

Oct. 14, 1969

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3,473,034

DEVICE AND SYSTEM FOR SCANNING INFORMATION SUPPORTS

Filed March 31, 1967

2 Sheets-Sheet 1

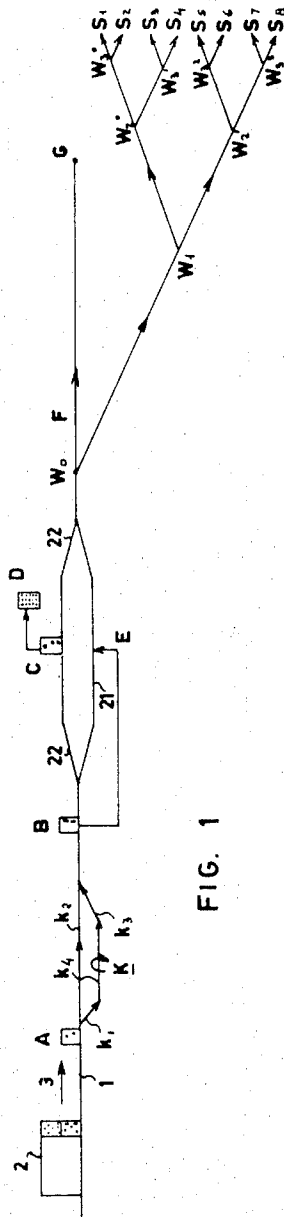


FIG. 1

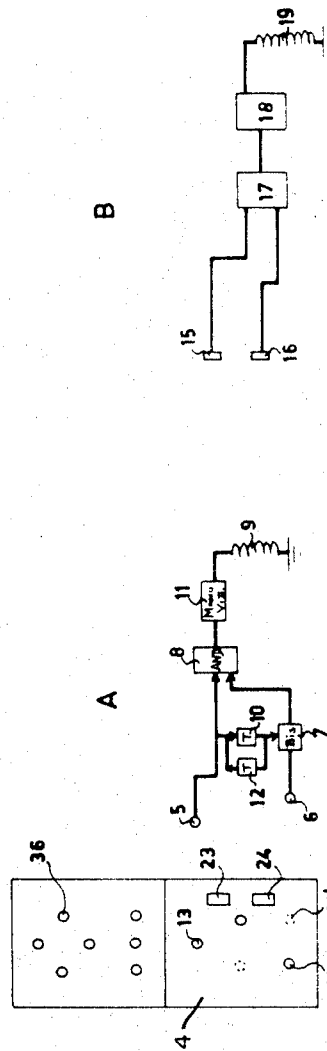


FIG. 2a

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2 Sheets-Sheet 2

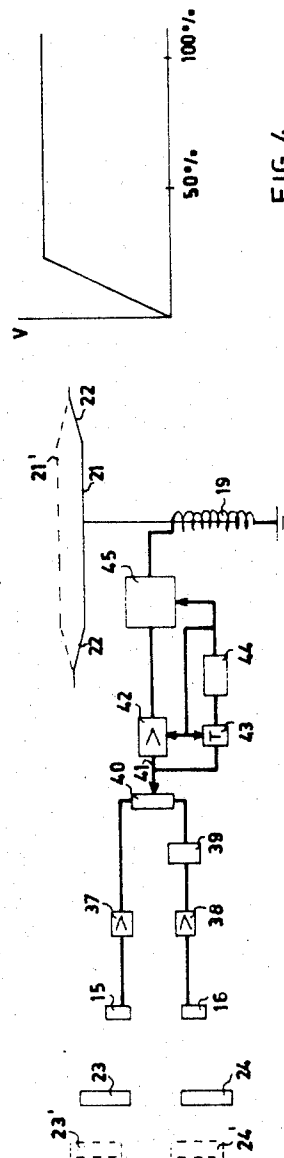
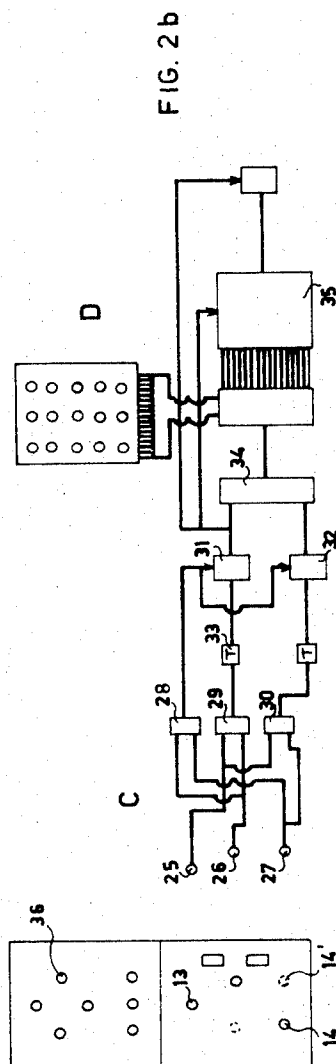
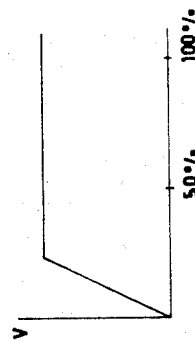


