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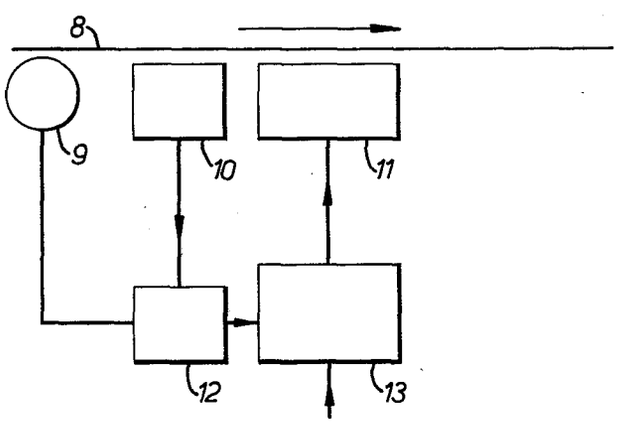
(54) Luminescent address bar codes.

(57) A luminescent address bar code is applied to a predetermined location of a postal item at an early stage in its handling by the Postal Authorities to provide in a machine readable form the destination address written on the postal item. This machine readable bar code is then sensed and used to route the postal item in automatic sorting machines. Errors in the reading of the luminescent address bar codes leads to the postal item being misrouted or being rejected. The quantity of light emitted from the luminescent address bar codes varies with the nature and properties of the surface of the postal item and it is this variation in the quantitiy of light emitted which leads to errors in reading the codes. To overcome this the reflectance of the surface of the postal item is monitored and then the quantity of flurescent or phosphorescent material applied to the postal item to form the bars of the address code is controlled in dependence upon the reflectance of the postal item, so that the visible light emitted from the code bars on every postal item is substantially constant.



EP 0 105 061 A1

The Post Office

LUMINESCENT ADDRESS BAR CODES

A luminescent address bar code is applied to a predetermined location of a postal item at an early stage in its handling by the Postal Authorities to provide in a machine readable form the destination address written on the postal item. This machine readable bar code is then sensed and used to route the postal item in automatic sorting machines used throughout the distribution of the postal item to its destination address. Any error on the reading of this luminescent address bar code leads to the postal item being misrouted or to it being rejected from an automatic sorting machine.

The luminescent address bar codes are printed on the surface of the postal items in a fluorescent or phosphorescent material which is substantially transparent to visible light so that the luminescent address bar code does not obscure any writing or any other information present on the postal item. The quantity of visible light which is emitted from the luminescent address bar codes is strongly dependent upon the material forming the surface of the postal item. The exact mechanism causing this is not fully understood but we have found that there is a predictable relationship between the reflectance of the surface of the postal item and the quantity of visible light emitted by the address code bars. Some of the exciting radiation incident upon the address code bars is also reflected from the surface of the postal item back through the address code bars causing further excitement of the material forming the address code bars when the surface of the postal item is highly reflective. Also, some

of the visible light emitted by the bars of the code is emitted in a direction towards the surface of the postal item and this visible light impinges on the surface of the postal item and is reflected by the surface when it is highly reflective so that this reflected light reinforces that emitted from the luminescent address bar code in a direction away from the surface of the item. Both of these factors contribute towards this variation in the quantity of light that is emitted by the address code bars in a direction away from the surface of the postal item. However, it is believed that there are further factors which affect this, perhaps including porosity of the surface of the postal item but, irrespective of the mechanism causing this effect we have found that there is a predictable relationship between the reflectance of the surface of the postal item and the quantity of visible light emitted by the address code bars. This difference in intensity of visible light emitted depends upon the reflectance of the surface of the postal item and leads to errors in the reading of the address bar codes by the sensors.

In particular, if sufficient fluorescent or phosphorescent material is applied for each of the bar codes to enable it to be read reliably by the sensor when it is applied to a dark, non-reflective background, this same quantity of fluorescent or phosphorescent material when applied to a shiny white or light coloured background leads to the sensor being overloaded and its output saturated. Once the sensor is overloaded and the circuits saturated, a finite time is required for them to recover and, during this finite time, the occurrence, or particularly the absence, of the next bar of the code is not monitored by the sensor which leads to an incorrect reading of the bar code.

In the past, a compromise quantity of fluorescent

or phosphorescent material has been applied, for example, the quantity corresponding to the correct amount for a manilla coloured postal item. In this case, when a white or highly reflective postal item is being sensed, the sensor is overloaded but, only to a limited extent, and equally, when a black or dark coloured postal item is being sensed, the light output is insufficient to give a consistently reliable reading and thus, errors frequently occur when either white and highly reflective postal items, or dark coloured items are sorted using the luminescent address bar codes.

