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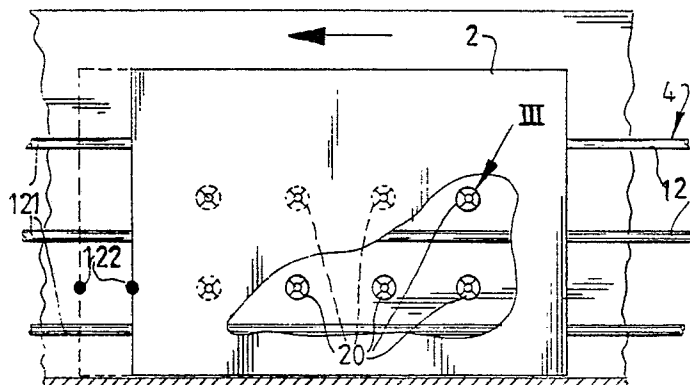
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**Apparatus for identifying one or more sheet-form objects, for instance a magazine, an identification method and recognition device.**

Apparatus for identifying one or more sheet-form objects (2), c.q. a magazine, comprising: a conveyor (4) for feeding the objects (2) with substantially constant speed. The apparatus further comprises a recognition device (8) provided with two or more discrete spaced apart light sensitive elements (20). These elements (20) sense two or more discrete surface areas (26) of the object (2). One or more triggering elements (121, 122) are positioned before the light sensitive elements (20) in the conveying direction, so as to trigger or start the sensing operation at a predetermined surface area (26) of the object (2).

**EP 0 300 545 A1**

**FIG.2**



**Apparatus for identifying one or more sheet-form objects, for instance a magazine, an identification method and recognition device.**

It is known from DE-A-32 39 938 to identify sheet-form objects in the form of magazines with video cameras; reference recordings of cover pages using a video camera are stored in an image memory and the cover pages of various magazines to be distinguished from one another are led past the camera and scanned by this camera. Thereafter these recordings are compared by means of complex image processing to the reference recordings.

In case of identification of magazines, the apparatus will mostly be used for identification of unsold magazines that are returned from kiosks and collected at a central collection depot and which have to be returned from there to the respective publishers or which can then be destroyed.

The present invention has for its object to provide a reliable apparatus and method of identification of sheet-form objects, which is usable at high speeds, user-friendly, simple to construct and therefore relatively inexpensive.

Therefore, an apparatus according to claim 1 is provided.

Preferred embodiments of this apparatus are characterized in the subclaims.

Tests made a prototype of the apparatus according to this invention, using two rows of four photocells and LEDs and two triggering elements behind one another have rendered satisfactory results. Substantially no fault recognition took place and approximately 95% correct recognition was achieved - if recognition values were seen as incorrect by the computer, correct recognition was manually performed. Those automatically obtained figures will offer an important further step towards increasing confidence between kiosk and depot and depot and publisher with respect to providing one another with information relating to accounts of abundantly delivered magazines, which could eventually lead to dispense with returning of the magazines.

Further features, details and advantages of the method and device according to the current invention will become apparent in the light of a description of an embodiment of the invention, whereby reference will be made to the drawing, in which:

Figure 1 shows a perspective, schematic view of a device performing the method according to the invention;

Figure 2 shows detail 2 from figure 1;

Figure 3 is a schematic sectional view of the detail 3 from figure 2;

Figure 4 shows schematically an element for connecting to the element from figure 3;

Figures 5-9 show examples of algorithms for application with the method and device as according to figures 1-5.

One magazine 2 at a time from a stack of magazines 3 is placed, usually manually, via a feed table 1 (fig. 1) onto a rope conveyor 4 which is disposed sloping at an angle. Care is taken that the spine of each magazine 5 touches against a gutter edge 6. A magazine 2 is guided as according to arrow 7 into an recognition device 8 which is connected, in a manner not shown, to a control computer 9 which, subject to identification in device or station 8, despatches magazines to one of the conveyors 10, 11 or 12 by opening one of the respective flaps 14, 15. Use is made in the embodiment shown of three discharge conveyors:

a conveyor 10 serves to discharge unidentified magazines which are guided past a terminal 16 connected in a manner not shown to control computer 9, where an operator can still identify the magazine with the naked eye and, via a simple input mechanism, for instance using a mouse or joystick, can enter such a magazine into the computer file in rapid manner, following which a conveyor 18 swivelling as according to arrow 17 can despatch the identified magazine to a conveyor 11 or 12;

discharge conveyor 11 leads for example to a manual or automated sorting device for return despatch to a publisher; finally, conveyor 12 carries away magazines for destruction.

