Feb. 16, 1954 J. PERRIN 2,669,354

PHOTOELECTRIC SORTER FOR DOCUMENTS SUCH AS CHECKS, ETC

Filed May 9, 1951

4 Sheets-Sheet 1

FIG. 1.

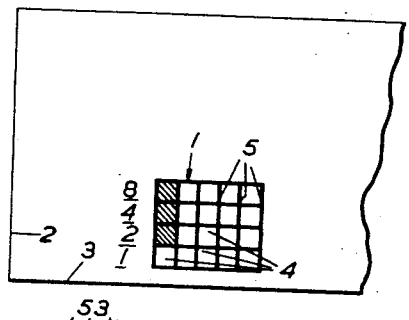
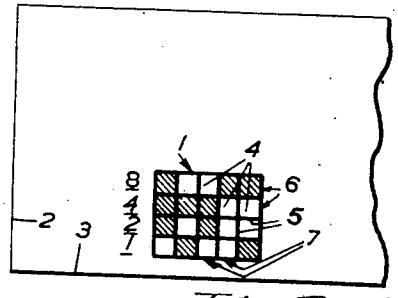


FIG. 3.

FIG. 2.



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FIG. 4.

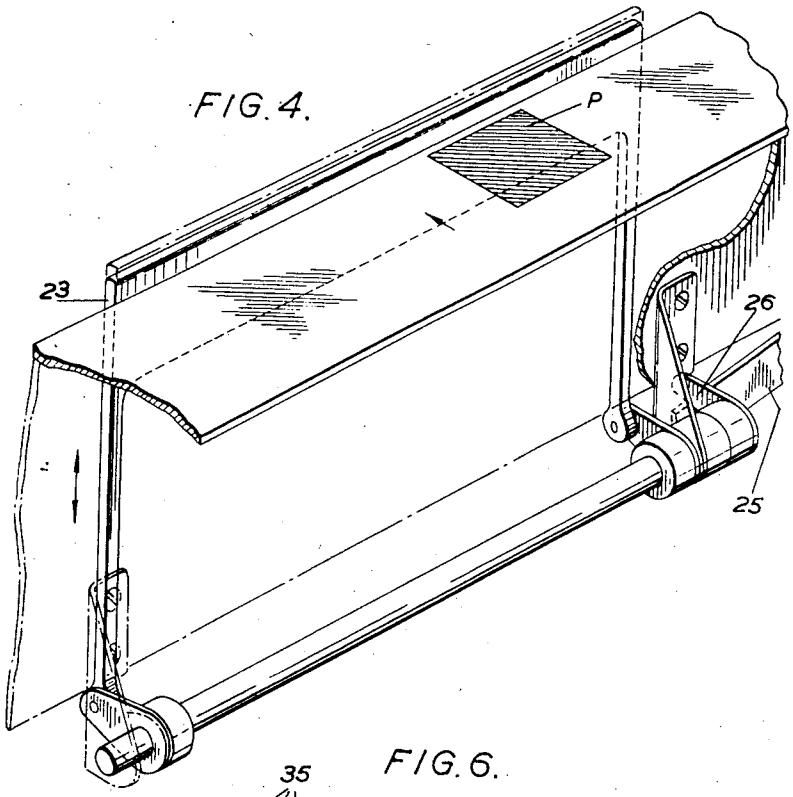
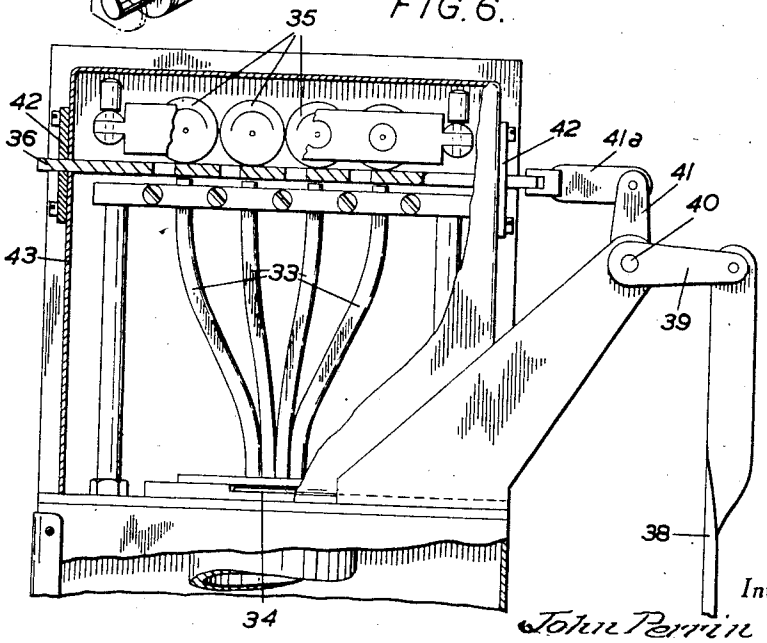


FIG. 6.



