

April 12, 1932.

M. MAUL

1,853,443

RECORD CARD WITH PRINTED INDEX POINTS

Filed July 1, 1927

4 Sheets-Sheet 1

Fig. 1.

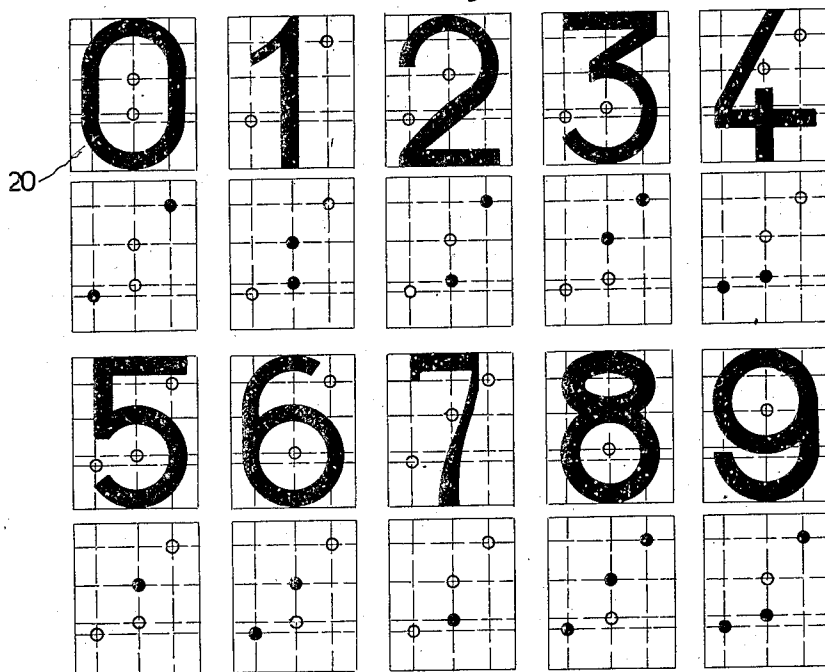


Fig. 2.

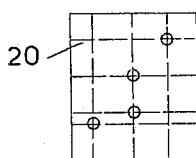


Fig. 3.

A	●	○	●	●	○	○	○	○	●	●
B	○	●	○	●	○	●	●	○	●	○
C	○	○	●	○	●	○	○	●	○	●
D	●	○	○	○	●	○	●	○	●	●
	0	1	2	3	4	5	6	7	8	9

Fig. 5.

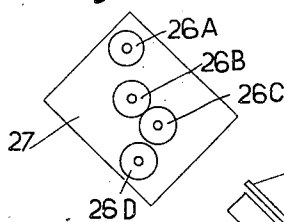
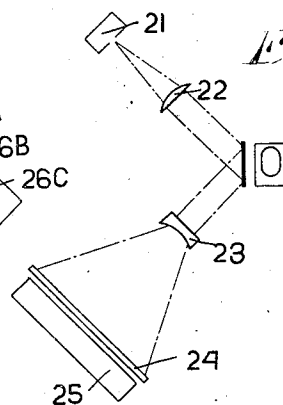


Fig. 4.



