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Ebukuro et al.

[11] **3,894,217**

[45] **July 8, 1975**

[54] **DEVICE FOR DISCRIMINATING COLOR CODED ARTICLES**

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[52] **U.S. Cl.** ..... **235/61.11 E;** 250/566

[51] **Int. Cl.** **G06k 7/10;** G08c 9/06

[58] **Field of Search** ..... 235/61.11 E; 340/146.3 K, 340/146.3 B; 250/555, 566; 209/111.6

[56] **References Cited**

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[57] **ABSTRACT**

A conventional color sensitive device produces a train of color signals responsive to rays incident thereon from an article having one of predetermined color codes. A pulse generator produces a pulse responsive to each of the color signals. A memory device produces a set of parallel signals responsive to the color signals and the pulses. Responsive to the parallel signals, a discrimination device produces a signal representative of the presence of the article having one of the color codes.

5 Claims, 3 Drawing Figures

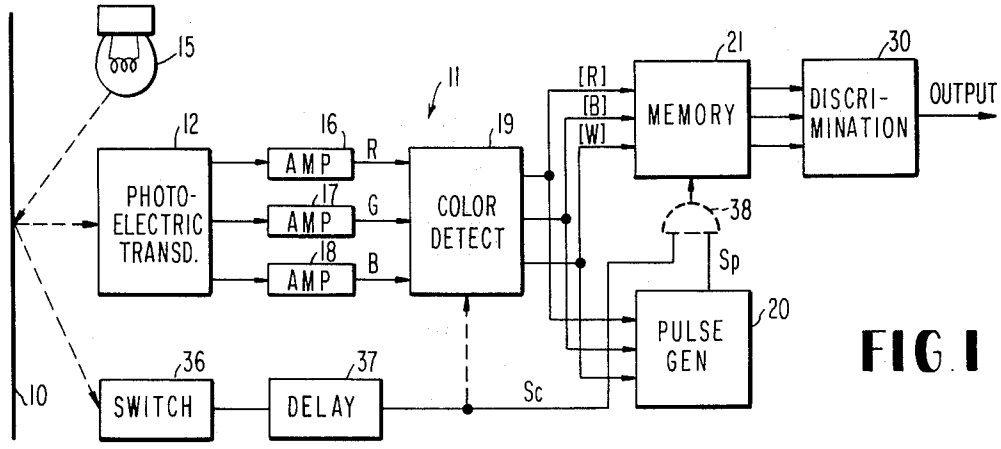


FIG. 1

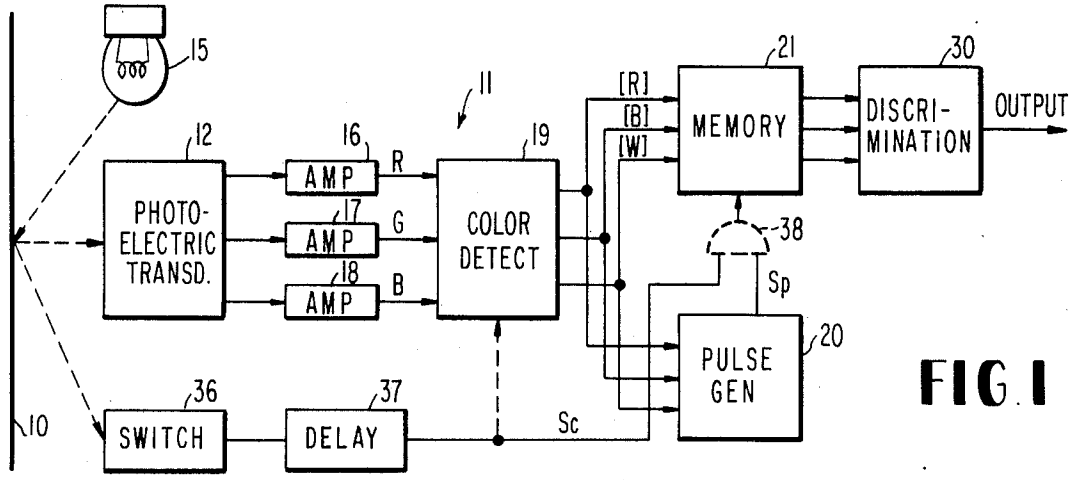


FIG. 1

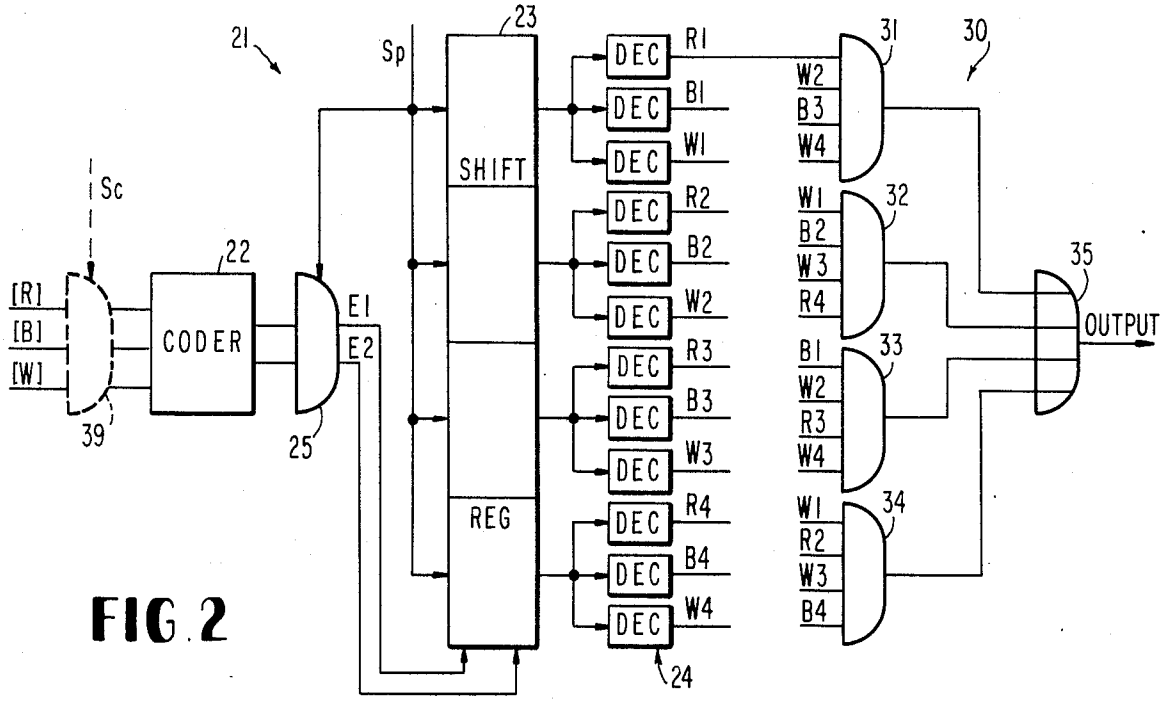


FIG. 2

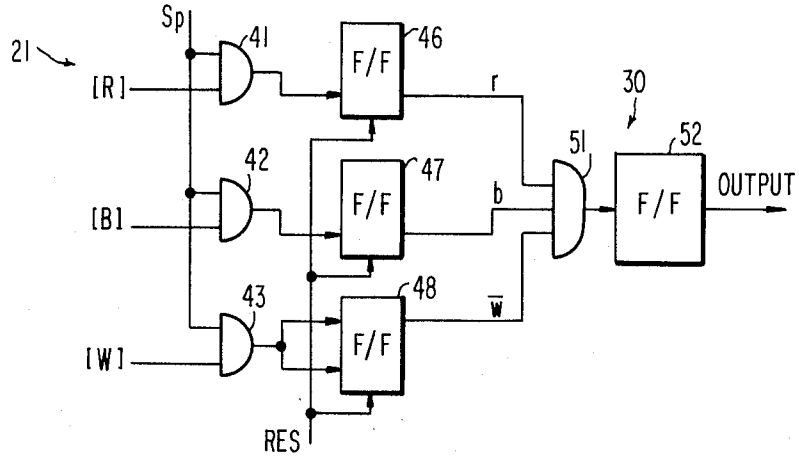


FIG. 3

DEVICE FOR DISCRIMINATING COLOR CODED ARTICLES

BACKGROUND OF THE INVENTION

This invention relates to a device for discriminating color coded articles from other articles. The device is useful in selecting airmails in automatic mail handling systems, in detecting articles having deficiencies in colors and their dispositions in manufacture, in sorting various color coded articles, and in other arts of handling articles having areas colored in a predetermined number of colors and arranged in predetermined orders.