FIG. 4



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DEVICE AND SYSTEM FOR SCANNING
INFORMATION SUPPORTS

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1 Claim

ABSTRACT OF THE DISCLOSURE

The invention relates to an improvement of systems for sorting objects especially postal documents on base of photo-electrically scanning of perforations in the objects. The improvement consists in that the position of the objects, when moved along a track passing a main reading station, mechanically is corrected by information obtained from pre-scanning stations prior to the main reading station, in order to enable the scanning of the perforations or to improve the reliability of the information scanned by the main scanning station.

The invention concerns an improvement of a device and a system for scanning information carriers or supports, provided with a conveyor for said supports, a scanning station placed along said conveyor and containing radiation sensitive elements for scanning the information bearing perforations and electromechanical means controlled by said radiation sensitive elements. Such devices and systems are of fairly common knowledge. A difficulty with scanning the perforations may be, that the position of the perforations in the support, especially in a direction transverse to the direction of movement of the conveyor is not always sufficiently exact. Further it is possible, that the information supports are placed in a total wrong position in the conveyor, e.g. turned over 180°.

The latter difficulty could be avoided by firstly sorting by hand the supports and putting them in the right position. This, however, involves rather much time and labour and prevents complete automation of the sorting.

An example in which the transverse position of the perforations rather frequently may differ from the required position for scanning them is present with postal documents, which by means of gluing have been provided with perforated edge tapes containing the information. If, e.g. the perforated edge-tapes, after they have been perforated have been attached to the postal documents, it is possible that the position of the perforations with respect to a position defining members, e.g. a guide edge along which the postal documents are guided, is not completely defined. Also with other uses of perforated supports the possibility exists, that the perforation pattern is not positioned at the required distance from the guiding edge for the supports.

An object of the invention is, to obviate the above indicated difficulties. Accordingly the invention provides in that electromechanical adjustment means are present for modifying the position of the information support in said conveyor, when in cooperative relation with said scanning station.

According to a preferred embodiment of the invention prescanning means are provided, which control said adjustment means.

For correcting the position of the perforations in a direction transverse to the direction of movements of the conveyor it is provided that the adjustment means are shifting means for shifting the conveyor transversely to the direction of movement of the conveyor.

According to a further possibility of the invention the electro-mechanical adjustment means contains a reversing

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device for rotating about 180° an information support, when it is in said conveyor.

The invention includes also a system containing a device as described above for sorting rectangular flat objects, such as postal documents that near at least one of their rims are provided with perforations, which system is characterized in that said flat objects contain further perforations for identifying their position with respect to the radiation sensitive elements of the said scanning station for scanning the information bearing perforations.

The above and other features of the invention will be explained in the following, in which reference is made to the accompanying drawings in which—

FIG. 1 shows schematically a device according to the invention for sorting postal documents;

FIGS. 2a and 2b, which are to be taken in prolongement of each other, show a block scheme of an embodiment of part of the device of FIG. 1;

FIG. 3 shows a block scheme of a further detail of the device according to FIG. 2; and

FIG. 4 shows an elucidating diagram.

Referring to FIG. 1 there is shown a conveyor 1 for conveying an information support or carrier 2 in the direction of arrow 3 with a constant velocity. Along said conveyor are placed, viewed in the direction of movement, first a pre-scanning device A, further a reversing device K, a further pre-scanning device B, a further scanning device C and a reading station D, which reading station is located near the shifting device E, and a sorting switch system F.

The working of the device is that the documents 2 are scanned by pre-scanning station A, if necessary reversed about 180° in the reversing device K, fed along the second pre-scanning station B which controls the transverse shift device E, and after this are scanned by the scanning station C, which defines the moment at which the scanning station D for scanning the information of the support 2 should be made active. The information then contained in station D controls the switching system F. If no senseful information is obtained from the scanning station D, the document is carried to the output G, from which preferably it is again carried to the input of the conveyor 1 after having been rotated about 90°. If legible information is obtained from the station D, the switches w_0, w_1, w_{20} and $w_{21}; w_{30}, w_{31}, w_{32}, w_{33}$ are actioned for delivering the document 2 at one of the stations s_1-s_8 in accordance with the information of said document.

