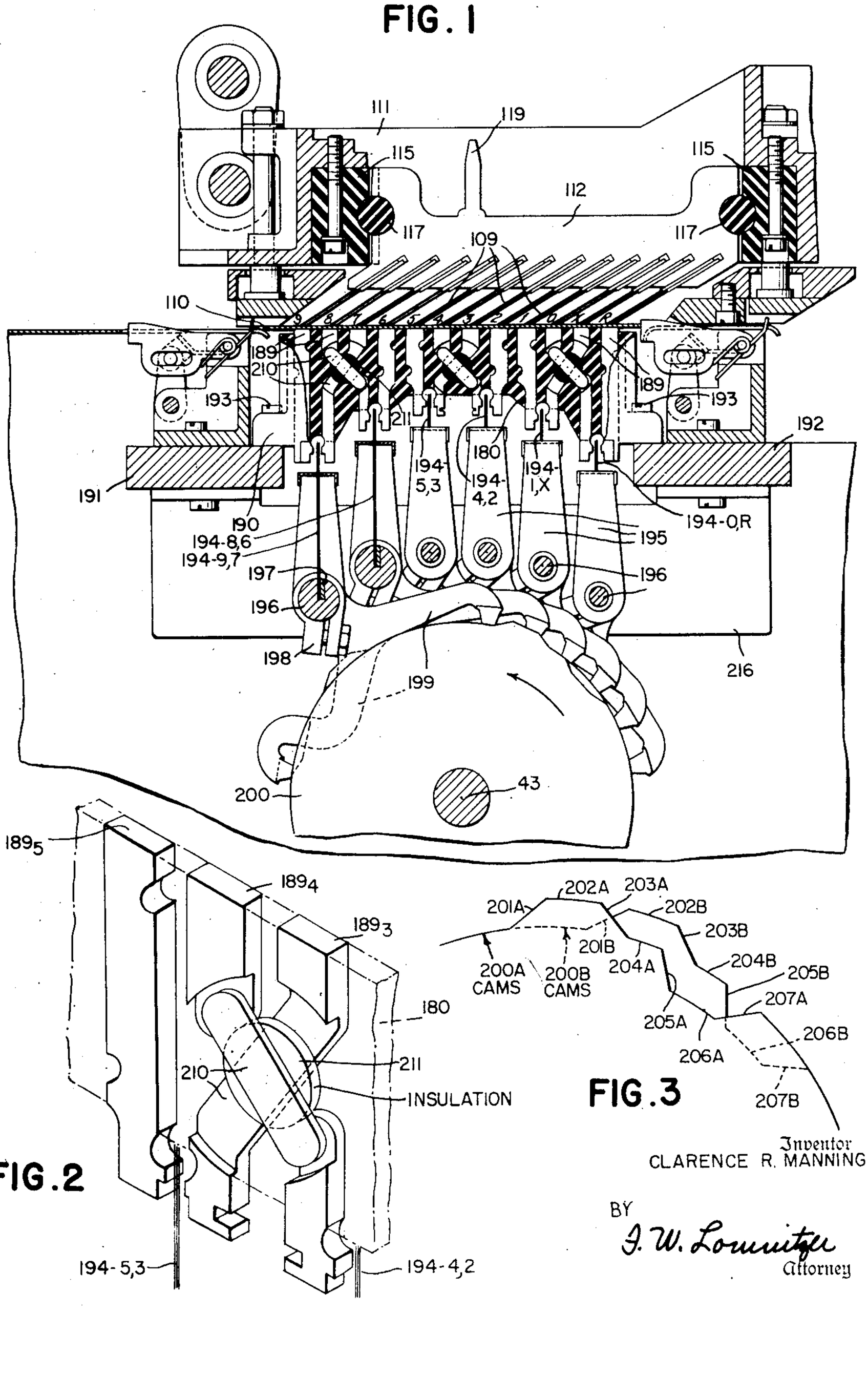

FIG. 2

FIG. 3

Inventor
CLARENCE R. MANNING

BY
J. W. Lonnitzer