To speak of the automatic mail handling systems, it is one of important functions to sort airmails from other mail articles. It has been conventional to select the airmails by detecting the colors of the relatively high-priced postage stamps usually attached to the airmails. This, however, results in mis-selection of some of airmails on which low-priced postage stamps used in ordinary mails were attached.

In general, there has been no device available for discriminating articles having predetermined color codes from other articles.

SUMMARY OF THE INVENTION

It is therefore an object of this invention to provide a device for discriminating articles having predetermined color codes from other articles.

A subordinate object of this invention is to provide a device for discriminating specific mails, such as airmails, from other mail articles without resorting to detection of the postage stamps attached to mails.

Specific articles to be discriminated by a device according to this invention have predetermined color codes. The color codes comprise areas, each colored in one of a predetermined number of colors, with the colored areas arranged in predetermined orders, respectively. The device comprises a conventional color sensitive device responsive to rays incident thereon from the colored areas of each article having one of the color codes for producing a train of color signals representative of the respective colors of the above-mentioned one color code. In order to produce the color signals in a train, the color sensitive device may manually be moved adjacent to the articles to be discriminated. In an automatically operable device, the articles to be discriminated are pereferably fed in front of the color sensitive device so that the color sensitive device may successively scan the articles. In accordance with this invention, the device for discriminating color coded articles comprises a pulse generator responsive to each of the color signals for producing a pulse. The device further comprises memory means responsive to the color signals and the pulses produced in response to the color signals for producing a set of parallel signals. The device still further comprises discrimination means responsive to the parallel signals for producing a signal representative of presence of the article having the above-mentioned one color code. The color may be one of the achromatic colors.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a block diagram of an embodiment of this invention;

FIG. 2 schematically shows an example of a portion of the embodiment depicted in FIG. 1; and

FIG. 3 similarly shows another example of the portion illustrated in FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

At first, an embodiment of this invention as applied to discrimination of airmails from other mail articles will be described by way of example. An airmail envelope has areas colored in a predetermined number of colors. The colored areas are arranged along the four edges of its front surface in one of predetermined orders. The colored areas may differ in color and width from envelope to envelope but may be said to provide predetermined color codes to the airmails. It is to be noted here that envelopes used in mails other than the airmails may have ornametal patterns on their front surfaces but that these patterns seldom coincide with the color codes of the airmails so that the mails having the predetermined color codes may be looked upon as airmails. For simplicity, it is assumed here that the colors used in the airmail envelopes as the codes are the background color called herein white for brevity, red, and blue and that the colored areas are arranged with a white area interposed between red and blue areas. In this connection, it should be pointed out that an automatic mail handling system includes a device for feeding mail articles one after another as described in U.S. Pat. No. 3,745,527 issued to Shoichiro Yoshimura, Rinzou Ebukuro, and Tomoyuki Isono, with one of the edges of each mail moving along a predetermined path.

Referring now to FIG. 1, a device for detecting the airmails among mail articles (not shown) fed one by one along a feed route **10** with aligned edges running along a predetermined path, comprises a conventional color sensitive device generally shown at **11**, which may be a combination of the filters **31** through **33**, phototubes **36** through **38**, and color detector **49** described in the above-mentioned patent. More particularly, the color sensitive device **11** comprises a photoelectric transducer device **12** responsive to rays incident thereon successively from the aligned edge portions of the mail articles. Preferably, the mail articles are illuminated by a lamp **15**. When an airmail is fed in front of the transducer device **12**, the colored areas of the airmail envelope send red rays (R), white rays (W), and blue rays (B) in one of the four orders: (1): (R), (W), (B), (W); (2): (W), (B), (W), (R); (3): (B), (W), (R), (W); and (4): (W), (R), (W), (B). The transducer device **12** comprises a condenser lens (not shown), means (not shown), such as one or more half-silvered mirrors, for splitting the rays having passed through the lens into a plurality of rays travelling along their respective paths, and a like number of phototubes (not shown) of specific spectral sensitivities placed in the respective paths of rays. Instead of the phototubes of the specific spectral sensitivities, use may be made of a plurality of optical filters disposed in the respective paths and phototubes of equal or different spectral sensitivities. Alternatively, dichroic filters may be used in place of the half-silvired mirrors and the optical filters. In the example being illustrated, the transducer device **12** produces responsive to the rays incident thereon from one of the colored areas one or a combination of a first signal representative of red R, a second signal representative of green G, and a third signal representative of blue B. The color sensitive device **11** further comprises three amplifiers **16, 17,** and **18** adjusted to produce equalized