According to a first aspect of this invention a method of applying a luminescent address bar code to a postal item includes the steps of monitoring the reflectance of the surface of the postal item, and applying address code bars to the surface of the postal item with the quantity of fluorescent or phosphorescent material applied to the postal item to form the bars being controlled in dependence upon the reflectance of that postal item, so that the visible light emitted from the code bars on every postal item is substantially constant.

According to a second aspect of this invention, an apparatus for applying address bar codes to the surface of postal items includes means to monitor the reflectance of the surface of a postal item and output a signal representative of the reflectance of the surface of the postal item, and variable intensity printing means for applying a bar code to the surface of the postal item, the quantity of fluorescent or phosphorescent material applied to the surface of the postal item by the variable intensity printing means being controlled by the output signal of the means to monitor the reflectance of the surface of the postal item, so that, the visible

light emitted from the code bars on every postal item is substantially constant.

Frequently, it is sufficient merely to monitor the overall reflectance of the total surface area of the postal item which carries the written address and this is true particularly when the postal item is formed by a plain envelope. However, it is possible to have address labels which differ in colour from the remainder of the surface of the postal item attached to the postal item or, alternatively, have variegated or multi-coloured envelopes or envelopes with printing, particularly multi-coloured printing on them, indicating their origin. In such cases, it is preferred that the reflectance of a particular region of the postal item which is to carry the address code bars is monitored. The address code bars are always placed at a predetermined location of the postal item and thus, it is relatively easy to determine the region which will carry them and simply monitor the overall reflectance of that particular region of the postal item. The monitoring of the particular region to which the address code bars are applied provides a sufficient uniformity for the bulk of the postal items and this is certainly superior to the prior method of using a constant quantity of ink for all postal items.

However, particularly when the luminescent address bar codes are applied on top of writing or printing on the postal item, for example on top of the written address destination written on the postal item or, alternatively, printed matter contained on the surface of the postal item, it is preferred that the reflectance of each particular portion of the region of the surface of the postal item at which each address code bar is to be placed is monitored individually and the quantity of ink used to form each bar of the address bar code is controlled in dependence upon the reflectance of that particular portion of the postal item. In this way,

not only is account taken of the general background reflectance of the postal item but also account is taken of any local variations in the reflectance of the postal item so that not only does the quantity of light emitted from the code bars of each postal item correspond to that emitted from the code boars of each other postal item but, the light emitted from each bar forming the code on every postal item has substantially the same intensity.

At present, automatic sorting machines and luminescent address bar codes are used principally for letters and postcards but they can also be used on small postal packets and even on parcels.

The quantity of fluorescent or phosphorescent material used to form each bar of the address bar code may be applied as a layer of uniform density but variable area or, alternatively, each address bar may be applied over a similar area but have a variable density of material applied to form it. When the address code bars have a variable area they preferably have a constant width but their length varies and when their density varies they preferably are formed by a number of individual elements and the number of these elements varied to provide the required variation in density.

Preferably the variable intensity printing means comprises an ink drop printer. This may be arranged to vary the length of the bars of the code in response to the output signal of the means to monitor the reflectance of the surface of the postal item or, alternatively, it may be arranged to vary the number of ink drops applied by the ink drop printer to form each bar of the address bar code in dependence upon the output signal of the means to monitor the reflectance of the surface of the postal item.

A particular example of a method and apparatus in accordance with this invention will now be described with reference to the accompanying drawings; in which:-

Figure 1 is a plan of an envelope showing the location and arrangement of a typical bar code used by the British Post Office;

Figure 2 is a block diagram of the apparatus;

Figure 3 is an optical diagram of one scanning device;

Figure 4 is a plan and side elevation of the scanner;

Figure 5 is a block diagram of the interface between the scanner and the ink jet printer; and,

Figure 6 is a circuit diagram of the scanner discriminating circuit.

In the coding system adopted by the British Post Office, envelopes are provided with a set of inward code bars and a set of outward code bars. The outward code bars describe the destination of the envelope from the primary sorting office where it is first sorted and given the codes whilst the inward code describes the final destination of the envelope and is used to sort the envelope once it has arrived at its final receiving sorting office. In the coding system adopted by the British Post Office these address bar codes are positioned one above the other in a particular location with respect to the bottom right hand corner of the envelope. Figure 1 illustrates this and illustrates the minimum size of envelope 1 and the maximum size of envelope 2 capable of being handled by the automatic sorting apparatus. The outward address bar code 3 and the inward address bar code 4 are located in a predetermined position with respect to the bottom right hand

corner of the envelope with the inward bar code 4 above the outward bar code 3. Each bar code consists of 13 separate positions or locations 5 at which the code bar may be located and in practice the bars are only present at some of these locations.

