

Nov. 5, 1968

C. C. SPERRY

3,409,129

LABEL SCANNING DEVICE AND PROCESS

Original Filed Oct. 5, 1966

3 Sheets-Sheet 1

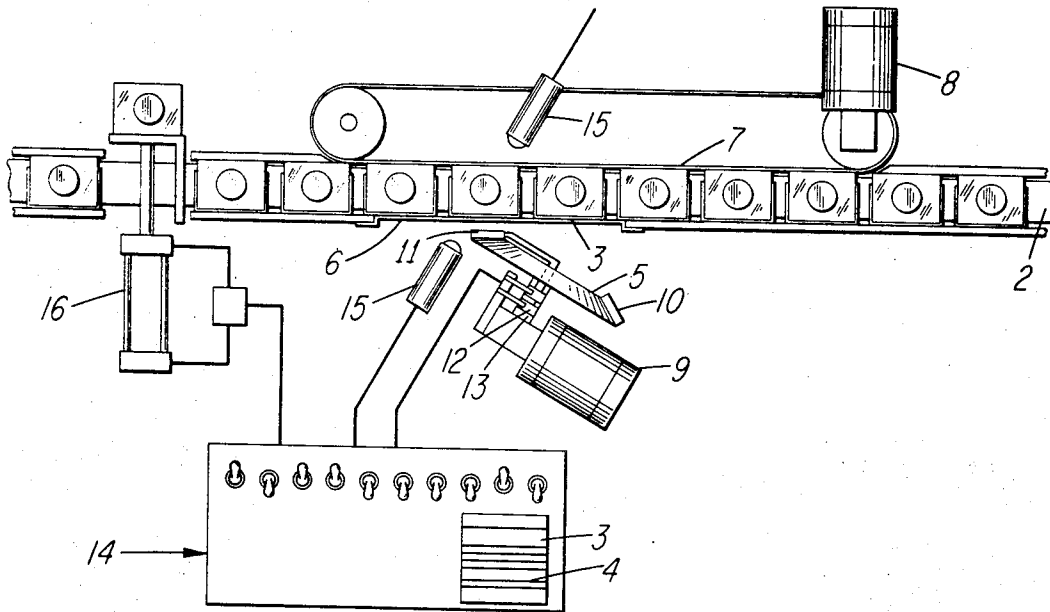


figure 1

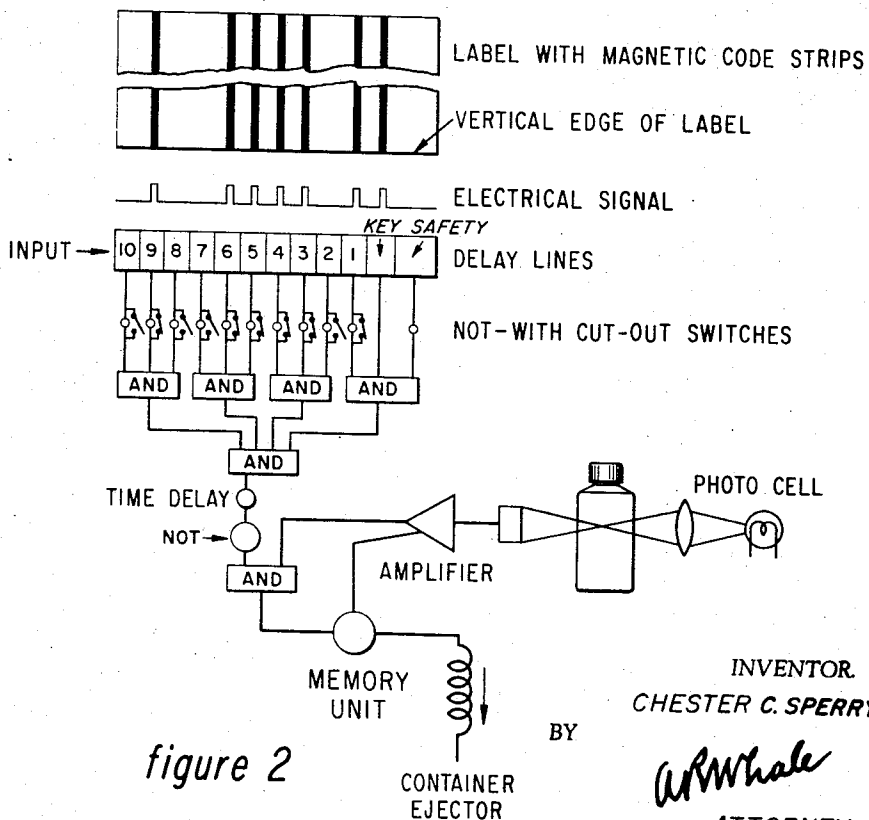


figure 2

INVENTOR