Attorney

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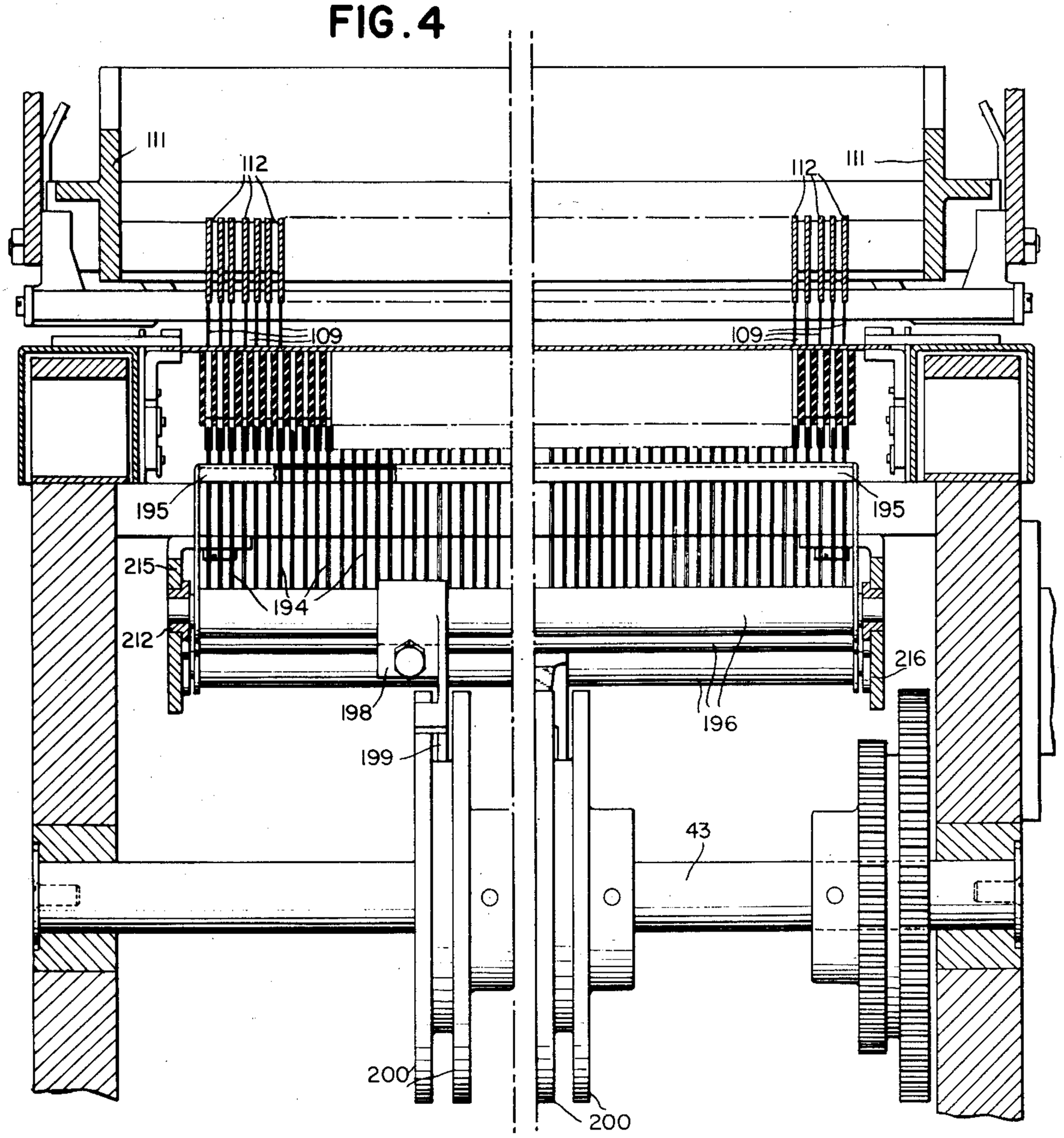
FIG. 4