Depending upon the reflectance of the surface of envelope 1 or 2, the number of individual droplets that are printed by an address bar code printer is either three or seven. In both cases, the droplets are arranged in a single bar or line starting from the top so that if the surface of the envelope 1 or 2 has a high reflectance only three dots are printed at 6 whereas if the envelope has a low reflectance the bars of the bar code comprise seven droplets all just touching as indicated at 7. Whilst intermediate numbers of droplets may also be printed, it has been found that, in practice, it is sufficient if just these two different lengths of code bar are used. The apparatus for achieving this effect will now be described in more detail with reference to the remaining drawings.

The envelopes 1 and 2 are moved along a letter path 8 by a conveyor (not shown) and their movement is indexed by an encoder 9. As the envelopes 1 and 2 are moved along the letter path 8 the parts of their surface that will receive the address bar codes 3 and 4 are scanned by an optical scanner 10 which includes a pair of separate scanning assemblies and then, downstream from the optical scanner 10 the address bar codes 3 and 4 are applied to the front face of the envelopes by an ink jet printer 11. A letter tracking system 12 receives an input from the encoder 9 and the scanner 10 and so controls the operation of the ink jet printer 11 via printer electronic control circuitry 13 to ensure that the length of each address code bar is determined in accordance with the reflectivity of the surface beneath that bar.

Each scanning assembly includes a common light source 14 including a collimator to provide a parallel illuminating beam of white light. This is directed non-normally to the surface of the envelopes 1 and 2 and then light scattered from the surface of the envelope is gathered by a lens 15 and applied through a slit 16 to a photodetector 17. The light is applied and collected from the surface of the envelope non-normally to minimise specular reflection from the surface of the envelope. The optical scanner comprises a pair of similar scanning assemblies mounted one above the other as shown most clearly in Figure 4. Light from the common white light source 14 is also allowed to impinge upon a reference surface (not shown) and a reference photodetector 18, shown in Figure 6, is arranged to view this reference surface.

The scanning detector circuit shown in Figure 6 compares the light received by the photodetectors 17 with the light received by the reference photodetector 18. Each of the photodetectors 17 are connected across the differential input terminals of operational amplifiers 19 and 20 so that when the photodetector receives a high light output there is zero output from the operational amplifiers 19 and 20 whereas when the photodetectors receive a low light output there is a high output from the operational amplifiers 19 and 20. The reference photodetector 18 is connected across the differential input terminals of an operational amplifier 21 and again the output of the differential amplifier 21 is dependent upon the level of illumination applied to the reference photodetector 18. Further differential operational amplifiers 22 and 23 compare the output from the amplifiers 19 and 20 with that from the amplifier 21 to provide outputs which are high when the light received by the detectors 17 is less than that received by the

reference detector 18 and zero when the light intensity received by the photodetector 17 is greater than that received by the reference photodetector 18.

As the envelopes 1 and 2 move past the optical scanner, the incremental encoder 9 samples the outputs from the amplifiers 22 and 23 at regular increments in the movement of the envelopes 1 and 2 past the optical scanners. The outputs from the amplifiers 22 and 23 are loaded into a shift register (not shown) and incremented through the shift register by the further pulses from the encoder 9. Thus, the data in the shift register represents information upon the reflectance of the particular regions of the envelopes upon which the inward and outward address bar codes 4 and 3 are to be printed, and then when that portion of the envelope is adjacent the ink drop printer 11, this information is emitted by the shift register and used to control the printer 11 via the printer control electronics 13 to determine whether address bar codes that have to be printed are three or seven droplets long. Naturally, whether a bar is printed or not depends upon the output of the code that has been allotted to a particular address written on the envelope.

C L A I M S

1. A method of applying a luminescent address bar code to a postal item including the steps of monitoring the reflectance of the surface of the postal item, and applying address code bars to the surface of the postal item with the quantity of fluorescent or phosphorescent material applied to the postal item to form the bars being controlled in dependence upon the reflectance of that postal item, so that the visible light emitted from the code bars on every postal item is substantially constant.

2. A method according to claim 1, in which the reflectance of the particular region of the postal item which is to carry the address code bars is monitored.

3. A method according to claim 1, in which the reflectance of each particular portion of the region of the surface of the postal item at which each address code bar is to be placed is monitored individually and the quantity of ink used to form each bar of the address bar code is controlled in dependence upon the reflectance of that particular portion of the postal item.

4. A method according to any one of the preceding claims, in which the quantity of fluorescent or phosphorescent material used to form each bar of the address bar code is applied as a layer of uniform density and variable area.