CHESTER C. SPERRY

BY

A. P. White
ATTORNEY

Nov. 5, 1968

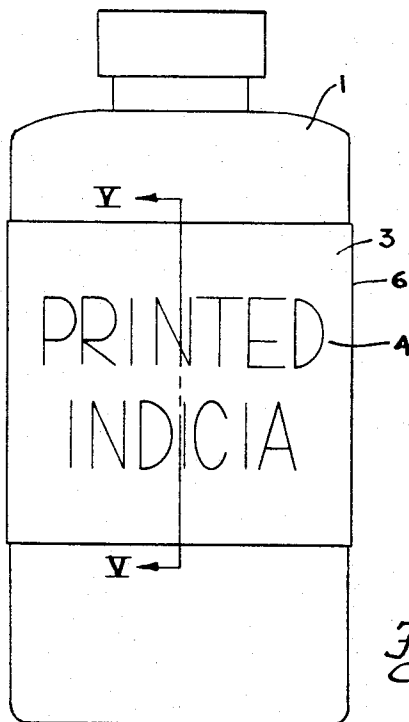
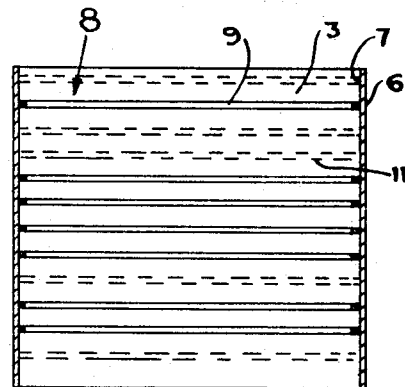
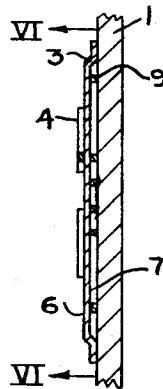
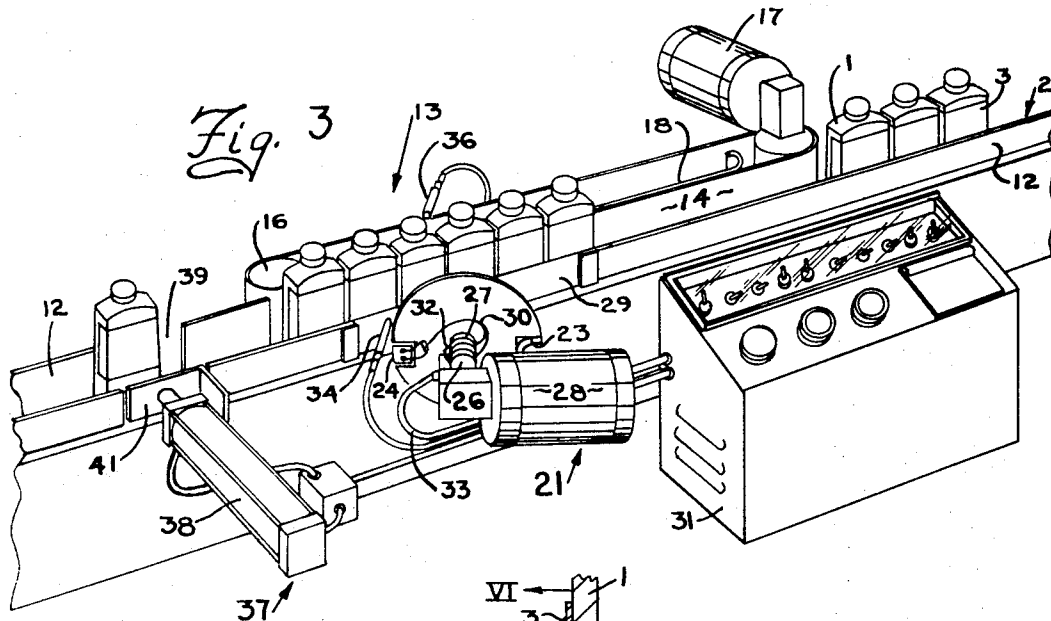
C. C. SPERRY