signals representative of the three primary colors R, G, and B in response to the first through third signals. The adjustment may be carried out by placing a sheet of photometrically white paper in front of the transducer device **12** until the amplifiers **16** through **18** produce output signals of equal level. The color sensitive device **11** still further comprises a color detector **19** having a plurality of output terminals and responsive to the equalized signals for producing a train of color signals, which are a "red" signal [R], a "blue" signal [B], and a "white" signal [W] produced at three of the output terminals in one of the four orders mentioned above in the case being illustrated. It is to be noted here that the color detector **49** described in the above-referenced patent includes the above-mentioned amplifiers **16** through **18.** Alternatively, the color detector **19** may process the equalized signals to produce the color signals in the manner revealed in Japanese Patent Application No. Syo 41-71524 or Syo 39-48951. As a further alternative, it is possible under the circumstances where the colors of the color codes are limited to three, such as generally red, generally blue, and generally white, to produce the color signals [R], [B], and [W] with a color detector **19** of very simple construction, by distinguishing the generally blue color from the generally white color which may be somewhat blue.

Referring further to FIG. **1**, the device according to the present invention further comprises a pulse generates **20** responsive to the color signals [R], [B], and [W] for producing a pulse Sp each time the color signal appears, and a memory device **21** responsive to the color signals and the pulses Sp produced in response to the color signals for producing a set of parallel signals. The pulse generator **20** may comprise a plurality of differentiating circuits (not shown) supplied with the respective color signals to produce pulses at the leading and the trailing edges of each color signal, diodes (not shown) connected with a predetermined polarity to the respective differentiating circuits to gate those pulses which are produced only at the leading or trailing edges of the color signals, pulse shaping circuits (not shown) connected to the respective diodes to shape the gated pulses, and an OR gate (not shown) connected to the pulse shaping circuits for producing the pulses Sp. As will become clear later, the pulses Sp serve to make the device according to the present invention discriminate airmails having color codes of different colored areas from other mail articles. Preferably, the pulse generator **20** further comprises a delay circuit (not shown) for giving a slight delay to the output pulses of the OR gate so that the pulses Sp may appear when the approximate middle points of the colored areas are scanned. The delay circuit may be a monostable multivibrator.

Turning to FIG. **2**, an example of the memory device **21** comprises an encoder **22** responsive to each of the color signals [R], [B], and [W] for producing a coded signal representative of the color represented by the color signal, a shift register **23** responsive to the coded signal and the pulse Sp for producing a set of parallel coded signals, and a plurality of decoders **24** responsive to the parallel coded signals for producing the aforementioned parallel signals. Inasmuch as the colors are three in number, use may be made of a coded signal of two bits E_1 and E_2. For example, these bits E_1 and E_2 become logic "0" and "1" to represent red, logic 1 and 0 to represent blue, both logic 1 to represent white, and both logic 0 for other colors. The encoder **22** may be composed of gate circuits (not shown) in the manner readily occur to those skilled in the wired logics because the color signals do not simultaneously appear. It will now be understood that there is one-to-one correspondence between the pulses Sp and the respective combinations E_1 and E_2 of the coded signals and that the encoder **22** produces logic 0 coded signals when the color sensitive device **11** scans ordinary mails. Preferably, the coded signals are supplied to the shift register **23** through an AND gate circuit **25** controlled by the pulses Sp produced when the substantial middle points of the colored areas are scanned. The color detector **19** shown in FIG. **1** may happen to produce an erroneous color signal [R], [B], or [W] in response to a spurious colored area, such as the letters described on the front surface of the mail being scanned. Inasmuch as the spurious areas are generally smaller in width than the areas of the color codes, the coded signal produced in response to the erroneous color signal will not appear simultaneously with the delayed pulse produced in response to the erroneous color signal. In the example being illustrated, the shift register **23** may be a four-stage two-bit shift register in which the two-bit coded signal E_1 and E_2 is shifted from stage to stage by the pulses Sp. After four colored areas have been scanned, the shift register **23** produces at the respective stages a set of parallel coded signals, each consisting of two bits. When the colored areas of an airmail are scanned, three of the decoders **24** connected to each stage of the shift register **23** decode one of the parallel coded signals supplied thereto so that the decoders **24** produce four parallel signals R_1, W_2, B_3, W_4; W_1, B_2, W_3, R_4; B_1, W_2, R_3, W_4; or W_1, R_2, W_3, B_4, each from the pertinent one of the three decoders. When the mail being scanned is not an airmail, the decoders **24** do not produce four parallel output signals. Each of the decoders **24** may be composed of gate circuits (not shown) as will easily be understood by those skilled in the wired logics.