5. A method according to claim 4, in which the length of the bars in the address code varies.

6. A method according to any one of claims 1 to 3, in which the quantity of fluorescent or phosphorescent material used to form each bar of the address bar code is applied over a substantially similar area and has a variable density.

7. A method according to claim 5 or 6, in which each bar of the address bar code is formed by a number of

individual elements and the number of elements varies to vary the length or density of the bars.

8 An apparatus for applying address bar codes to the surface of postal items in accordance with any one of the preceding claims, the apparatus including means to monitor the reflectance of the surface of a postal item and output a signal representative of the reflectance of the surface of the postal item and variable intensity printing means for applying a bar code to the surface of the postal item, the quantity of fluorescent or phosphorescent material applied to the surface of the postal item by the variable intensity printing means being controlled by the output signal of the means to monitor the reflectance of the surface of the postal item, so that the visible light emitted from the code bars on every postal item is substantially constant.

9 An apparatus according to claim 8, in which the variable intensity printing means comprises an ink drop-type printer.

10 An apparatus according to claim 8 or claim 9, in which the means to monitor the reflectance of the surface of a postal item comprises a white light source to illuminate the surface of the postal item, an optical system to collect light reflected from the surface of the postal item, and at least one photodetector located to receive the light reflected from the surface of the postal item.