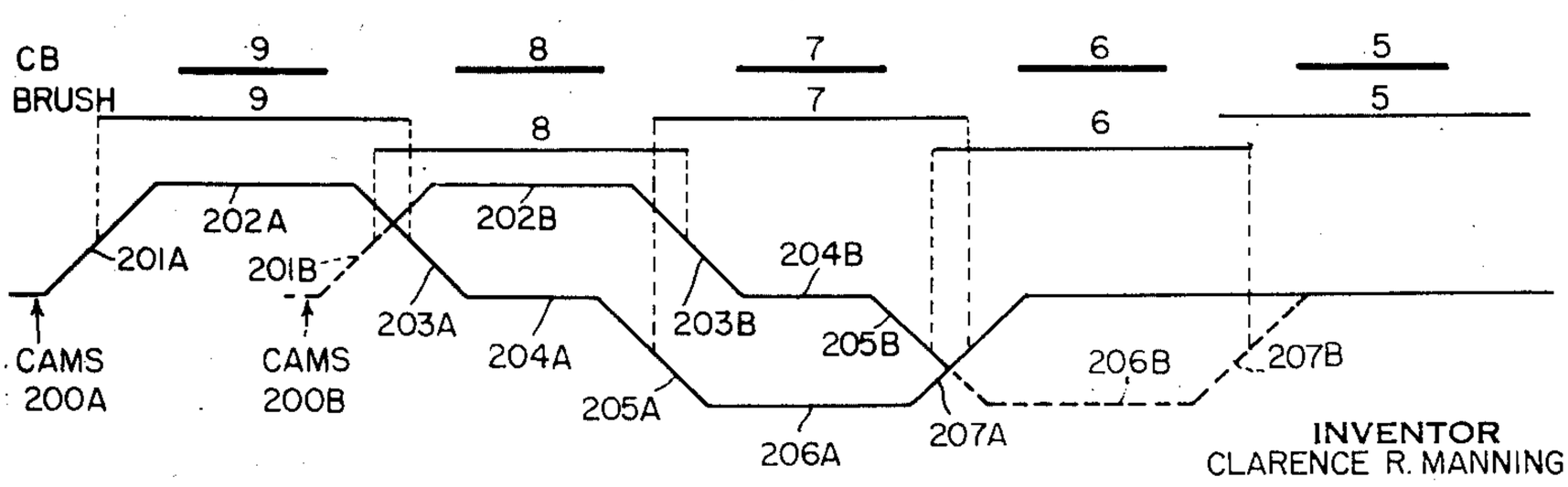


FIG. 5

INVENTOR
CLARENCE R. MANNING

BY
F. W. Lowenitzer
ATTORNEY

Patented Jan. 6, 1953 2,624,511

UNITED STATES PATENT OFFICE

2,624,511

RECORD PERFORATION ANALYZING MECHANISM

Clarence R. Manning, Vestal, N. Y., assignor to International Business Machines Corporation, New York, N. Y., a corporation of New York

Application September 13, 1951, Serial No. 246,362

5 Claims. (Cl. 235—61.11)

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This invention relates to record controlled machines, and more particularly to improvements in record perforation analyzing mechanisms therefor.

In one form of record perforation analyzing mechanism, shown in the patent to George F. Daly, No. 2,514,031, issued July 4, 1950, a series of perforation analyzing brushes are moved downwardly to make contact with a series of stationary contact points through the record perforations, said contact points comprising commutator spots which are successively wiped over by a rotary brush to transmit differentially timed electrical digit representing impulses, to control electrical instrumentalities of a record controlled accounting machine.

The purpose of this invention is to devise an improved arrangement having all of the advantages of the above described type of record perforation analyzing mechanism but to construct it in such a manner that a more efficient and longer duration of electrical contact is provided, thus insuring the proper operation of the electrical instrumentalities of the record controlled accounting machine.

One object of the present invention is to dispense with the rotary brush or wiper in the earlier arrangement and effect the electrical contact with the contact points by wire brushes which are positively pressed against said contact points by successively operated cams, which cams establish by their cam contour formations the time and duration of the electrical contact.