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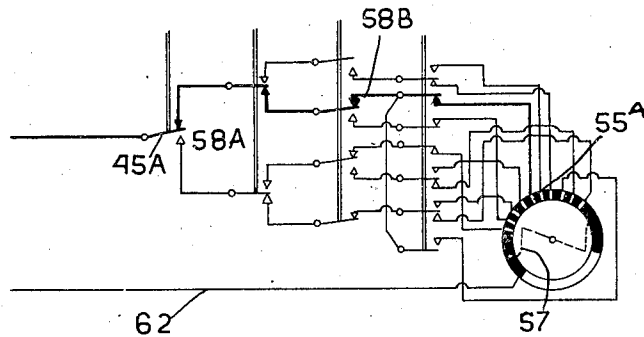
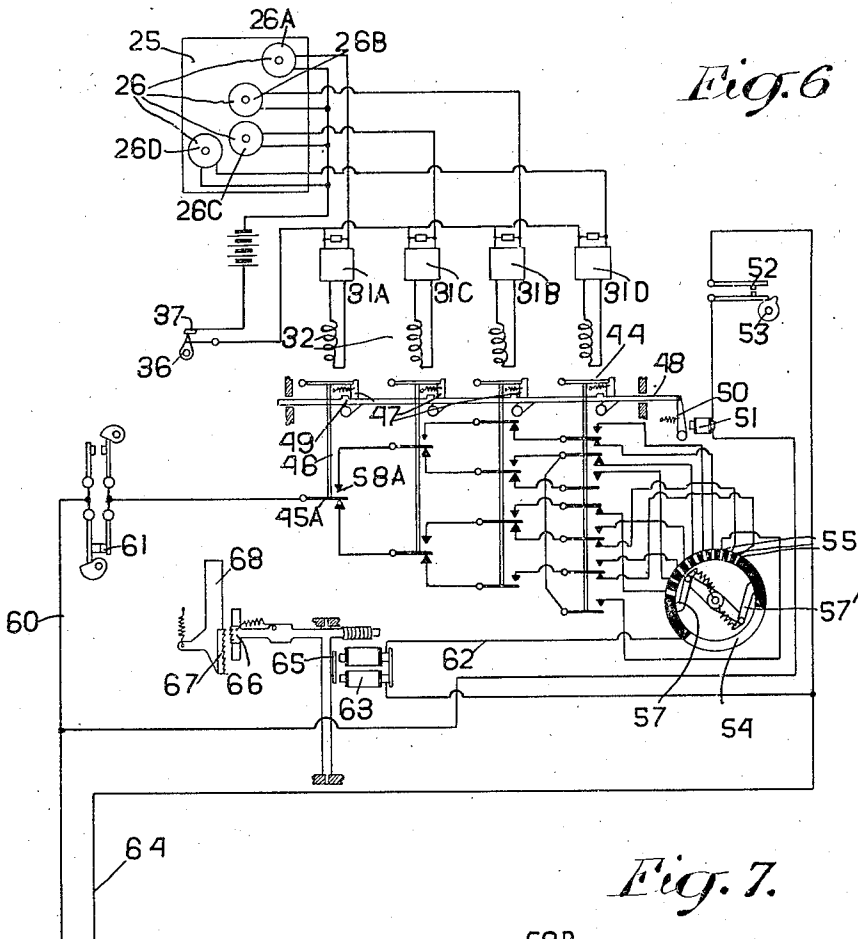
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Fig. 8.

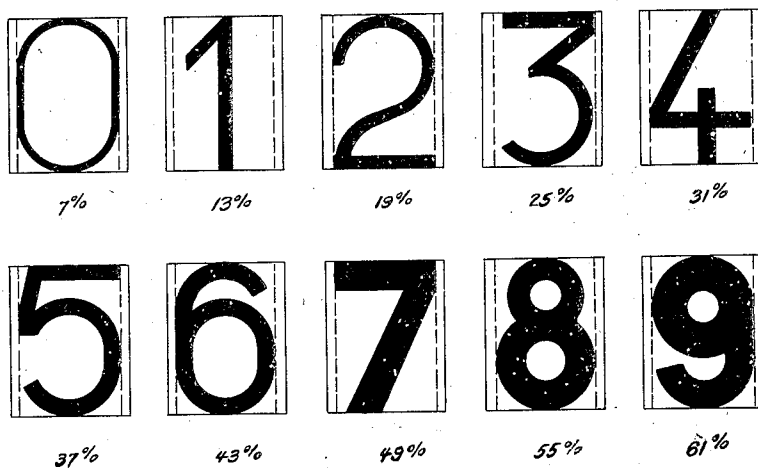


Fig. 9.