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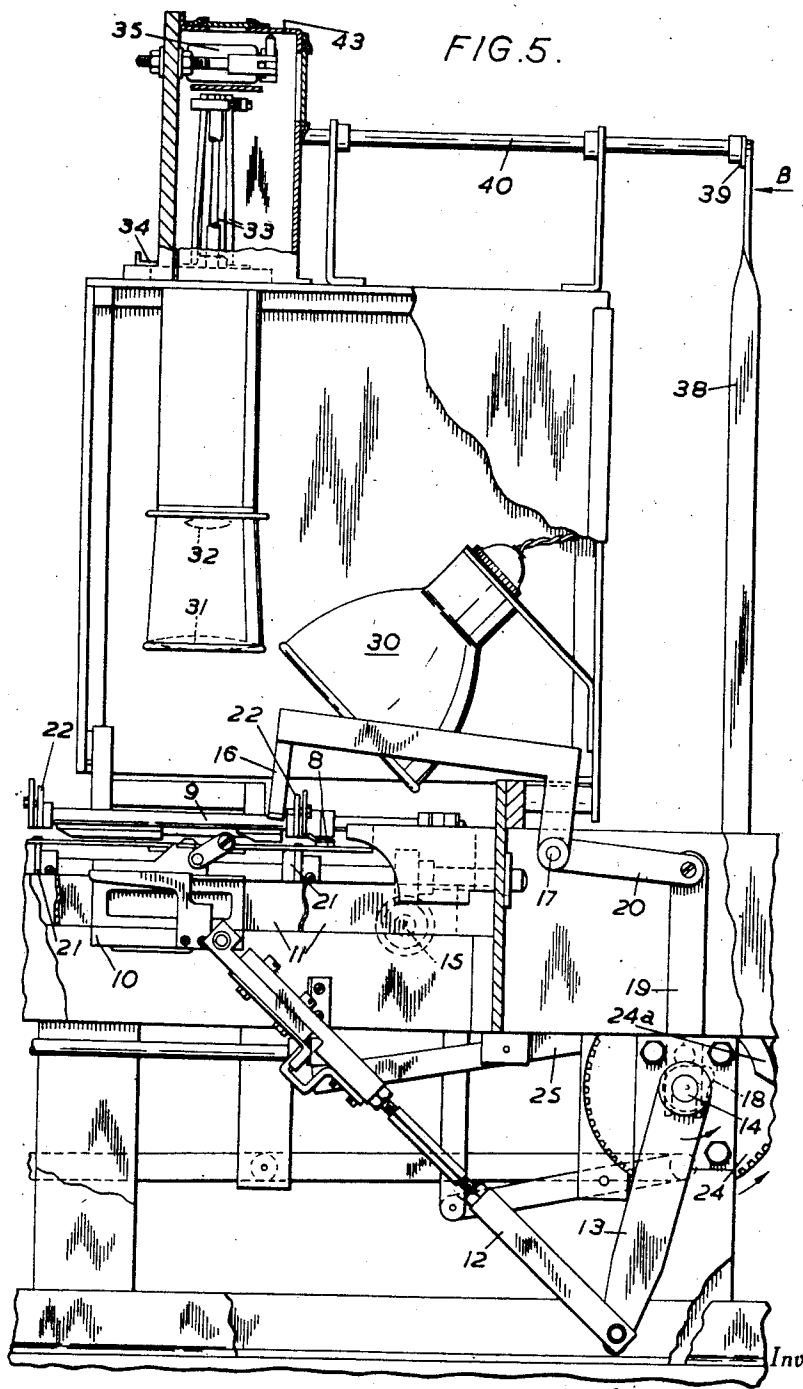
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FIG.5.