The disposition shown in figure 1 has already been found to be cost effective for roughly 50.000 magazines for processing per day (two per second), while more than 200 different titles have to be identified per day. If the numbers of magazines amount to an order greater than the above number it may become effective to employ a separate remotely controllable flap per title, so that the magazines are immediately sorted per title.

Arranged at identifying station 8 (fig. 2) between the ropes 121 the rope conveyor and at a short distance from the magazine 2 passing in the figure are two rows of four light sensitive or photo elements 20. Likewise arranged between two ropes 121 are two trigger elements 122 initiating the reading of the photo elements 20, which trigger elements can comprise a light beam to be interrupted by the magazine, an element similar to photo element 20 or an ultrasonic or mechanical detection element.

Light sensitive element 20 (fig. 3) is preferably

built up of a LED (light-emitting diode) 21 which is provided in a manner not shown with the correct supply voltage and of a photo sensitive transistor 22, both accommodated in a housing 23 provided with transparent windows 24 and 25. A quantity of light emitted by the LED 21 onto a surface portion 26 on the underside of a magazine 2, preferably on the cover page located on the underside of magazine 2, is for example three-quarters reflected, this depending on the so-called grey value of this surface portion 26.

In another embodiment a light sensitive element comprises a photo diode enveloped by a radiant wire.

As is shown schematically (figures 3, 4) a voltage is transmitted from phototransistor 22 via lines 27 to an AD converter (analog-digital converter) 28 which is further provided with twelve digital outputs 29 as well as two terminals 30 and 31 which are connected in a manner not shown to the trigger elements 122, so that reading of the phototransistor 22 is initiated by these trigger elements 122, after which the digital value thereof can be further processed via the lines 29. Through the setting of phototransistor 27 a mean value of the amount of light received by the phototransistor 22 can be obtained over a greater area than the surface portion 26. It is also possible to take a mean value of two or more samples taken shortly after each other.

Entering of the digital values takes place during interrupt of the control computer 9 (fig. 5): 32 shows the interrupt label while at 33 is verified if the incoming digital values, that is, 8 x 8 bits, which cause the interrupt relating to the first or second trigger element 122, and should it be the second trigger element 122, the identification algorithm 34 is set into operation, while at 35 is the exit to the main program.

The operation of the identification algorithm performed at 34 is substantially as follows (fig. 6A, 6B, 7, 8): included in a part of the memory of the control computer 9 are tables 40 for each photo element 20, in which are stored the recorded values of the reference recordings, such as for instance for 200 magazines taken at the beginning of the day. In figure 6A for each magazine, during the initiating entering at the start of the day or week, there are stored sixteen 8-bits numbers or standard values, as is indicated using the squares 42. The sixteen values measured per magazine for identification, as is shown schematically with 43 (fig. 6B), now define the sum of the absolute values of the difference between all values as stored in the squares 42 and after the search through the entire table, as indicated schematically with arrow 44, the ranking number, viz. the title of that particular magazine, of smallest difference is stored in addition to

the ranking number of the smallest difference but one.

For each line 41 the sum S of the absolute values of the sixteen 8-bits numbers is compared with the smallest value obtained up until that moment as shown at 45 (fig. 7); when the old smallest value is substituted by the new smallest value at 46, the preceding smallest value becomes the smallest value but one, following which there is a return at 47 to the search routine as according to arrow 44 (fig. 6B). If the sum is greater than the smallest value up to that moment, a check is made at 48 to see whether the sum is smaller than the smallest value but one, after which, if this be the case, the old smallest value but one, while at 50 and 51 a return is made to the comparing routine as according to arrow 44.

In order to achieve a speed of 50,000 magazines per day, roughly 10 magazines per second, the above mentioned algorithm is preferably performed in machine language.