Turning back to FIG. **1** and referring further to FIG. **2**, the device according to the present invention comprises a discrimination device **30** responsive to the parallel signals for producing a signal representative of detection of an airmail. In the example being illustrated, the discrimination device **30** comprises four four-input AND gates **31, 32, 33,** and **34** connected to the decoders **24** in such a manner that a logic product signal is produced from the pertinent one, when a set of four parallel signals R_1, W_2, B_3, W_4; W_1, B_2, W_3, R_4; B_1, W_2, R_3, W_4; or W_1, R_2, W_3, B_4 are produced by the decoders **24.** The discrimination device **30** further comprises an OR gate **35** connected to the AND gates **31** through **34** so as to produce an output signal of the device according to this invention when one of the AND gates **31** through **34** produces a logic product signal.

Further referring to FIG. **1**, the device according to the present invention preferably comprises a photoelectric switch **36** placed adjacent to the feed route **10** upstream of the color sensitive device **11** and a delay circuit **37,** responsive to an output signal produced by the photoelectric switch **36** when the leading edge of a mail article enters the field of the photoelectric switch **36,** for producing a mail presence signal Sc that lasts from the time when the mail article enters the field of the color sensitive device **11** until the time at which the mail article tends to go out of the color sensitive device field. The mail presence signal Sc is supplied to an

AND gate **38** depicted with broken lines to open the same for a predetermined time interval so that the pulses S*p* may be produced only while a predetermined area of the mail article is scanned. The mail presence signal S*c* may further be supplied to another AND gate **39** shown in FIG. **2** with broken lines to ensure production of the coded signals, each having two bits E_1 and E_2 in the example being illustrated, within the predetermined time interval. Alternatively, the mail presence signal S*c* may be supplied to the color detector **19** as symbolized by a broken line connection to restrict in effect the area of scan.

In connection with the example illustrated with reference to FIG. **2,** it may be mentioned here that two of the decoders **24** for the parallel coded signals W_1 and W_4 may be dispensed with when the presence of a white area between a red and blue area is taken into consideration of the conditions for discrimination. Likewise, it is possible to dispense with the fourth stage of the shift register **23** in view of the predetermined orders of the colored areas. Further, use may be made of a shift register **23** having only two stages in consideration of the fact that a white area is always contiguous to a red and a blue area. It should, however, be noted that such simplifications of the device according to the present invention may result in misrecognition of airmails. On the contrary, it will be easy for those skilled in the art to adapt the embodiment thus far described to discrimination of airmails enclosed with airmails envelopes, each having a generally green area instead of the blue area, a generally green and a generally yellow area instead of the red and blue areas, or a continuation of a red, a blue, and a white area.

Referring now to FIG. **3,** another example of the memory device **21** comprises three two-input AND gates **41, 42,** and **43,** supplied simultaneously with the pulse S*p* and the color signals [R], [B], and [W], respectively, for producing a logic product signal in the presence of one of the color signals. The pulse S*p* serves as a sampling pulse which may be supplied similarly to the AND gates (not shown) of the encoder **22** shown in FIG. **2.** The memory device **21** further comprises flip-flops **46, 47,** and **48** set by the logic product signals produced in the presence of the red, blue, and white signals, respectively. The flip-flops **46** through **48** are reset by a reset pulse RES produced, for example, at the leading edge of the mail presence signal S*c*. It will be understood from FIG. **3** that the flip-flop **48** connected to the AND gate **43** for the white signal operates as a binary counter. Inasmuch as the white rays (W) appear twice in each of the four orders mentioned above, this flip-flop **48** is reset to turn the NOT output $\overline{w}$ to logic 1 when four colored areas have been scanned. This output $\overline{w}$ and set outputs *r* and *b* of the other flip-flops **46** and **47** serve as the afore-mentioned parallel signals. Another example of the discrimination device **30** comprises a three-input AND gate **51** supplied with the parallel signals for producing a logic product signal and a temporary memory, such as flip-flop **52,** for storing the logic product signal.