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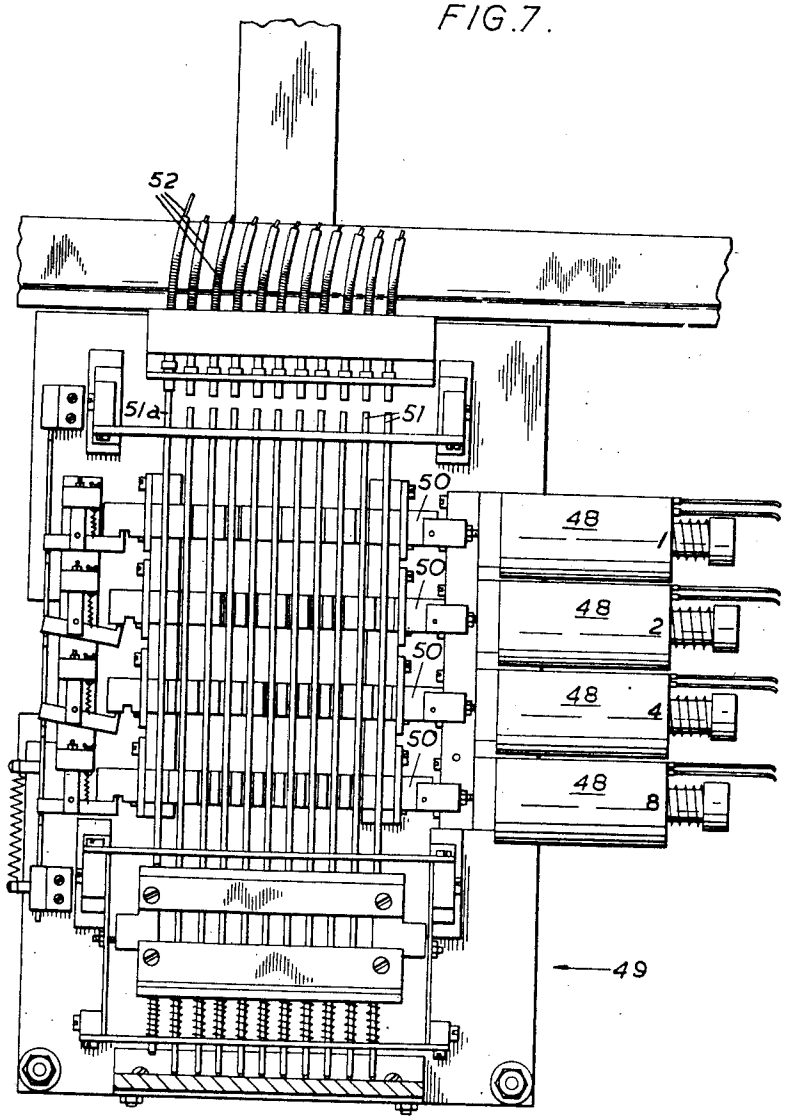
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FIG. 7.



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UNITED STATES PATENT OFFICE

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PHOTOELECTRIC SORTER FOR DOCUMENTS SUCH AS CHECKS, ETC.

John Perrin, Croydon, England, assignor to Powers-Samas Accounting Machines Limited, London, England, a British company

Application May 9, 1951, Serial No. 225,309

Claims priority, application Great Britain May 17, 1950

2 Claims. (Cl. 209—111)

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This invention relates to sorting documents, such as cheques or bills of lading, consisting of sheets of relatively thin paper or similar material.

Many documents, such as cheques and copies of bills of lading, are of a character such that after use they must be returned to their source of origin. Documents such as cheques have information relating to their source of origin printed on the face thereof, the information stating the name of the bank and the address of the branch which issued the cheque. Before the cheques can be returned to the issuing branch from the clearing house they must all be sorted to separate the cheques of the respective branches from those to be returned to the other branches. This operation has heretofore usually been performed by manually sorting the cheques by visual inspection thereof and is a relatively slow and costly procedure.

It is a main object of the present invention to provide a document with a new means for indicating its source of origin, the new means being of a character such that the documents can be sorted automatically.

According to the invention a method of applying information to a document, for example information indicating the source of origin of a document such as a cheque or a bill of lading, having a normally light reflecting surface consists of applying a substantially non-light reflecting media to the document to prescribe an area thereof in relation to two adjoining sides of the document, said non-light reflecting media rendering the prescribed area substantially non-light reflecting except in predetermined sub-areas thereof, the sub-areas being light-reflecting and representative of desired information. The sub-areas may be disposed in horizontal rows and vertical columns.