Each card column usually has twelve index point positions, 9, 8, 7, 6, 5, 4, 3, 2, 1, 0, X and R which are sensed by a corresponding number of perforation analyzing brushes which make individual contact with the commutator spots or contact points through the perforations. In the present machine the desired pressure contact between each wire brush and its contact point can also be provided by having twelve cams which successively press twelve wire brushes against the related commutator contact points but in the preferred arrangement each cam moves a wire brush to make contact with either one of a pair of contact points, thus requiring for twelve contact points only six cams and six wire brushes.

Thus, it is a still further object of the invention to devise the contact making arrangement in such manner that the number of brushes and cams operating the brushes comprise only half of the number of commutator contact points.

A still further improvement is to provide a

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design of cam which establishes by its cam contour the duration of contact between a wire brush and a commutator point, thus enabling electrical impulses of a longer duration than that possible by a rotary wiper, as in the earlier Daly Patent No. 2,514,031

A still further improvement is to arrange the contact making mechanism in such manner that a second, or following impulse, is initiated before the preceding impulse is terminated, thus providing for the transmission of successive overlapping impulses, in the order 9, 8, 7, 6, 5, 4, 3, 2, 1, 0, X and R.

If it were not otherwise provided for, in the contact of a single wire brush with a pair of contact points alternately, such as 9 and 8, for example, the contact between the wire brush and the 9 contact point would have to be broken before said wire brush could make contact with the 8 contact point. Thus, without some special provision or arrangement the desired overlapping of transmission of impulses could not be derived.

Accordingly, a further improvement consists in arranging the contact points in association with the brushes in such manner after two neighboring brushes are operated one after the other in one direction to engage the 9 and 8 commutator contact points to transmit 9 and 8 impulses, then are successively operated in another direction to engage the 7 and 6 commutator contact points to transmit the 7 and 6 impulse. Obviously, since the successive movement of neighboring brushes in said one direction can overlap, the resultant digit impulses, such as 9 and 8, will also overlap. The above describes the principle embodied for transmitting 9, 8, 7 and 6 impulses, and by the same mode of operation the remaining four wire brushes transmit overlapping impulses 5, 4, 3, 2, 1, 0, X and R.

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 said drawings:

Fig. 1 is a sectional view showing the perforation analyzing brush structure of the prior patented arrangement and its association with the improved contact making arrangement.

Fig. 2 is a perspective view showing the manner of forming the commutator contact points so that they are associated with the correct wire

brushes in a manner according to the present invention.

Fig. 3 is an enlarged view of two operating cams to show in more detail their cam formations and their relative disposition about their common drive shaft.

Fig. 4 is a side elevational view which is partly in section showing the means for supporting a series of wire brushes and their associated operating cams.

Fig. 5 is a timing diagram used in the description for describing the sequence of events.

The improvements are preferably incorporated in a record perforation analyzing mechanism of the form shown in the patent to G. F. Daly, No. 2,514,031, issued July 4, 1950. Fig. 1 shows the present improvement coordinated with a part of the structure which is substantially the same as Fig. 9 of the above cited patent. A general description will be given of the common structure using, as far as possible, the same reference numerals as in the aforementioned patent.

A frame 111 is adapted to carry a plurality of analyzing units 112 each comprising a metal plate carrying angularly disposed perforation analyzing brushes 109 which project through the perforations of a perforated card 110. The eighty-column card is preferably of the type shown in the patent to C. D. Lake, No. 1,772,492, issued August 12, 1930, and has in each column from the bottom to top the index points 9, 8, 7, 6, 5, 4, 3, 2, 1, 0, X, R which are read out in the named order. Only one analyzing unit is shown in Fig. 1, but for the analysis of eighty columns of the card a corresponding number of units are provided on the frame 111, as shown in Fig. 4, thus providing a row of brushes 109 for each of the aforesaid index points. An electrical connection is made to each analyzing unit 112 by an integral terminal 119. The plurality of analyzing units 112 are fitted in spacing slots of insulating spacing bars 115 carried by frame 111 and are locked in position in frame 111 by rods 117 of insulating material which fit in semicircular cutouts formed in the analyzing units 112 and along the edge of each spacing bar 115.

This spacing coordinates the analyzing units with the card columns.