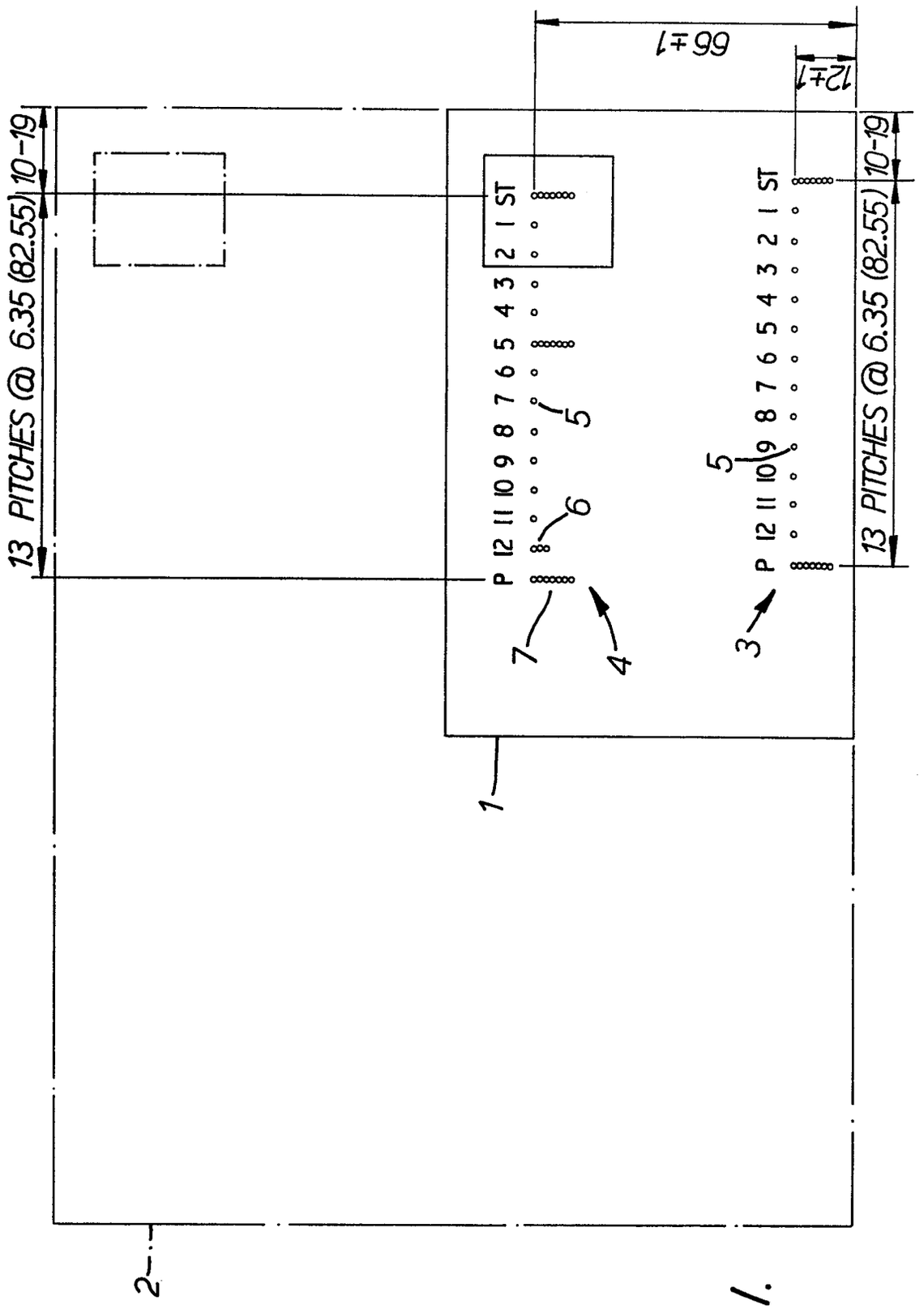

66±1
12±1
13 PITCHES @ 6.35 (82.55) 10-19
13 PITCHES @ 6.35 (82.55) 10-19
P 12 11 10 9 8 7 6 5 4 3 2 1 ST
1
2
3
4
5
6
7

FIG. 1.

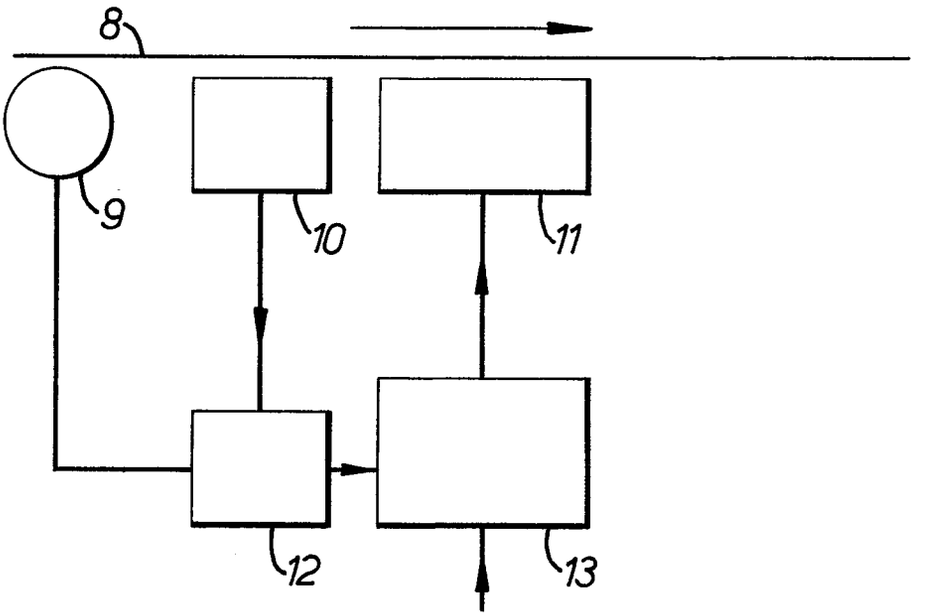

8
9
10
11
12
13

FIG. 2.