In order to enable more accurate comparison it is preferred that the different measurements done using the separate trigger elements be separated, whereby the above mentioned search process takes place independently for these two measurements. This is shown in schematic form in figure 8, whereby indicated with - - in the vertical column is the sequence number p,q,r,s,t or u of the magazine found in the table, whereby the smallest value of the aforementioned sum is found, while indicated with \* is the sequence number associated with the smallest sum but one. Column 60 therefore relates here to the first result performed using the first trigger element 22, while column 61 shows the result that is subject in each case to the first measurement and carried out using the second trigger element 122. Except in the case the smallest sum and the smallest sum but one coincide, it has been found in practice that also for the cases shown in figures 8A, B, C and D the magazine is identified:

A) the ranking number of the smallest sum at the first measurement coincides with the smallest sum from the second measurement while the smallest sums but one differ; the magazine passed through is deemed to be the magazine stored in line p in the tables;

B) the ranking number of the smallest sum but one found at the second measurement coincides with the smallest sum of the first measurement, while the smallest sum but one of the first measurement and the smallest sum of the second measurement differ; the identified magazine is deemed to be that defined by line p from the table;

C) the case corresponding to B, but reversed; the identified magazine is the one stored under q; and

D) the ranking numbers smallest sums but one coincide, while the smallest sums differ from each other; the scanned magazine is the magazine is entered under r in the table.

Continuation of the algorithm shown in figure 9 is carried out by control computer 9: indicated at 70 is the arrival of a crate of magazines returned from a kiosk, at 71 they are loaded on one by one and at 72 automatic identification is commenced; if at 73 the automatic identification has succeeded the administrative records of the relevant kiosk are updated at 74 and after it has been determined at 75, subject to the wishes of the publisher, which magazine may be destroyed, flap 15 is actuated at 76, while flap 14 is actuated at 77. If identification is not successful at 73, flap 13 is opened at 74 whereby at 75 the magazine may have to be turned over and identified by an operator sitting on seat 19 (fig. 1) who can then still enter the magazine into the file of computer 9 using a rapid search system, for example so-called scrolling with a mouse or joystick (not shown) at control station 16 on the screen thereof. If found at 76 that the magazine is present in the file, it is entered therein and accounted at 75. Depending on the fact if such a magazine is allowed to be destroyed it can be routed to conveyor 12 at 80, or e.g. if not, at 81 to conveyor 11.

If the magazine for identification is not included in the file of that day, as established at 76, this can be indicated as such at 82 with control station 16, administrative recording thereof can be carried out at 83 by control computer 9, and at 80 the magazine can be discharged to belt 12 for destruction. It is also conceivable that belt conveyor 18 has an additional third position, in which for example in this latter case the magazine drops into a collecting bin or crate next to control station 16.

The apparatus according to preferred embodiments of this invention simple to use and construct, operates fast and reliable, is easily extendable and provides an on-line connection to the (small) computer which at the time automatically does the administration for the different accounts.

## Claims

1. Apparatus for identifying one or more sheet-form object, e.g. a magazine, comprising:  
- a conveyor for feeding the object with substantially constant speed; and  
- a recognition device, provided with two or more discrete light sensitive elements spaced apart, for sensing two or more discrete surface area's of the object.

2. Apparatus for identifying one or more sheet-form object, e.g. a magazine, comprising:

- a conveyor for feeding the object with substantially constant speed; and

- a recognition device, provided with two or more discrete light sensitive elements spaced apart, for sensing two or more discrete surface area's of the object and one or more triggering elements positioned before the light sensitive elements in the conveying direction, so as to trigger or start the sensing operation at a predetermined surface area of the object.

3. Apparatus as claimed in claim 1 or 2, provided with a light emitting element for each light sensitive element, or one common for the light sensitive elements together for casting light onto said object.

4. Apparatus according to anyone of the claims 1-3, provided with two rows of four light sources and therewith associated light sensitive elements, said rows extending in the conveying direction.

5. Apparatus according to anyone of the foregoing claims, wherein two elements for triggering and recognition are disposed one after the other and subsequent to the light sensitive elements in the conveying direction.