The frame 111 is normally elevated so that the card to be analyzed may be fed to the perforation analyzing brushes 109 without interference and is lowered when the card is in analyzing position. As more fully explained in the Daly Patent No. 2,514,031, concurrent with the lowering of the frame 111 to move the twelve rows of brushes 109 against the upper face of the card, a lateral displacement of frame 111 slightly to the right causes the brushes 109 to wipe over the card, and the particular brush 109 which passes through a card perforation wipes over an associated contact point 189. This lateral displacement of the frame is shown in Fig. 1. With the frame held in such position a card readout operation by the improved mechanism takes place, as will be presently described.

After the card readout operation the frame 111 is elevated, allowing the brushes 109 to unbend, but due to the previous concurrent shift of the frame 111 the brushes are disengaged from the perforations without striking the wall thereof, and damage them. This is fully explained in the aforementioned Patent No. 2,514,-031.

As in the Daly patent, associated with the

rows of perforation analyzing brushes 109 are the aforesaid rows of contact points 189. In the Daly patent a separate stator carries each set of contact points 189 for a card column but in the present machine a flat plate 190 of insulating material has embedded therein the plurality of rows of contact points, there being one row for each row of brushes 109, or twelve rows in the aggregate. The plate 190 is attached to support bars 191 and 192 by hold-down screws 193. It is evident, therefore, that each individual perforation analyzing brush 109 will make contact with the associated commutator contact point 189 through the perforation located at the respective brush position.

Differing from the sensing commutator in the Daly patent, instead of a wiper brush (204 in the patent) which is rotated to pass successively over the contact points 189 in a clockwise direction, a more efficient electrical contact is made to each contact point 189 by flexible wire brushes 194 and for a duration of time dependent upon the contour of a profile cam which rocks the brush, rather than dependent upon the length of time that the wiper makes contact with a contact point 189, as in the Daly patent. By the present contact making arrangement not only is a more efficient contact made, but the period of contact is lengthened over that possible with the arrangement in the Daly patent to thus more efficiently energize the controlled magnet, or electrical instrumentality of the record controlled accounting machine.

The twelve contact points 189, of which there is one for each of the twelve brushes 109 for a card column, project downwardly beneath the bottom surface of the plate 190 and are arranged in pairs so that the contact points of each pair are alternately contacted by a wire brush 194. Since there are twelve contact points 189 there are six brushes 194 for each card column. Since there is a row of eighty contact points for the same index point a corresponding number of brushes 194 are provided in each row, and are preferably carried by a related bail 195. Each bail 195 is secured to an associated rock shaft 196 and its transverse plate has eighty holes in which the brushes 194 project through to be separated apart a distance which is commensurate with the spacing of the adjacent contact points 189. Each rock shaft 196 has a longitudinal slot in which fits a slotted wedging plate 197 to securely and electrically connect the series of eighty brushes 194 to the related rock shaft 196. Thus, by rocking shaft 196 first counterclockwise a row of wire brushes 194 make contact with the left-hand row of contact points 189 and then rocking shaft 196 clockwise they will make contact with the right-hand row of contact points 189. All the brushes 194 are in a neutral non-contacting position at the start of the operation of the machine.

To rock said shafts 196 in such manner as to accomplish the desired operation, attached to each rock shaft 196 by a clamp 198 is a double follower arm 199 engaging a pair of complementary profile cams 200. The six pairs of complementary cams 200 have the same cam profile but are successively arranged on a drive shaft 43 so as to rock the shafts 196 seriatim.

The six shafts 196 are mounted concentric with respect to shaft 43 and each carries at one end a bushing 212 (Fig. 4) fitting in a bracket 215. By a similar mounting a bracket 216 carries the other end of each shaft 196. The drive shaft

43 corresponds to the same designated shaft of the patent to Daly, No. 2,514,031, and is driven one revolution for each cycle of machine operation.