In FIG. 2, which shows the right hand edge portion 4 of the document 2 on an enlarged scale, the first pre-scanning device A is provided with two radiation sensitive elements 5 and 6, which, when they receive radiation, provide a signal. The signal from 5 is transmitted via a retardation circuit to one of the inputs of a bi-stable multivibrator, the first input of which is connected to 6. If both 5 and 6 simultaneously begin to receive light, 6 will immediately trigger the bi-stable multivibrator 7, so that the AND gate 8 is opened. The output of the AND gate 8 is connected to a monovibrator 11 which is triggered and remains in its triggered position during a predetermined period, in a well known way defined by the components of the monovibrator. In the triggered condition of monovibrator 11 the coil 9 of an electromagnetic device is energized. This electromagnet device controls the reversing device for rotating the document 2 about 180°. This reversing device may be of any suitable kind. For instance it is possible to use a switch k_1 , which when energized directs the postal document to one out of two tracks k_2 and k_3 , the track k_3 being twisted about 180° as schematically indicated by arrow k_4 .

After the period of time defined by the retardation device 10 the bi-stable multivibrator 7 is reset in its original position and blocks AND gate 8, but the monovibrator

11 has already been triggered and will only restore its original position in which 9 is de-energized, after the period of time predetermined by the monovibrator 11 itself.

The retardation period of the retardation device 10 is smaller than the time period in which the conveyor 1 moves over the horizontal distance between the elements 5 and 6. Consequently the trailing edge of a document 2 cannot energize the monovibrator 11 because first the element 5 will receive light and before the element 6 receives light the retardation time period of 10 has elapsed, so that the output of 10 disables the bi-stable multivibrator to be triggered. This situation remains, until the leading edge of a following document blanks the light input to element 5. The trailing edge of the control signal impulse from 5 is retarded by a further retardation device 12, which has a retardation time somewhat longer than the conveyor needs for travelling from 5 to 6. Consequently the light input to element 6 will be interrupted before the retarded signal from element 5 is removed, so that no triggering of the AND gate 8 will occur. Interference between the retardation circuits 10 and 12 can be obviated in a known way, e.g. by means of diodes. It is remarked that the input from 10 or 12 to 7 is an inhibition input immediately causing the reset of the bi-stable multivibrator 7 when receiving a signal or, when carrying a signal, preventing triggering of said multivibrator 7.

If the perforations 13 and 14 are positioned as indicated, the reversion device K will not be activated. If, however, the document has been turned about 180° the position of 14 becomes 14' and in that instance the document is reversed.

After leaving the reversing device K the document is scanned by the station B, which is provided with two radiation sensitive elements 15 and 16, which are connected to the inputs of a balancing device 17, the output of which is connected to the input of an amplifier 18, the output of which is connected to the transverse shifting device 19 schematically shown as a solenoid.

An embodiment of the circuits pertaining to the pre-scanning and transverse shift devices B and E is shown in FIG. 3. A control member 20 is connected to a portion 21 of the conveyor 1 which is adjustable responsive to energization of solenoid 19 between first and second positions indicated at 21 and 21', respectively. The control member 20 includes a magnetizable end portion which protrudes into solenoid 19. Continuity of the conveyor track is obtained by flexibility, that is adjustably mounted intermediate portions 22.

The radiation sensitive areas of the elements 15 and 16 are oblong in a vertical direction, so that they will receive the same quantity of light, when fully aligned with two oblong perforations 23 and 24. If, however, these perforations are displaced vertically either element 15 or element 16 will receive less light.

Further it will be clear that some retardation time will be necessary in order to energize the solenoid 19 at the moment the document 2 sensed by radiation sensitive elements 15 and 16 has come in the position it can be scanned by the main scanning station D.

Before discussing the circuit for obtaining this result, which circuit has been shown in FIG. 3 reference will be made to FIG. 2b, in which the scanning of the information bearing perforations is carried out. Scanning station C is provided with three radiation sensitive elements 25, 26 and 27 of which 25 is placed ahead of 26 and 27. The horizontal distance between 25 on the one hand and 26, 27 equals that between the perforations 13 and 14. Each group of two of the elements 25, 26 and 27 is connected to an AND-gate 28, 29 and 30 respectively. The elements 26 and 27 can only receive light simultaneously, if no object to be sorted impedes the light transmission to said elements. In that instance the AND-gate 28 is opened, which with its output is connected to the

inhibitor circuits 31, respectively 32, which carry out their blocking function when AND-gate 28 is opened. If, however, on the other hand 25 and 26 receive light simultaneously, the AND-gate 29 is opened which after a short delay originating from the delaying circuit 33 transmit a signal to one of the inputs of the OR-gate 34. If elements 25 and 27 do not receive light simultaneously, the AND-gate 30 is closed, so that the OR-gate 34 is opened which results in that the reading station D is connected to the decoding circuit 35. The fact that the OR-gate 34 was opened by a signal from AND-gate 29 and not by AND-gate 30 contains an information, which also can be carried to the decoding device 35. This is so, because if OR-gate 34 has been opened by a signal from AND-gate 30 the orientation of the document is the reverse from the orientation when the opening of the OR-gate 34 is carried out by means of AND-gate 29. Consequently it is possible to adjust the decoding device on decoding either the direct position of the information bearing perforations 36 or the mirror image of them.