In operation, it is assumed that an airmail provides a pattern of the order (1) mentioned above. It is also assumed that the flip-flops **46** through **48** are reset at first to produce outputs *r*, *b*, and $\overline{w}$ which are logic 0, 0, and 1, respectively. Responsive to the red signal [R], the output *r* of the flip-flop **46** becomes logic 1. Responsive to the first white signal [W], the output $\overline{w}$ of the flip-flop **48** turns to logic 0. Responsive to the blue signal [B], the output *b* of the flip-flop **47** turns to logic 1. Responsive to the second white signal [W], the output $\overline{w}$ of the flip-flop **48** returns to logic 1. The AND gate **51** therefore produces a logic product signal of logic 1 to make the temporary memory **52** produce a signal representative of detection of an airmail.

Besides the examples described in the opening paragraph of the instant specification, a device according to the present invention is applicable to discrimination of express delivery mails from other mail articles if the express delivery mails are provided with specific color codes. As an example of sorting various color coded articles, it is possible with the use of an automatic assembly machine equipped with a device according to the present invention to deliver various color coded resistors to respective locations of electronic apparatus according to the resistances. An article to be detected may have two or more of the predetermined color codes.

What is claimed is:

1. A device for discriminating articles having predetermined color codes from other articles, said codes comprising areas, each colored in one of a predetermined number of colors, with the colored areas arranged in predetermined orders, said device including color sensitive means responsive to rays incident thereon from the colored areas of each article having one of said codes for producing a train of color signals representative of the respective colors of the areas of said one code, wherein the improvement comprises:

a pulse generator responsive to each of said color signals for producing a pulse,

an encoder responsive to each of said color signals for producing a coded signal representative of the color represented by said each color signal,

shift register means responsive to said coded signal and to the pulse produced in response to the color signal responsive to which said coded signal is produced, for producing a set of parallel coded signals,

a plurality of decoders responsive to said parallel coded signals for producing said parallel signals, and

discrimination means responsive to said parallel signals for producing a signal representative of said each article.

2. A device as claimed in claim **1,** wherein said discrimination means comprises:

a plurality of AND gates, each responsive to the parallel signals produced responsive to a predetermined number of the colored areas for producing a logic product signal and

an OR gate responsive to said logic product signal for producing the signal representative of the article having said one code.

3. A device as claimed in claim **1,** further comprising:

article detection means responsive to rays incident thereon from a predetermined number of said colored areas for producing an article presence signal and

gate means enabled by said article presence signal for making said memory means produce said parallel signals only while said rays are incident on said color detection means from said predetermined number of the colored areas.

4. A device for discriminating articles having predetermined color codes from other articles, said codes

comprising areas, each colored in one of a predetermined number of colors, with the colored areas arranged in predetermined orders, said device including color sensitive means responsive to rays incident thereon from the colored areas of each article having one of said codes for producing a train of color signals representative of the respective colors of the areas of said one code, wherein the improvement comprises:

a pulse generator responsive to each of said color signals for producing a pulse,

a plurality of AND gates responsive to said pulses and the respective ones of said color signals for producing logic product signals, respectively, said logic product signals being representative of the respective colors respresented by said color signals,

a plurality of flip-flops set by the respective ones of said logic product signals to produce said parallel signals; and

discrimination means responsive to said parallel signals for producing a signal representative of said each article.

5. A device as claimed in claim **4,** wherein said discrimination means comprises:

an AND gate responsive to the parallel signals produced responsive to a predetermined number of the colored areas for producing a logic product signal and

a temporary memory responsive to the last-mentioned logic signal for producing the signal representative of the article having said one code.

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