3,409,129

LABEL SCANNING DEVICE AND PROCESS

Original Filed Oct. 5, 1966

3 Sheets-Sheet 2



INVENTOR
CHESTER C. SPERRY
BY
Robert E. Woodhams
ATTORNEY

Nov. 5, 1968

C. C. SPERRY

3,409,129

LABEL SCANNING DEVICE AND PROCESS

Original Filed Oct. 5, 1966

3 Sheets-Sheet 3

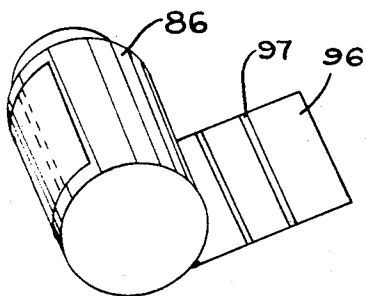


Fig. 9

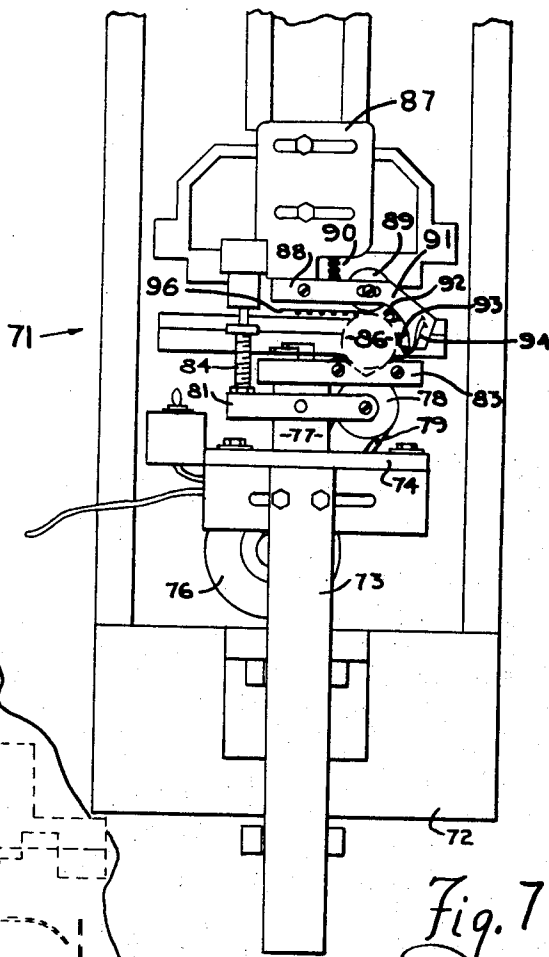


Fig. 7

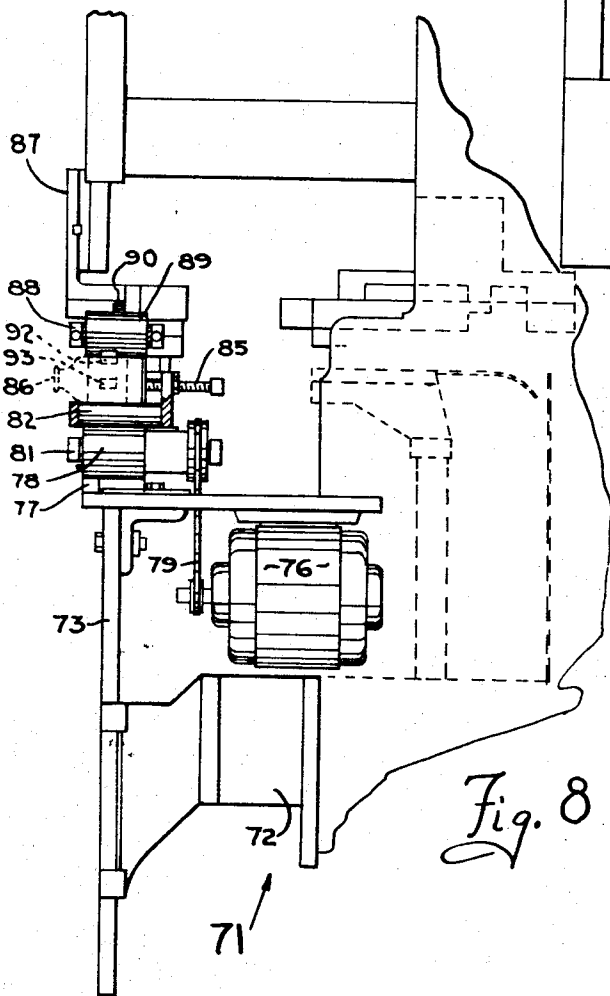


Fig. 8

INVENTOR
CHESTER C. SPERRY
BY
Robert E. Woodhouse
ATTORNEY

1

3,409,129

LABEL SCANNING DEVICE AND PROCESS

Chester C. Sperry, Kalamazoo, Mich., assignor to The Upjohn Company, Kalamazoo, Mich., a corporation of Delaware

Continuation of application Ser. No. 622,005, Oct. 5, 1966. This application Jan. 15, 1968, Ser. No. 705,878
32 Claims. (Cl. 209—111.8)

ABSTRACT OF THE DISCLOSURE

A method and apparatus for sensing the presence of an improper label on an object in a line of successively presented labeled objects, in which apparatus a code pattern is applied to the label. The code pattern is unique to the particular type of label to which it is applied, and a detector is employed to sense the absence of a correct code pattern on the label and to provide an appropriate signal.

This application is a continuation of application Ser. No. 622,005, filed Oct. 5, 1966, now abandoned, which in turn was a continuation-in-part of application Ser. No. 290,030, filed June 24, 1963, also abandoned.

This invention relates to a method and apparatus for detecting proper labeling of objects and more particularly relates to such a method and apparatus utilizing a code on the label, which code is not visible on the installed label and in no way interferes with the normal design and printed information on the label together with a highly effective method for scanning same.