The light reflecting sub-areas may be so disposed in the vertical columns that one or more sub-areas are disposed in any one column to represent data according to a predetermined code.

The invention also includes a method of sorting documents prepared by a method as set forth in the preceding paragraphs, a document prepared by such method, and a machine for sorting such documents.

In order that the invention may be clearly understood an embodiment thereof will now be described by way of example, with reference to the accompanying diagrammatic drawings, in which:

Fig. 1 illustrates a part of a cheque prepared according to the invention,

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Fig. 2 illustrates a part of another cheque prepared according to the invention,

Fig. 3 shows a rear elevation of a part of a machine for sorting cheques in accordance with the invention.

Fig. 4 is a perspective view illustrating the stop which arrests cheques in scanning or sensing position,

Fig. 5 is a broken view, partly in section, looking in the direction of arrow A, Fig. 3.

Fig. 6 is a view, partly in section, looking in the direction of arrow B, Fig. 5, and

Fig. 7 is a side elevation of decoding apparatus employed in the sorting machine.

In the following description it will, for convenience, be assumed that the invention is applied to a cheque which, as is usual, has a light-reflecting surface.

Referring to Fig. 1, it is therein assumed that the identification means applied thereto in accordance with the invention is applied to the rear of the cheque but it will be understood that, if desired, the identification means may be applied to the face of the cheque. The cheque has applied to a prescribed area 1 thereof a substantially non-light reflecting media such as black printing ink. The prescribed area is disposed in predetermined position with relation to two adjoining edges 2, 3 of the cheque so that the said edges may be employed to locate the cheque in a scanning or sensing position in a sorting machine as will be described below.

In the prescribed area 1, predetermined sub-areas 4 remain untreated by the non-light reflecting media so that they are still light reflecting and the sub-areas are indicative of data representing a number or the combination of letters and figures indicating the bank of origin. So that the prescribed area may be as small as possible, the data may be printed according to a code, and in one embodiment of the invention the code used is the well-known 8—4—2—1 code.

So that the sub-areas 4 of the prescribed area are clearly separated one from the other they are defined by black lines 5 forming a grid across the prescribed area and dividing the prescribed area into a number of equal sub-areas which are arranged in horizontal rows 6 and vertical columns 7. When, as will herein be described, the data is represented according to the 8—4—2—1 code the prescribed area is provided with four horizontal rows 6 of sub-areas representative respectively of the numerals "8," "4," "2" and "1," and a number of vertical columns 7 in sub-areas corresponding to the highest number of characters required to indicate the

source of origin of the cheque. Thus, if, as illustrated in Fig. 2, a five figure number is to be catered for, there will be five vertical columns 7 of sub-areas. In each of the vertical columns the numeral according to the code will be represented by one or more sub-areas 4 which, as described above, do not have the non-light reflecting media applied thereto so that they remain light-reflecting while the other sub-areas in the column have the non-light reflecting media applied thereto. The sub-areas, as shown in Figs. 1 and 2, may be of substantially square form or they may be of oblong rectangular form or of circular form, or they may be of substantially oblong rectangular form with the longitudinal axes disposed at an angle of about 45° to the vertical.

The dimensions of the sub-areas are so chosen that each is capable, as described below, of reflecting a sufficient intensity of light to activate a photo-electric cell associated with a transmitter and in Fig. 1, in terms of the 8—4—2—1 code, it is assumed that the source of origin is indicated by a single digit represented by the single light-reflecting area denoting the digit "1." On the cheque shown in Fig. 2 there is represented the number 10976.

The cheques are sorted by scanning or sensing the prescribed sub-areas 4 thereon column by column, the cheques being fed through the sorting machine a number of times corresponding to the number of columns to be scanned or sensed.

Referring to Figs. 3 to 7, cheques to be sorted are placed in a magazine, not shown, from which they are removed one at a time by any suitable means and moved lengthwise into engagement with stationary stops 8, Fig. 5. In the drawings the said means is shown as a gripper device 9 supported on a carriage 10 which is reciprocated along a fixed path formed by guides 11. The carriage is reciprocated by a link 12 and a crank arm 13 secured to a cam shaft 14 which is rotated from the main shaft 15 of the sorting machine through gearing not shown. When a cheque engages the stationary stops 8 it is momentarily held in this position by a presser 16 pivoted at 17 and rocked about its pivot by a cam 18 on the shaft 14, the presser 16 being connected with the cam 18 by links 19, 20.