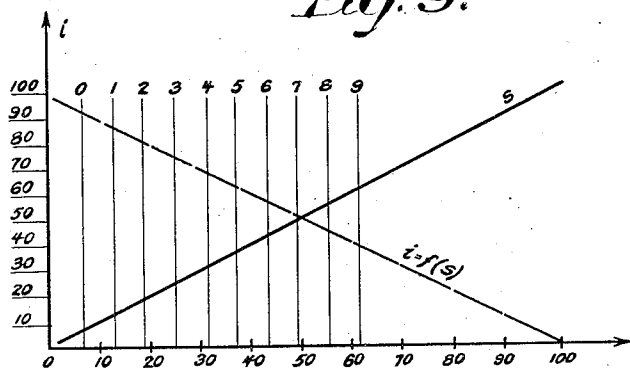
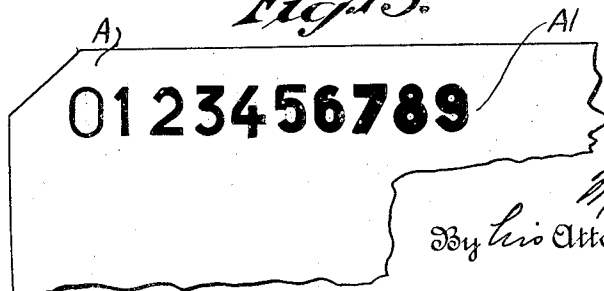


Fig. 13.



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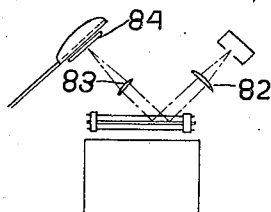


Fig. 11.

Fig. 10.

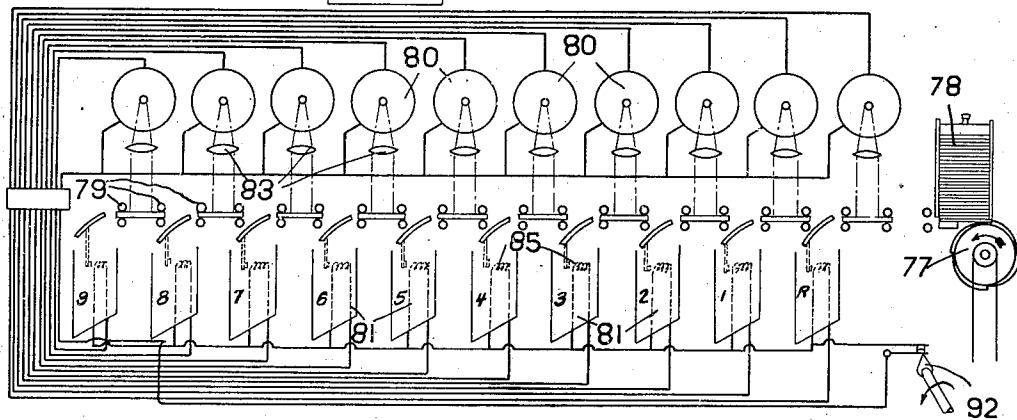
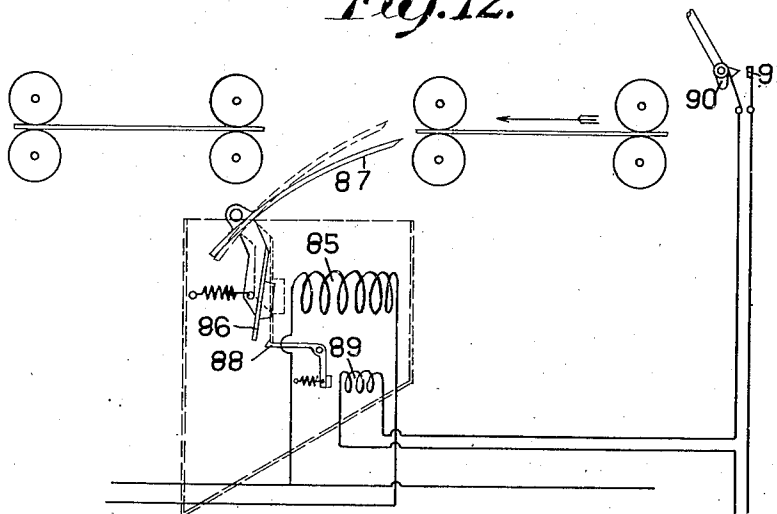


Fig. 12.