In many industries, such as the pharmaceutical industry, extreme precautions are taken to prevent label mix-ups in which the wrong label is affixed to a container either by hand or in automatic labeling equipment. A variety of means for checking the containers for proper labeling have been employed in the past, but in general have been insufficiently reliable and/or rapid, particularly for use with efficient high-speed processing and finishing lines. Heretofore, perhaps the most common method for spotting and removing mislabeled bottles from a series thereof moving past a checkpoint has been to employ a human observer. However, it has been found necessary to replace the observer at frequent intervals, for example, at the end of a twenty minute shift, in order to insure reliable detection of mislabeled containers.

Attempts have been made in the past to provide mechanized devices for detecting mislabeled bottles. Many of these, such as the one shown in U.S. Patent No. 2,783,389, have required a precise positioning of the label with respect to the detecting apparatus, which in turn requires a precise positioning of the label on a bottle and an equally precise positioning of the bottle on a conveyor. However, normal container processing lines currently in use allow some variation in the positions of the containers thereon and current labeling methods used allow some variation in the position of the label on the container. In other words, the tolerance of at least certain prior inspection devices was less than that permitted to the bottles, the labels or the position of the labels on the bottles. This results in rejection by the detecting device of numbers of acceptably labeled containers along with the incorrectly labeled ones and hence is not commercially satisfactory.

In working with this problem there have in the past been suggested many types of scanning devices for inspecting the label and many labels have been suggested for this purpose utilizing various marking indicia of which some utilize markings made by energy radiating inks. Examples of such inks are magnetic inks and fluorescent inks.