When the cheque is released by the presser 16 it is engaged between feed rollers 21, 22 which move it transversely of its length against a vertically reciprocable stop 23, Fig. 4, actuated by a cam 24a secured to a gear wheel 24, on shaft 14 through links 25, 26. The stop 23 arrests the cheque in scanning or sensing position and retains it in this position until scanning or sensing is effected when it releases the cheque for delivery, in known manner, to receiving compartments 27, Fig. 3, by feed rollers 28, 29 of which the upper rollers 28 are freely rotatable and the lower rollers are positively rotated by the main shaft 15.

While the cheque is arrested in the scanning or sensing position by the movable stop 23 a source of light 30 is directed on to the prescribed area to be scanned or sensed. The area 1, when the cheque is arrested by the stop 23, is disposed beneath a lens system 31, 32 which transmits an image of the vertical column 7 being scanned or sensed to the lower ends of a row of transparent plastic refractive elements 33. As mentioned above only one vertical column 7 is scanned or sensed at one time, but a row of four plastic refractive elements 33, representative of the 8—4—2—1 code, is provided for each of the vertical columns 7 of the prescribed area 1 of a cheque. In order that the desired row of plastic refractive elements may be selected to co-operate with the appropriate vertical column 7 of a prescribed area, a shutter 34, having a slot, not shown, is disposed between the lower ends of the refractive elements 33 and the lens system 31, 32 and the shutter 34, Fig. 6, can be manually adjusted to any desired position so that according to the disposition of the shutter slot one row only of the refractive elements is exposed to the lenses.

Between the plastic refractive elements 33 and a number of the photo-electric cells 35, one for each row of elements 33, there is provided an obturator formed as a slotted shutter 36, Fig. 6, mounted for reciprocation in timed relation with the movement of the stop 23. The obturator 36 is operated by a cam 37, Fig. 3, on the shaft 14 through links 38, 39, spindle 40 and links 41, 41a the obturator being slidable in plates 42 secured to a box-like container 43 housing the photo-electric cells 35 and refractive elements 33. Thus when the stop 23 arrests a cheque in the scanning or sensing position, the obturator 36 shutter is moved to expose the ends of each of the plastic refractive elements 33 to their associated light cells 35 so that light which passes along the refractive elements is guided or deflected thereby to the appropriate photo-electric cells.

The refractive elements 33 are made of transparent poly methyl meth-acrylate, preferably of the kind known as "Perspex," and each plastic refractive element, in the embodiment being described, is of substantially square cross-section and is disposed with the ends thereof nearest the lens system 31, 32 closely adjacent one to the other, see Fig. 6. The photo-electric cells 35 cannot be disposed in such a confined space, however, and each of the plastic refractive elements 33 is suitably curved so that the ends thereof are out of alignment and the one end is adjacent the lenses 31, 32 while the other end is disposed beneath its associated photo-electric cell 35.

The curves of the plastic refractive elements are such as to avoid loss of light as much as possible and further to reduce such loss the outer surfaces of the refractive elements are highly polished all over and all sharp edges are removed. Further, the plastic refractive elements are disposed to be free from physical contact with any other substance. For example, if the refractive elements were to be painted or immersed in oil or water, some loss of light passing along the elements would occur due to physical adhesion of the oil or water, etc. with the refractive element. If, however, the refractive elements are engaged by dry substances, they will function in the manner desired because there is no true physical contact between dry material and the refractive elements.

So that the photo-electric cells shall not be actuated when a cheque is not in the sensing or scanning position, that portion of the bed of the machine which is directly below the lens 31, 32 has black material affixed thereto, as indicated at P, Fig. 4, so as to be substantially non-light-reflecting.

The photo-electric cells 35 are activated by light transmitted thereto by the plastic refractive elements 33 and are connected via leads 44, Fig. 3, through amplifiers 45 which amplify the elec-

trical impulses received from the photo-electric cells 33, to electro-magnetic relays 46. It will be understood that due to the very small amount of light which is received by a photo-electric cell, the electrical impulse therefrom is a very weak impulse without amplification would not be sufficient to actuate the electro-magnetic relay 46 with which it is associated. Accordingly, as above described, the impulse from the photo-electric cell is amplified before it reaches the associated electro-magnetic relay.