The pair of complementary cams 200 which are first effective cause the rocking of the row of brushes 194—9, 7 (see Fig. 1) to the left to contact the row of 9 contact points 189 to read out 9's, then to neutral position. After this the next pair of complementary cams which are next effective rock the adjacent row of brushes 194—8, 6 to the left to read out 8's, then to neutral position. The cams 200 which were first effective then rock the brushes 194—9, 7 to the right to read out 7's and then to the left to neutral. Thereafter, said next pair of complementary cams rock said adjacent row of brushes 194—8, 6 to the right to read out 6's, then to neutral. Thereafter, the next two rows of brushes 194—5, 3 and 194—4, 2 are reciprocated sequentially by their cams 200 in the same manner to read out 5, 4, 3, and 2, and then the next two rows of brushes 194—1, X and 194—0, R are then reciprocated by their cams to similarly read out 1, 0, X and R in sequence. Since the readout operation for each group of four successive index points is alike the operation will be described in detail in connection with the readout of the group of four index points 9, 8, 7 and 6, in a single column and with particular reference to the cam formations shown in Fig. 3, and the timing of Fig. 4.

The duration of contact is shown at "Brush" (Fig. 5) for 9, 8, 7 and 6 index points effected by leading cams 200A and lagging cams 200B; that is to say, the cams 200B are effective slightly later in the cycle. While the cams are complementary cams the action of the cam surface of only one will be considered in the following description:

As cam 200A rotates counterclockwise its rise 201A rocks shaft 196 the same direction, moving contact wire 194—9, 7 to the left from neutral to make contact at the midpoint of the cam rise with the "9" contact point 189, the cam rise 201A thereafter bending brush wire 194—9, 7 to make a very firm electrical pressure contact. A dwell 202A retains this pressure contact and brush 194—9, 7 begins to unbend when descent 203A is effective. At the midpoint of the descending cam part 203A the electrical contact is broken, and the contact wire 194—9, 7 is then restored to neutral position.

The period between the make and break establishes the length of the transmitted impulse and is designated "9" at "Brush" in Fig. 5.

Just before the "break" a cam rise 201B of lagging cam 200B is effective at about its midpoint to shift brush 194—8, 6 to make contact with the "8" contact point, which is held by the dwell 202B, and part of the descending cam part 203B. This establishes in the same manner the period of the make and break delimiting the "8" impulse.

After the descending cam portion 203A has broken the contact between brush 194—9, 7 and contact 189—9 it is maintained by a dwell 204A. Thereafter, a descending cam portion 205A shifts at its midportion contact brush wire 194 to the right to make contact with the "7" contact point 189, thus initiating the "7" impulse. The dwell portion 206A maintains the contact which is broken by a following cam rise 207A. This completes the sequence of events by cam 200A which makes and breaks contacts for transmitting the "9" and "7" digit impulse.

In the same manner cam portion 203B, dwell 204B and cam portion 205B of the lagging cam 200B makes and breaks the contact between brush 194—8, 6 and the "6" contact point 189.

Prior to breaking the contact for the "6" impulse another pair of cams 200 (not shown in Fig. 5) are now effective to move a brush 194—5, 3 to the left to make contact with the "5" digit contact point 189, to thereby initiate the "5" digit impulse, and so on by the above described events, to transmit the remaining impulses 4, 3 and 2 of this group.

As shown, the successive impulses overlap, that is, one "makes" before the preceding "breaks," but if found objectionable a circuit breaker CB in the energizing circuit (see timing of Fig. 5) may establish shorter digit impulse periods and prevent breaking of the circuits at the brush wires 194 and contacts 189.

The successive movement of the brushes 194 to transmit or read out the digit impulses in the proper sequence is desirable because it enables the transmitted impulses to overlap and establishes by each cam the desired longer duration of impulse time.

It is evident then that to accomplish the above brush 194—9, 7 (see Fig. 1) is associated with the digit contacts 189_9 and 189_7 and the brush 194—8, 6 with the digit contacts 189_8 and 189_6. To establish this interspersed relationship a pair of contacts such as 189_8 and 189_7 have crossover connections 210 (Fig. 1) separated electrically by a button 211 of insulating material. A similar crossover arrangement is provided between contact points 189_3 and 189_4 (Fig. 2) and 189_0 and 189_X (Fig. 1).