6. Apparatus according to anyone of the foregoing claims, wherein the conveyor is a rope conveyor, the rope conveyor is disposed at a slope, that a stop or gutter for the spine of the magazine is disposed on the underside of the slope and the light receiving elements and triggering elements are disposed shortly underneath the rope conveyor and transversely spaced relative to the ropes or said conveyor.

7. Apparatus according to anyone of the foregoing claims, provided with an analog-digital converter for converting the signal of the light receiving elements into n-bits ( $n = 1, 2 \dots$ , preferably 8) and a computer memory wherein the digital values are compared with pre-defined standard values stored therein.

8. Apparatus as claimed in claim 7, wherein the triggering elements trigger at least two independent measurements performed by the light sensitive elements, and two independent comparisons are made.

9. Apparatus according to claim 6, 7 or 8, wherein an algorithm is implemented in machine language.

10. Apparatus of anyone of the foregoing claims, provided with a manually operable identification station.

11. A method for identifying one or more sheet-form objects, using an apparatus according to anyone of the foregoing claims.

12. Recognition device for use with an apparatus according to anyone of the claims 1-10.

FIG.1

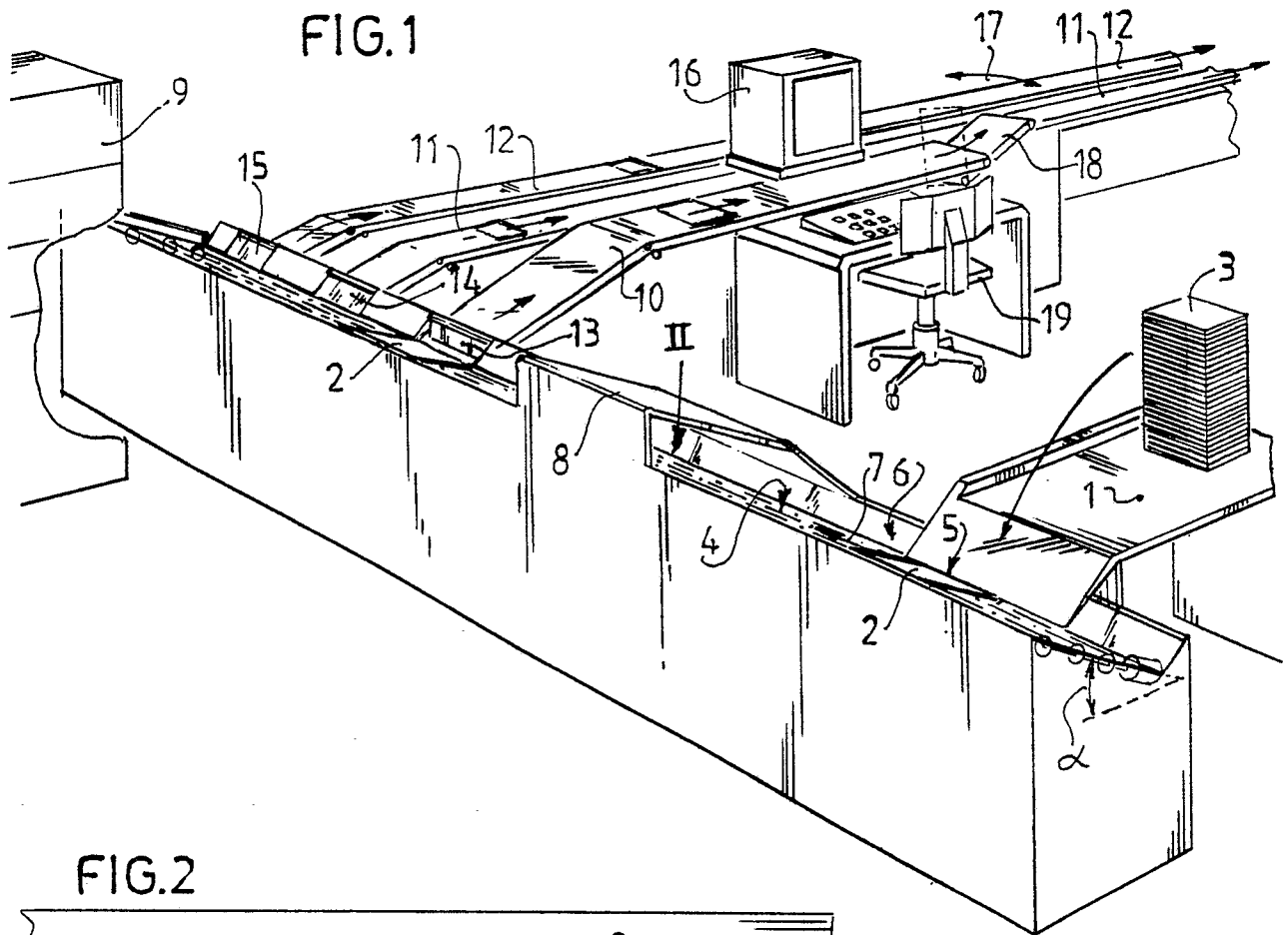


FIG.2

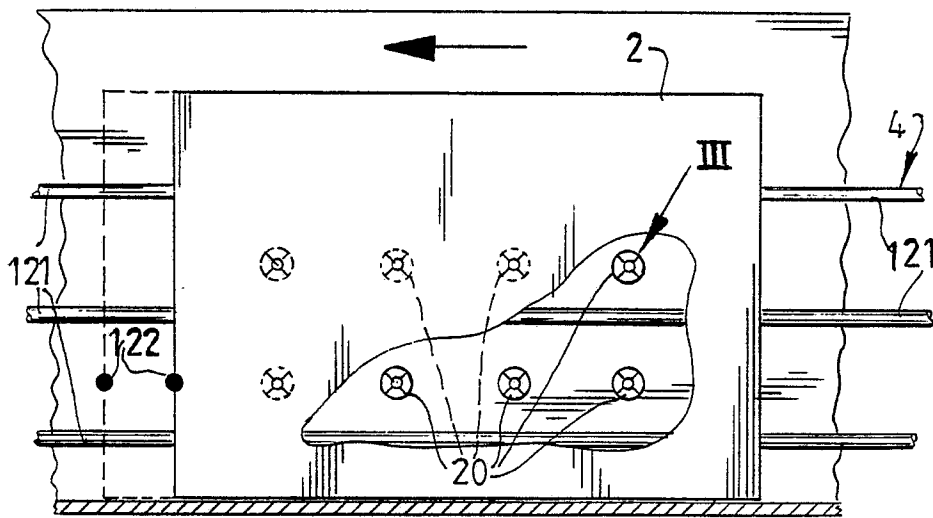


FIG.3

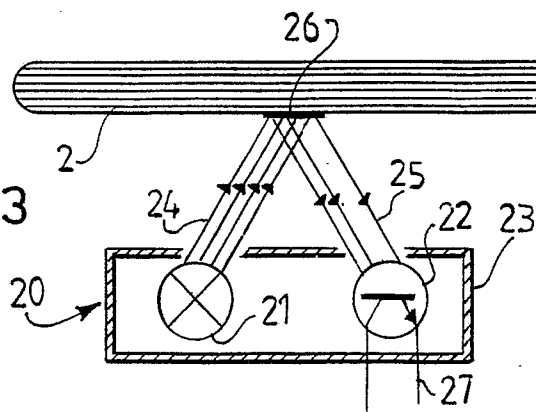
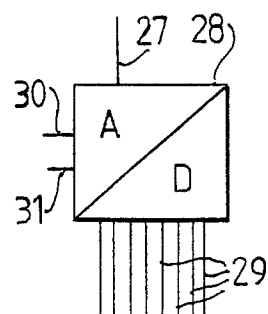
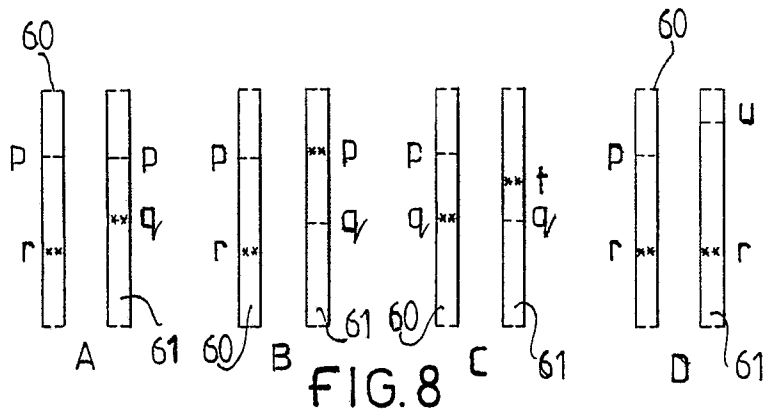
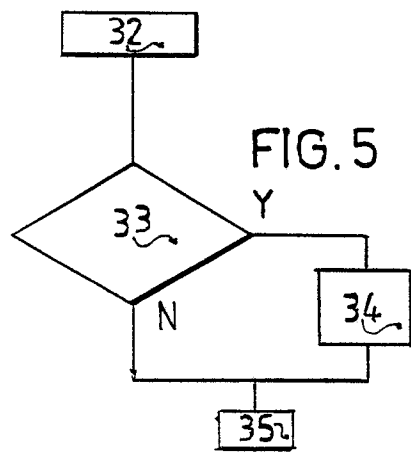
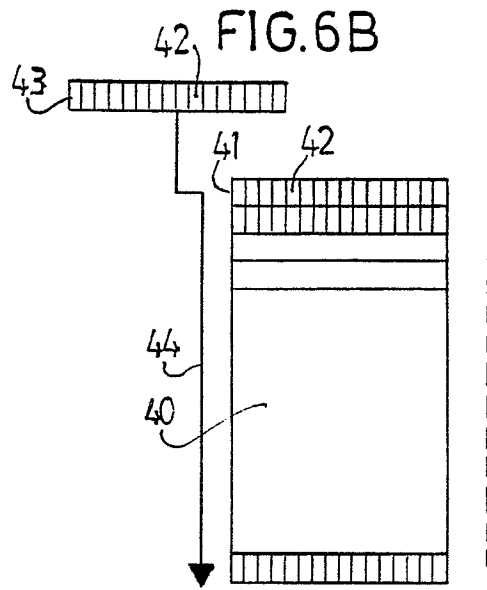
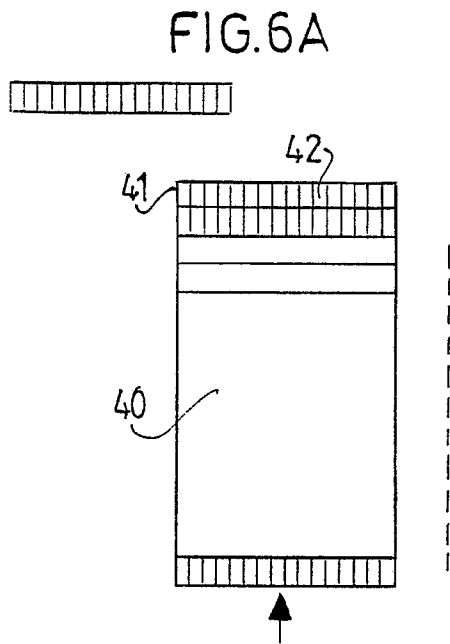
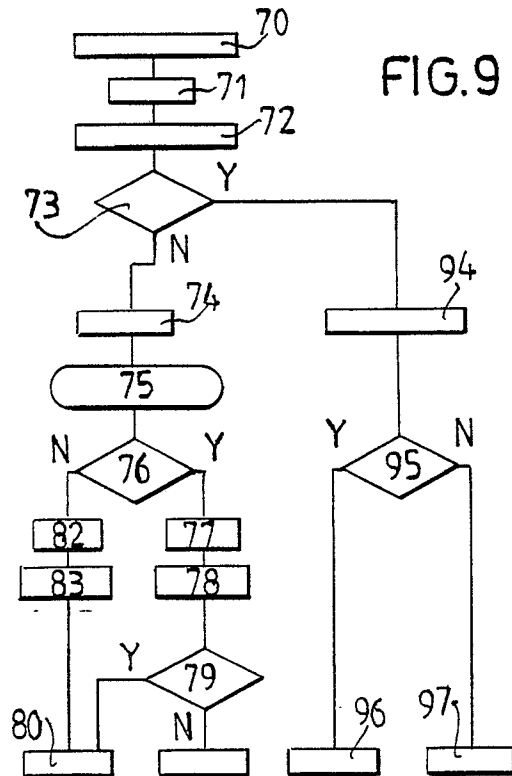
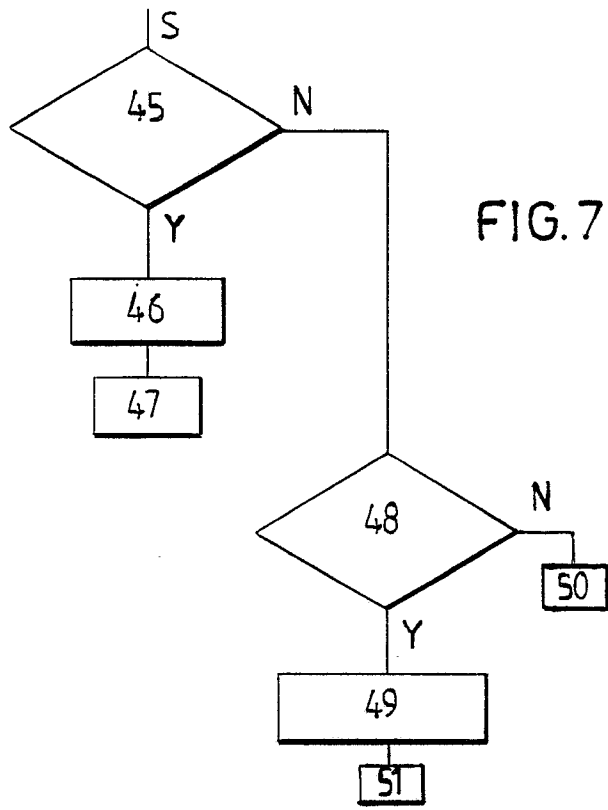