In dealing with the scanning portion of the problem, it was recognized that a given inspection device may be

2

called upon to inspect labels applied to containers of various shapes, such as containers of flat, cylindrical, elliptical or partially elliptical cross section. Further, while normally only a single type of container will appear in a processing line at any given time, under some circumstances it is possible that various types or shapes of containers will appear successively in a processing line and it is desirable that the scanning device be able to scan effectively all of such containers.

Further, even with close control of such containers in said processing line, it is entirely possible for them to occupy slightly different positions as same move along a conveyor line. Hence, whatever scanning system is provided, it must have sufficient tolerance to permit said scanning to be effective in spite of said differences in container shapes and in spite of slight differences in position of the containers on the conveyor.

Thus, it is an object of this invention to provide a method and apparatus for identifying mislabeled objects serially presented to an inspection station.

A further object of this invention is to provide a method and apparatus, as aforesaid, for sensing the presence of an improper label on an object in a line of successively presented labeled objects, in which apparatus a code pattern is applied to the label, the code pattern being unique to the particular type of label to which it is applied, and in which apparatus a detector is employed to sense the absence of a correct code pattern on the label and to provide an appropriate signal.

A further object is to provide a method and apparatus, as aforesaid, in which the code pattern on the mounted label is not visible or at least is quite inconspicuous compared to the printing or design on the face of the mounted label, in which the code pattern in no way interferes with or obliterates portions of printed matter or design on the label and in which the arrangement of printed matter and design on the label may be made independently of any consideration of the arrangement of the code pattern on the label.

A further object is to provide a method and apparatus, as aforesaid in which the code pattern includes a plurality of relatively wide and relatively widely separated bands of energy radiating material distributed over a large enough portion of the label to allow the detector to be spaced at a substantially greater distance from the container than would be possible with a visible magnetic code pattern small enough not to interfere with printed matter on the label.

A further object is to provide a method and apparatus, as aforesaid, useable with objects and labels of a wide variety of shapes and sizes in which the objects may move past the detector in a somewhat randomly spaced manner, in which some of the objects may be cocked or shifted toward or away from the detector within a relatively wide range, in which the objects may be axially displaced to some extent, in which the position of the label on the object may vary substantially from object to object, all without affecting the reliability of detection of incorrect labels.

A further object of this invention is to provide a method and apparatus, as aforesaid, in which the said bands are arranged substantially perpendicular to a selected straight-line element lying in the label carrying surface of said container and the scanning head is caused to travel rapidly and repeatably in a direction substantially parallel to and spaced from said element.

A further object of this invention is to provide a method and apparatus, as aforesaid, in which the code pattern consists of magnetizable indicia in which the magnetizable material is placed on the opposite face of the label from that bearing printed matter and/or design patterns

3

and in which the magnetizable material is applied to the back of the label so as to be sandwiched between the body of the label and the container to which the label is applied.

A further object of this invention is to provide a method and apparatus, as aforesaid, in which the detector is arranged adjacent the side of the object bearing the label and in which the detector senses the code pattern through the thickness of the label.

Other objects and purposes of this invention will be apparent to persons acquainted with apparatus of this general type upon reading the following description and inspecting the accompanying drawings.

In the drawings:

FIGURE 1 is a schematized top view of one form of apparatus according to this invention.

FIGURE 2 is a schematic of a preferred logic and ejection system for comparing and utilizing the signals produced in response to the code pattern on the object label.

FIGURE 3 is an oblique view of the apparatus of FIGURE 1.

FIGURE 4 is a front view of a label applied to an object by means of the apparatus and method embodying the invention.

FIGURE 5 is a fragmentary, somewhat schematized view taken on the line V—V of FIGURE 4 with portions of the printed matter and one form of code pattern, said latter being raised for purposes of clear illustration.

FIGURE 6 is a sectional view taken on the line VI—VI of FIGURE 5 and showing the back face of the label of FIGURE 5.

FIGURE 7 is a front elevational view of a modified label detecting apparatus incorporated in a label attaching machine for small circular containers.

FIGURE 8 is a side elevational view, partially broken, of the apparatus of FIGURE 7.