The above described operation gives the sequence of events for the readout of 9, 8, 7 and 6 digit impulses, but by a duplicate arrangement the remaining impulses are read out, overlapping and with the desired duration. A complete sequence of events is explained below in tabular form:

6 Pairs of Cams 200	Digit Impulse	Direction of Movement of 6 Rows of Wire Brushes 194
200A	9	9–7 to the left to read out 9 impulse.
200B	8	8–6 to the left to read out 8 impulse.
200A	7	9–7 to the right to read out 7 impulse.
200B	6	8–6 to the right to read out 6 impulse.
200C	5	5–3 to the left to read out 5 impulse.
200D	4	4–2 to the left to read out 4 impulse.
200C	3	5–3 to the right to read out 3 impulse.
200D	2	4–2 to the right to read out 2 impulse.
200E	1	1–X to the left to read out 1 impulse.
200F	0	0–R to the left to read out 0 impulse.
200E	X	1–X to the right to read out X impulse.
200F	R	0–R to the right to read out R impulse.

While there have been shown and described and pointed out the fundamental novel features of the invention, 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. An analyzing mechanism for analyzing a perforated record having rows of index points comprising a plurality of rows of contact points, one row being provided for each row of index points, a plurality of rows of analyzing brushes, each brush adapted to make electrical contact with the associated contact point through a record perforation, a plurality of reciprocable carriers, each carrying a row of brushes adapted to make contact with a related row of contact points representing the same index point, a series of sequentially effective cams, and actuating mechanism operated by said cams to rock said carriers sequentially and to cause said rows of brushes to contact said rows of contact points in succession.

2. An analyzing mechanism for analyzing a perforated record of the Hollerith type having perforations in a column of index points arranged according to a code comprising a series of analyzing brushes for each column, a corresponding number of contact points, each of said analyzing brushes adapted to make contact with the associated contact point through a record perforation, contact elements, each adapted to make successive contact with a pair of contact points associated with non-adjacent index points, and means to shift each associated contact element in contact with a related pair of contact points associated with analyzing brushes correlated with non-adjacent index points but in alternation with the contact of another contact element with its associated pair of contact points.

3. An analyzing mechanism for analyzing a perforated record of the Hollerith type having perforations in a column of index points arranged according to a code comprising a series of analyzing brushes for each column, a corresponding number of contact points, each of said analyzing brushes adapted to make contact with the associated contact point through a record perforation, contact elements, each adapted to make successive contact with a pair of contact points associated with non-adjacent index points, and means to shift each associated contact element in contact with a related pair of contact points associated with analyzing brushes correlated with non-adjacent index points but in alternation and

overlapping with the contact of an adjacent contact element with its associated pair of contact elements.

4. An analyzing mechanism for analyzing a perforated record having rows of index points comprising a plurality of rows of contact points, one row being provided for each row of index points, a plurality of rows of analyzing brushes, each brush adapted to make electrical contact with the associated contact point through a record perforation, a plurality of reciprocable carriers, each carrying a row of contact elements adapted to make alternating contact with two rows of contact points associated with two rows of analyzing brushes which analyze non-adjacent index points, and a series of sequentially effective cams constructed and arranged to rock said carriers in such manner that each carrier causes its contact elements to make contact with its related two rows of contact points and in alternation with the contact by the contact elements of the next operated carrier with two other rows of contact points.

5. An analyzing mechanism for analyzing a perforated record of the Hollerith type having perforations in a column of index points arranged according to a code comprising a column of analyzing brushes, a corresponding number of contact points, said analyzing brushes adapted to make contact with the associated contact point through a record perforation, contact elements, each adapted to make contact with a pair of contact points associated with non-adjacent index points, and perforation analyzing readout means constructed and arranged to rock said contact elements in succession and each contact element in alternating contact with a related pair of contact points associated with analyzing brushes correlated with non-adjacent index points but in an alternating overlapping operation with the alternating contact of the next operated contact element with two other pairs of contact elements associated with analyzing brushes also correlated with other non-adjacent index points.

CLARENCE R. MANNING.

No references cited.