FIG.4









DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	DE-A-1 034 685 (KLUGE) * Figures 1,2; column 1, line 41 - column 3, line 45 *	1,3	B 07 C 5/342 B 07 C 5/34 B 07 C 3/08
Y	---	2,4,11, 12	
A	---	5	
Y,D	DE-A-3 239 938 (LICENTIA PATENT-VERWALTUNGS-GmbH) * Figure 1; page 6, line 19 - page 8, line 20; page 9, lines 10-12 *	2,11,12	
A	---	4,7	
Y	US-A-3 538 499 (CONTROL DATA) * Figures 1-3; column 4, lines 29-70 *	4	
A	---	5,8	
A	GB-A-1 132 483 (PTT-NL) * Figures 1,2; page 1, line 58 - page 2, line 9; page 2, lines 32-64 *	6	TECHNICAL FIELDS SEARCHED (Int. Cl.4)
A	US-A-1 900 633 (PAPYRUS) * Page 1, lines 42-77 *	6	B 07 C
A	EP-A-0 119 402 (LICENTIA PATENT-VERWALTUNGS-GmbH) * Figures 1,2; abstract; page 4, line 20 - page 5, line 10 *	6	
A	US-A-4 134 498 (GEOSOURCE) * Figures 1-4; column 4, line 64 - column 8, line 59 *	7	
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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 18-10-1988	Examiner FORLEN G.A.
<b>CATEGORY OF CITED DOCUMENTS</b> X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... & : member of the same patent family, corresponding document	



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	EP-A-0 067 438 (OXBRIDGE) * Figures 1-3,9; page 1, lines 17-26; page 13, line 11 - page 25, line 23; page 34, line 34 - page 36, line 4 * -----	7-10	
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 18-10-1988	Examiner FORLEN G. A.
<p><b>CATEGORY OF CITED DOCUMENTS</b></p> <p>X : particularly relevant if taken alone  Y : particularly relevant if combined with another document of the same category  A : technological background  O : non-written disclosure  P : intermediate document</p> <p>T : theory or principle underlying the invention  E : earlier patent document, but published on, or after the filing date  D : document cited in the application  L : document cited for other reasons  .....  &amp; : member of the same patent family, corresponding document</p>			

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