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UNITED STATES PATENT OFFICE

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RECORD CARD WITH PRINTED INDEX POINTS

Application filed July 1, 1927, Serial No. 202,806, and in Germany April 7, 1927.

This invention relates to tabulator cards or sheets for use with accounting or tabulating machines, the several operations of which are effected by means of index points on the tabulator records. Prior to this invention, it has only been known to use index points differentiated from each other by varying their position in the record field.

These index points have generally been in the form of perforations, necessitating a special punching operation on the records previous to their use in the accounting machine. The interpretation of normal written data onto a record thus required a separate operation which had to be carefully checked for accuracy by one acquainted with the particular code used to interpret the written data. The records after having the data perforated thereon according to a certain code were adapted to be separated into groups by means of a sorting machine. Usually, these groups of records, after sorting, were placed in an accounting machine wherein means, controlled by each card of the group individually, accumulated the totals of the several records, listed the successive totals, and printed the total after listing.

The object of the present invention is to provide record means other than perforations for effecting controlling operations of a sorter, tabulator, or the like. By means of this invention, the control is effected directly by graphic indications, which may control the machine by varying the contour or form of the written character so that it covers a combination of basic or code points in a standard record field. In this case, the character controls the tabulating operations by actuating an analyzing means according to the combination of points corresponding to each character. This analyzing means may be a wave controlled means, such as a plurality of light sensitive cells, preferably potassium cells, for analyzing the character field at its several code points.

The controlling characters, according to this invention may also be differentiated from each other by varying the proportion of the record field covered by the character. In the latter case, this invention provides only

one light sensitive cell for analyzing the character field at its several code points.

The controlling characters, according to this invention may also be differentiated from each other by varying the proportion of the record field covered by the character. In the latter case, this invention provides only one light sensitive cell for analyzing the character field.

The object of this invention is, further, to do away with the necessity of having a definite position in the record field to denote a character. The characters are positioned, according to the present invention, regardless of their significance as characters. In other words, a character will have the same effect no matter where it is located on the record.

Another object of this invention is to have index points in the same position of the record fields cause different operations of the accounting machine.

The characters may be differentiated from each other, according to this invention, by varying any of their inherent physical characteristics, such as size, shape, area or material.

Other objects of this invention will be disclosed and pointed out in the succeeding portions of the specification.

In the drawings;

Fig. 1 shows the characters 0-9 positioned in the standard record fields with a showing beneath each character of its resulting representation in a four point code.

Fig. 2 shows the code points in a standard field.

Fig. 3 is a table showing the combination of points corresponding to each character.

Fig. 4 shows the optical analyzing device.

Fig. 5 is a top view of the photo cells unit of the device shown in Fig. 4.

Fig. 6 shows the optical analyzer applied to a tabulating machine.

Fig. 7 is a detail of Fig. 6 showing the parts when figure 4 is under the analyzing light.

Fig. 8 shows an alternate system of causing variations in the analyzing light by the form of the printed characters.

Fig. 9 is a graph showing the proportion of

the field covered by each character and the resulting current.

Fig. 10 is a schematic showing of a form of sorter used with the characters of Fig. 8.

Fig. 11 is a detail of the analyzers used in Fig. 10.

Fig. 12 is a detail of Fig. 10.

Fig. 13 shows a card with characters printed thereon in accordance with my invention.