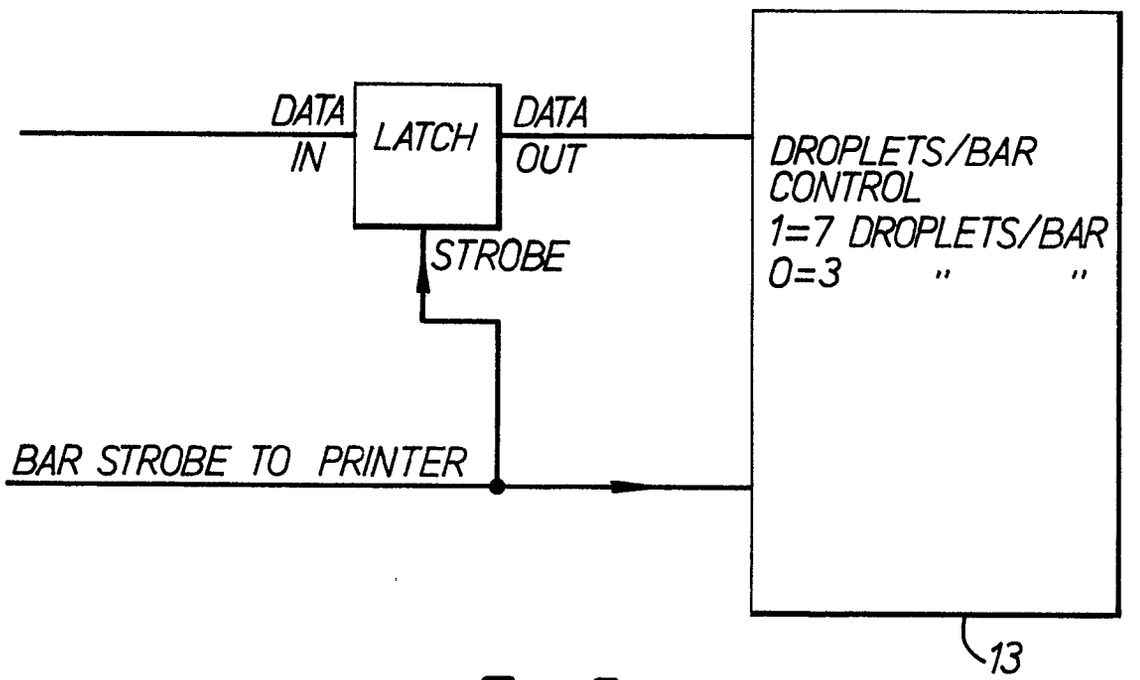

DATA IN
LATCH
DATA OUT
STROBE
BAR STROBE TO PRINTER
DROPLETS/BAR CONTROL
1=7 DROPLETS/BAR
0=3 " "
13

FIG. 5.

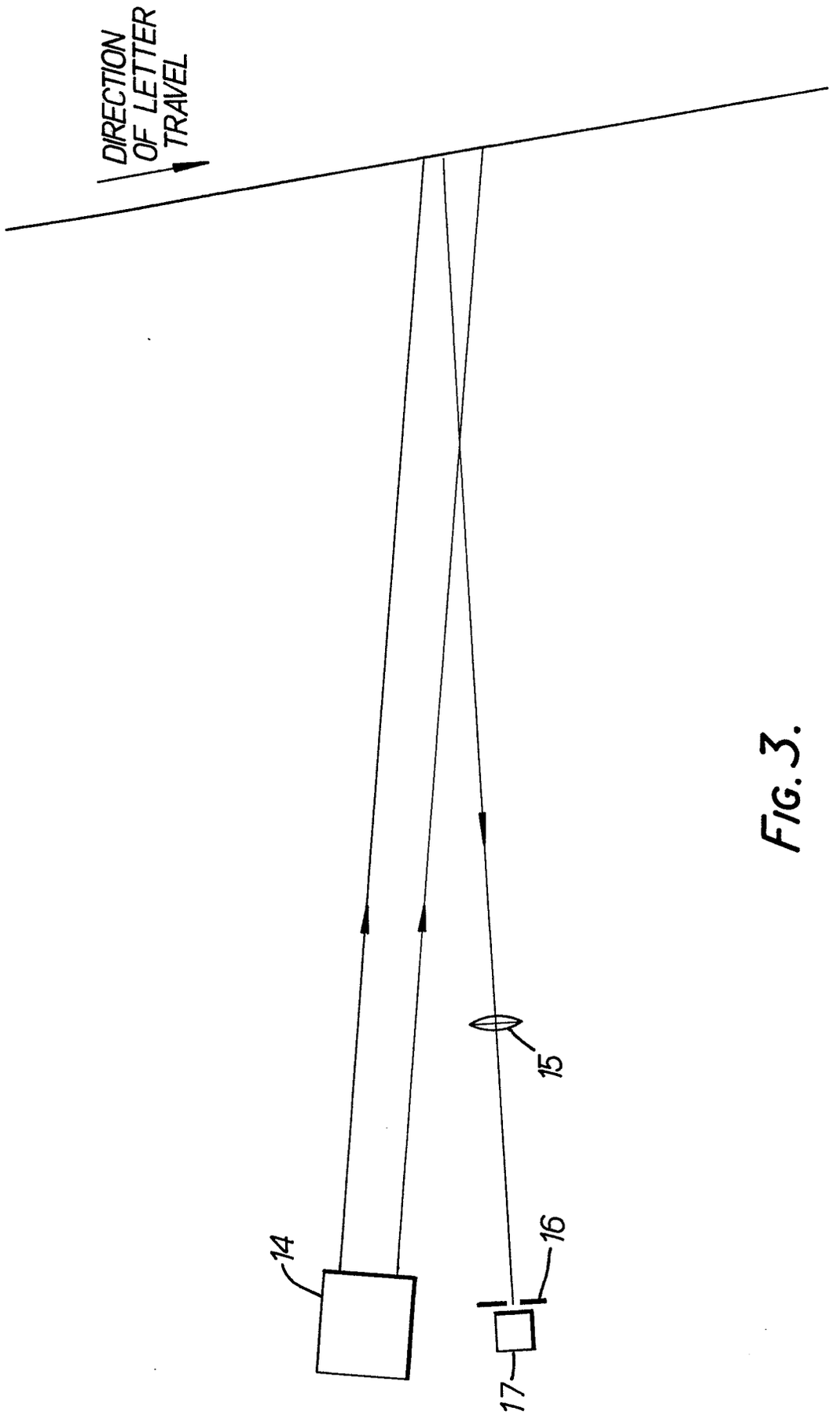


FIG. 3.