From the electro-magnetic relays 46 the impulses pass via leads 47 to electromagnets 48, Fig. 7, forming part of a decoding device 49. The decoding device operates in known manner and consists of a single column of decoding bars 50 and transmission elements 51 of which, in the device shown, there are eleven representative of the digits 0 to 9 and one which, for present purposes, is not required. According to the electromagnets 48 which are energised, the decoding bars permit one of the transmission elements 51 to be moved lengthwise as indicated at 51*a*, Fig. 7, in which the element representative of the digit 9 is shown active. The lengthwise movement of a transmission element 51 actuates a Bowden wire 52 associated therewith and this, in turn, conditions the appropriate one of a number of timing devices 53, Fig. 3, of which one is associated with each receiver compartment 27 of the machine.

Each receiver compartment is provided with a movable deflector 54, for example as described in United States patent specification No. 2,034,010 and the timing devices 53 may be as described in said prior specification. Thus when the stop 23 releases the cheque, the cheque is moved by the feed rollers 28, 29 over the deflectors 54 until it reaches the compartment whose deflector has been operated by its associated timing device 53, when the cheque will be delivered into that compartment.

If, however, the transmission element 51 is arranged to operate an electric switch instead of a Bowden wire, the switch when operated may complete or break an electric circuit to an electro-magnet associated with the timing device 53 whereupon the armature of the electro-magnet is actuated to operate the timing device so as to cause the deflectors 54 to be conditioned to deflect into the receiver compartment 27 associated therewith the documents delivered from the scanning or sensing positions.

Alternatively, if desired, the timing mechanism for the deflectors may be similar to that described in United States patent specification No. 1,502,993, the timing mechanism being operated either by Bowden wires actuated by the transmission elements or by the movable armature of an electro-magnet as above described.

I claim:

1. In a sorting machine having feeding means to feed in succession to a sensing position documents having data recorded thereon by light reflecting sub-areas thereof for sensing by photo-electric cells adapted to control the operation of actuating means for timing devices co-operating with deflectors to guide documents into selected ones of a plurality of receiving compartments, apparatus for selectively operating said timing devices comprising in combination four photo-electric cells representative of numbers according to a predetermined code, a plurality of columns of transparent light guiding elements, each column consisting of four elements, one for each said cell, extending lengthwise between said cells and the document sensing position to guide light reflected from sub-areas of a document in sensing position to the cells, a slotted obturator supported for reciprocation between the cells and the ends of said elements adjacent thereto and in a direction transverse to the lengths of said elements, obturator actuating means operable in timed relation with said feeding means to permit the passage of light from said elements to said cells only when a document is in position for sensing, a manually operable shutter supported for sliding movement adjacent the ends of said elements remote from the cells and selectively operable to determine the column of elements by which light is to be guided to the cells, an amplifier to amplify electric impulses from said cells and to transmit amplified impulses, and a decoding device to receive amplified impulses from the amplifier and to decode them into single impulses for controlling the operation of said timing device actuating means.

2. In a sorting machine having feeding means to feed in succession to a sensing position documents having data recorded thereon by light reflecting sub-areas thereof for sensing by photo-electric cells adapted to control the operation of actuating means for timing devices co-operating with deflectors to guide documents into selected ones of a plurality of receiving compartments, apparatus for selectively operating said timing devices comprising in combination a photo-electric cell for each data-indicating sub-area of a column of sub-areas on a document, a plurality of columns of transparent light guiding elements, each column of elements including one for each cell and the elements extending lengthwise between the cells and the document sensing position to guide light reflected from sub-areas of a document in sensing position to the cells, a slotted obturator supported for reciprocation between the cells and the ends of said elements adjacent thereto and in a direction transverse to the lengths of said elements, obturator actuating means operable in timed relation with said feeding means to permit the passage of light from said elements to said cells only when a document is in position for sensing, a manually operable shutter supported for sliding movement adjacent the ends of said elements remote from the cells and selectively operable to determine the column of elements by which light is to be guided to the cells, and an amplifier to amplify electric impulses from said cells to provide an amplified impulse to control the operation of said timing device actuating means.

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