Referring to Figs. 1, 2, and 3, the record card or sheet has a number of equal portions or fields 20, preferably alined in a row, in each of which is printed, in accordance with the statistics to be tabulated, one of the figures 0-9 in heavy black type. If four imaginary points be arranged in each field as A, B, C and D, (see Fig. 2) then each figure when printed in the field will cover one or more of the points, depending on the contour of the figure. For example, character 0 will cover points A and D, leaving B and C exposed (as shown by the unprinted field below the printed figures where the black points are those covered and the white points those exposed); figure 1 will cover points B and C, leaving A and D uncovered; figure 2 will cover points A and C, leaving B and D uncovered; etc. Each figure will cover and uncover a different combination of points thus providing a different code for each character as tabulated in Fig. 3. Now if a single record field 20 be exposed as in Fig. 4 to a beam of light, hereinafter termed the analyzing beam, directed at an angle from the source 21 through a lens 22, the rays of light will be reflected by the exposed or white surfaces of the record field and be absorbed by the black surfaces or figure printed on the field. The reflected rays will pass through a lens 23 which will direct them on a transparent plate 24 such as plate glass, thus reproducing on said plate an image of the record field. Below the plate, in a frame 25 are arranged four light sensitive cells 26, such as potassium cells, in the same order and position relative to the reflected field 27 as imaginary points A, B, C and D in the actual record field. Since the reflected field is dark in portions corresponding to the character on the actual record field, those cells which are directly under the dark portions will not be energized as represented by the black points of Fig. 1. For example, if figure 0 be reflected on field 27, cells 26A and 26D will not be energized while cells 26B and 26C will be exposed to the beam of reflected light and be energized. It is of course understood that the form of the figure may be varied, that the number of cells may also be varied both in number and arrangement or either; that instead of figures, letters or other characters may be used; and that in each case, the printed character may be so shaped as to cover a different combina-

tion of basic points, thus giving a distinctive characteristic to each character.

The adaptation of the invention to one form of a tabulating machine is shown in Figs. 6 and 7. As is usual in tabulating machines for each record column or in this case record field is provided an individual analyzing, accumulating and printing means. For the purpose of simplifying the explanation, only one such unit is illustrated and described. Thus Fig. 6 shows the mechanism operating to analyze, accumulate and print in accordance with the figure contained in one standard record field 20. The analyzing beam energizes cells 26 in accordance with the character code hitherto explained and the resulting current is amplified by units 31 to energize translating magnets 32, at a period in the cycle determined by cam 36 closing contacts 37. In this case the magnets 32 serve to control the differential mechanism which actuates the accumulator and printer in accordance with the analyzed figure. Magnets 32, upon energization thereof in accordance with the code, attract armatures 44 linked with contact fingers 45 by means of rods 46. After actuation, the armatures are retained in position by detents 47 which are moved to release the armatures at the end of the cycle by a bar 48 having lugs 49 contacting the detents. Bar 48 is actuated by armature 50 attracted by magnet 51 when contacts 52 are closed at the end of the cycle by a cam 53. A commutator 54 is provided with ten conducting segments 55, corresponding in succession to the digits 0 to 9. Rotating in synchronism with the movement of type bar 56 is a pair of diametrically opposed brushes 57. In the rotation of the brushes, contact will first be made with the segment corresponding to figure 0 then with the segment corresponding to figure 1, etc. Fig. 7 illustrates the position of the contact fingers 45 when figure 4 is analyzed. The code for figure 4 (see Fig. 3) results in energizing cells 26A and B, causing magnet 31A to move the contact finger 45A to close contacts 58A and magnet 31B to close contacts 58B. When the brushes 57 reach the commutator segment 55⁴ corresponding to figure 4, a circuit is completed from power source line 60 through cam closed contacts 61, contacts 58A, 58B, commutator segment 55⁴ the brush 57, brush 57', line 62, magnet 63 and back to the other line 64 of the power source. This circuit results in energizing magnet 63 causing it to attract its armature 65 to release a toothed detent member 66 for engagement with a toothed portion 67 of type bar 68 moving in synchronism with the rotation of the commutator brush 57. The manner in which the setting and operation of the type bar 68 controls the printing of the data and the accumulation of values is more specifically brought out in