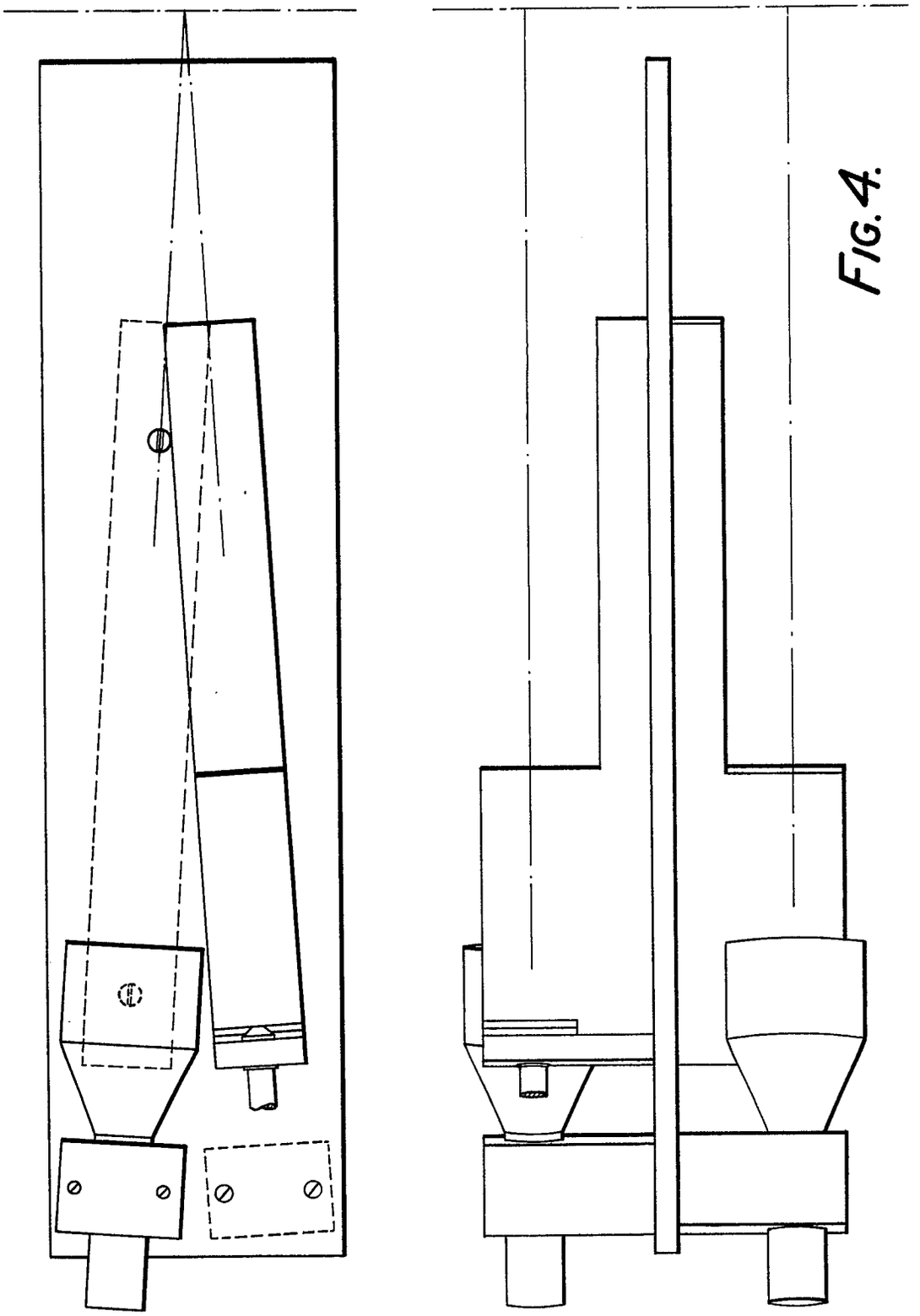


FIG. 4.