Further the information about the position of the document 2 (the perforated edge either leading or trailing) is important for timing the switches w.

In FIG. 3 a further elaboration of the station B has been shown. Here again the radiation sensitive elements 15 and 16 have been shown as well as the perforations 23 and 24. In the position shown the signals from elements 15 and 16 will have equal strength and no control signal will be generated. If, however, the perforations 23 and 24 take the position of 23' and 24', the output signal from 15 will be very small whereas that from 16 will be strong. Both these signals are first amplified in amplifiers 37 and 38 respectively, after which the signal from 16 is inverted in an inverting circuit 39.

The inverting circuit 39 only inverts the sign of the signals without modifying the amplitude. The signals from 37 and 39 are connected to the ends of a potentiometer resistor 40, with a branch point 41. The voltage taken off by 41 from 40 is carried to a circuit 42 for storing the voltage value and also to a time switch 43. The output of the time switch 43 is connected to a monovibrator 44, the output of which controls a gate 45, which, when opened, transmits the voltage of 42 to the solenoid 19. A reset line 26 is adapted to send a reset pulse through 42 and 43 at the moment the monovibrator 44 resets. The period the monovibrator 44 remains in its set condition is sufficient to let the document 2 attain the reading station D and to be read by said station. When monovibrator 44 resets itself the impulse of line 26 removes the voltage stored in 42 and resets the retardation circuit 43, so that the device is again ready to adjust the transverse shift on base of information from a further support 2.

The shown device has the advantage, that equal strength of the radiation impinging elements 15 and 16 does not induce a signal in line 41, but it will be clear that it is also possible to provide protection circuits for inhibiting energization of solenoid 19 if no cooperation with significant openings 13 and 14 are present. Circuits of this type could be analogous to the circuit C. When reading information from perforations 36 by means of the radiation sensitive elements of station D it is possible that some of the perforations are partly obtruded, e.g. by dirt, and/or have been torn somewhat, so that the radiation sensitive elements of station D receive unequal quantities of radiation. In order to obtain nevertheless reliable results in the output circuit of the elements of station D cut-off stages may be inserted having e.g. the voltage-radiation percentage characteristic shown in FIG. 4, in which the radiation percentage is indicated as abscissa for a perforation having a standard dimension and in which the ordinate is the output signal. If the device according to the invention should not be used it could be possible that the perforations were positioned on a wrong level, so that it should be necessary to use a relatively high percentage of the normal radiation transmission of a perforation of

standard dimension for letting the receiving radiation sensitive element deliver a significant signal. Because with the invention the most important fault source, that is a wrong level, has been eliminated it is allowed to lower the percentage of radiation that can be considered to be significant in a very considerable way.

The invention is not restricted to the described embodiments. It is also possible to have a single radiation sensitive element instead of the two elements 15 and 16 by giving the perforation and the radiant sensitive area of the radiation sensitive element a dimension in the direction of the transverse shift, which dimension equals the maximum transverse deviation of the support to be accepted, in which case the amplitude of the signal may be a measure for the transverse deviation, in which case the transverse deviation is zero if half the perforation covers the radiation sensitive area of this radiation sensitive element.

The radiation sensitive elements may be e.g. photocells or photo resistors or any other suitable device giving an electrical output signal when receiving radiation.

The shifting device needs not to be necessarily a solenoid, but each device, which causes a transverse displacement when receiving an electrical signal, can be used, e.g. an electric motor receiving a signal proportional to its energizing current.

Further it is not necessary that the shifting device resumes its original position when a document has passed it. By comparing the control signal from the radiation sensitive elements with a signal depending on the position of the shifting device and feeding the results of this comparison (difference signal) to the transverse shifting device, a smooth and nevertheless quick action can be obtained e.g. if a motor is used as a driving means for the transverse shifting device.

What I claim:

1. A device for scanning perforations arranged to provide information and carried by individual information carriers, said device comprising conveying means for conveying said individual information carriers along a path; a first scanning station located along said path and including a source of radiation and at least one radiation sensitive element for receiving radiation passing through the perforations of said individual carriers and for producing an electrical signal in accordance with the radiation received; electromechanical means responsive to the electrical signal produced by said at least one radiation sensitive element; shifting means controlled by said electromechanical means for shifting said conveying means transversely to the path of movement provided by said conveying means, said shifting means being located downstream of said first station along said path; and further radiation sensing means located at the location of said shifting means for receiving radiation transmitted through the perforations of said individual carriers when said carriers are appropriately positioned by said shifting means.

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U.S. Cl. X.R.

209—73, 111.7; 226—20