U. S. Patent #1,780,685, to John Royden Peirce, for Printing tabulating machines.

In Fig. 8 is shown a system of printing characters on a standard field which does away with the necessity of analyzing the field at predetermined basic points. The characters are differentiated from each other by varying their relative sizes, each character covering a different percentage of a standard field. If characters 0-9 for example be printed on the fields, they may be varied in area according to the percentages marked in Fig. 8. If the analyzing beam of light be directed with uniform intensity at all portions of the field, the quantity of light reflected toward the photo cell unit will be varied according to the area of the field covered by the character. In this system, only one photo cell is required for each analyzing mechanism which will have a current produced therein varying with the quantity of light reflected and consequently with the size of the character. Each character thus produces a different current in the photo cell as illustrated by the dotted line in Fig. 9 which also shows the graph of the area covered by the characters of Fig. 8, the intensity of the current varying inversely as the area of the character which constitutes the black portion of the field.

In Fig. 10 is shown an adaptation of this system to a sorter for record cards. The rotating picker device 77 feeds one card at a time from magazine 78 to a series of feed rollers 79 which conduct the card beneath a series of photo cells 80, one for each sorting pocket 81. The card field is illumined diagonally at each sorting station by an individual light source 82 (Fig. 11). The rays of light reflected from the field are concentrated by means of a converging lens 83 on the transparent plate 84 above which is the photo cell 80. The current in the photo cell energizes a magnet 85 corresponding thereto to attract its armature 86 and raise deflector 87 to intercept the advancing card causing it to drop into the pocket 81. The magnet coil 85 for each pocket has a different number of ampere turns, the minimum number of turns being on the magnet in the reject pocket, taking care of blank fields, the next highest number of turns on the magnet in the 0 pocket and the greatest number of turns on the magnet in the 9 pocket. The card passes successively through the reject sorting station, the 1 sorting station, the 2 sorting station, etc., in the order indicated. It is known that the magnetic attraction of a coil varies directly as the number of ampere turns. If, for example, Figure 5 is on the card field, it will pass successively under the analyzing cells for the reject 0, 1, 2, 3 and 4 pockets. The current produced in any of these cells energizes the magnets for these pockets but the magnet field set up by the coils of these magnets is

insufficient to attract their armatures. When the card reaches the 5 analyzing cell, the number of ampere turns of the magnet in the 5 pocket is sufficient to attract the 5 armature and hence guide the card into the 5 pocket. To hold the armature in position till the end of the cycle, after actuation, a detent 88 is provided behind which the armature 86 snaps as soon as it is attracted. At the end of the cycle, a magnet 89 under control of cam 90 closing contacts 91, actuates detent 88 to release the armature 86. The current through the cells and the magnets is completed when the cards are in their proper position in front of the photo cells by means of contacts 92.

It is apparent that in all the above described machines, means are provided to prevent light not reflected by the card field from reaching the photo cells.

It is understood that the invention may be carried out in a great number of ways and by a variety of means. It is not necessary to utilize photo cells or any other light phenomena to translate the reading of the field. For example, an induction field may be used as an analyzing field and the characters in the card field be printed in ink having metallic characteristics. Then if each character has a different quantity of metal printing, the induction field will be varied by the passage of a character therethrough to control mechanisms such as magnet coils or the like in a manner heretofore indicated.

It is obvious that the records operated on by the machines described may be in the form of a card, a strip, a roll, or any other form of device containing printed matter.

In Fig. 13 the record card A is shown with a group of numerals A1. It will be noted that these numerals cover varying areas in accordance with the disclosure in Fig. 8.

The accounting means herein described as operating in conjunction with the record card or sheet bearing printed index points forms the subject matter of an application filed July 1, 1927, Serial No. 202,805.

What is claimed is:

1. Means for controlling the operation of a machine, comprising a sheet having characters imposed thereon of substance adapted to control the reflection of light, said characters varying in area in accordance with the value of the character in order to differently control the operation of a machine.

2. Means for controlling the operation of a machine, comprising a carrying medium having characters imposed thereon for controlling the operation of a machine, characters of different values being of different areas to differently control the operation of a machine.

In testimony whereof I hereto affix my signature.

MICHAEL MAUL.