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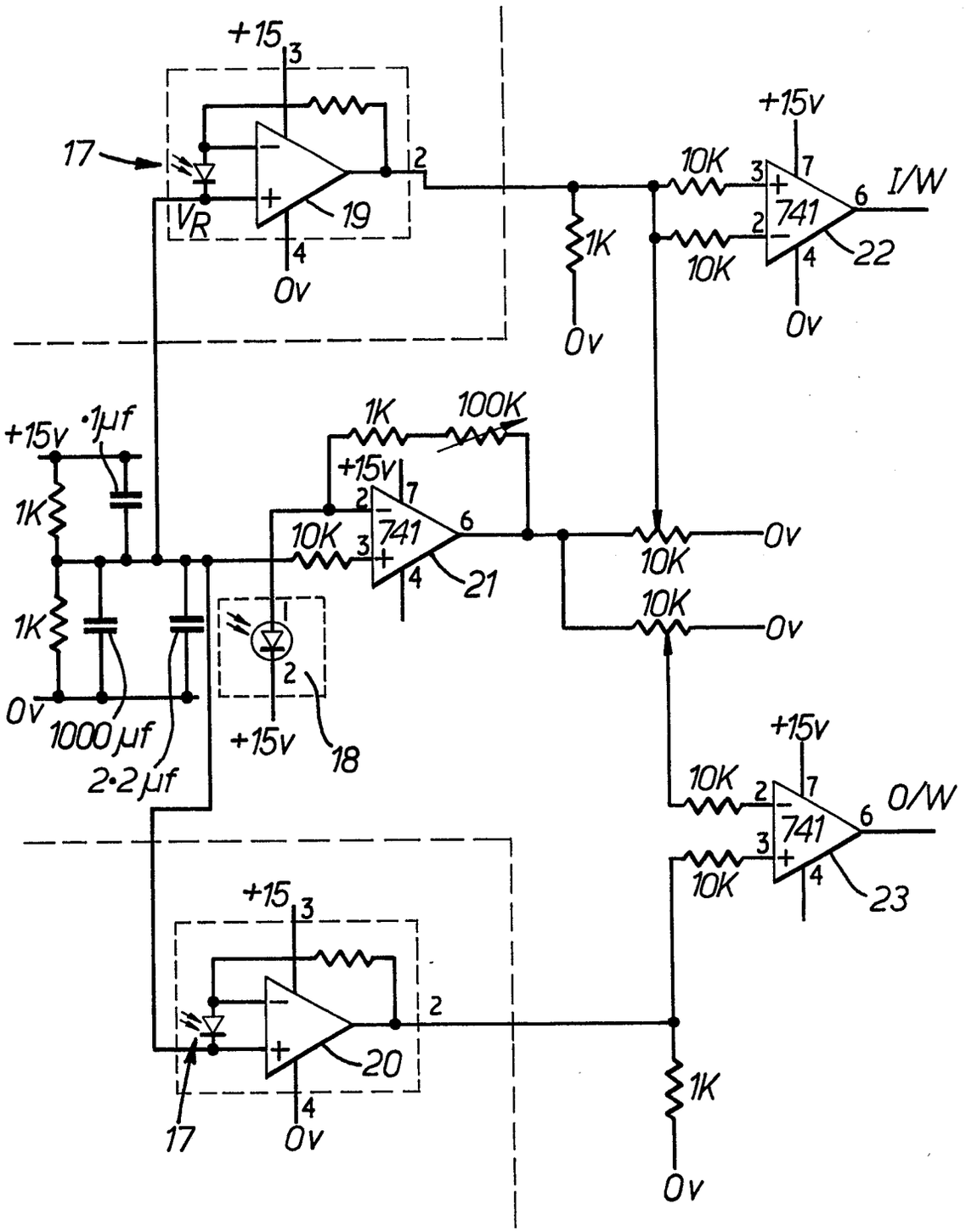
+15
3
17
2
VR
19
4
0v
1K
0v
+15v
10K
3
7
741
6
I/W
2
10K
4
22
0v
+15v
·1µf
1K
1K
100K
+15v
2
7
10K
3
741
6
4
21
10K
0v
10K
0v
1K
0v
1000µf
2·2µf
2
+15v
18
+15v
10K
2
7
741
6
O/W
3
10K
4
23
+15
3
2
20
4
17
0v
1K
0v

FIG.6.

European Patent Office

EUROPEAN SEARCH REPORT

0105061
Application number

EP 82 30 5205

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. ³)
A	GB-A-1 294 784 (GAO)	1	B 07 C 3/18
A	THE POST OFFICE ELECTRICAL ENGINEER'S JOURNAL, vol. 62, no. 2, July 1969, pages 120-124, London, GB C.F. FORSTER: "Luminescent materials used in postal automation" * Whole article *	1	
A	US-A-3 869 986 (PITNEY-BOWES)	1	
A	GB-A-1 276 420 (XEROX)	1	
A	US-A-3 787 881 (MEAD)	1	TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
A	US-A-4 243 876 (WESTINGHOUSE)	1	B 07 C 3 G 06 K 1 G 06 K 7

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	08-06-1983	FORLEN G.A.

CATEGORY OF CITED DOCUMENTS

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