FIGURE 9 is an oblique view of a container with a label partially applied thereto as by the labeling machine of FIGURES 7 and 8.

Certain terminology will be used in the following description for convenience in reference only and will not be limiting. The words "upwardly," "downwardly," "rightwardly" and "leftwardly" will designate directions in the drawings to which reference is made. The words "forwardly" and "rearwardly" refer to the direction of material flow through the device, forwardly being the normal flow direction and toward the left in FIGURES 1 and 3. The words "inwardly" and "outwardly" will refer to directions toward and away from respectively the geometric center of the device and designated parts thereof. Said terminology will include the words above specifically mentioned, derivatives thereof and words of similar import.

General description

In general, the objects and purposes of this invention are met by providing a method and apparatus for detecting incorrect labels on objects in which an energy radiating material is applied to the labels in a manner invisible from the front thereof and in a preselected pattern which designates the identity of the object labeled, the label normally bearing suitable printed indicia on the front face thereof to visually identify the object. Particularly, the material is applied in parallel, wide and spaced bars, or bands, the same often extending at least substantially across the full available dimension of the label, and being arranged in a direction substantially perpendicular to a straight-line element of said containers. A scanning head is arranged to scan rapidly the area occupied by said bands and to follow a path as close as possible to, and parallel with, said element.

In one preferred embodiment the energy radiating material is magnetic and the labels bearing same are fixed to the objects to be identified, the magnetic material being between the label and the object. Thereafter, the magnet-

4

izable material of each label, if not already magnetized, may be magnetized through the label. The code pattern is magnetically then detected through the thickness of the label by a magnetic detector, for example, as a series of such labeled objects pass along a processing line. An object whose label is incorrect, i.e., does not have a code pattern corresponding to the particular kind of object intended to be moving along the processing line, will then be ejected from the line by means responsive to the magnetic detector.

Detailed description

Referring now to FIGURES 1 and 3, the apparatus embodying the invention includes a substantially conventional conveyor 2 for transferring a plurality of objects, here, pharmaceutical containers 1 in a leftwardly direction. The containers 1 may be of any convenient, non-magnetizable type, for example, glass or plastic bottles where magnetizable ink is used but may be any material including glass or plastic where, for example, an invisible, fluorescent, ink is used.

Each of the containers 1 is provided with a label 3 carrying suitable printed matter generally indicated at 4 on its outer face 6 for indicating, in a conventional manner, the contents of the container 1, directions for useage thereof, or the like. In addition if desired, suitable decorative patterns or designs, not shown, may appear on the outer face 6.

In the embodiment here illustrated utilizing magnetic ink, same is placed on the back or inner face 7 of the label 3 to provide a code pattern, generally indicated at 8 (FIGURE 6). The code pattern 8 in such case comprises a plurality of magnetizable bands, bars or strips 9 arranged in spaced location with respect to each other, the pattern of spaces and bands providing an identifiable code, which as hereinafter described, can be detected for indicating proper or improper labeling of the container 1. The magnetic material may be applied to the back face 7 of the label 3 by any convenient means, for example, as a magnetic ink applied by conventional printing processes. In the preferred embodiment shown in FIGURES 5 and 6, the bands 9 are printed on the back 7 of the label at selected ones of evenly spaced, parallel stations distributed vertically on the label. In one embodiment, the bands were approximately $\frac{1}{2}$ inch wide and the stations at which they could be printed were spaced on $\frac{1}{8}$ inch centers. As indicated in broken lines at 11 in FIGURE 6, there may be blank stations at which no magnetic material is applied, the arrangement of stations bearing magnetic material and stations bearing no magnetic material providing a binary code distribution. Also in the preferred embodiment shown, the bands are elongated and extend the length of the label in a horizontal direction namely perpendicular to those straight elements parallel to the axis of the bottle by which the surface of the bottle is defined. When the bottle is circular or elliptical in cross section, said bands will still preferably be positioned perpendicular to the straight-line elements comprising the surface of the bottle on which the label is affixed. The same is true when the bottle is of uniform cross section or of changing cross section, such as conical, provided only that a substantial portion of the bottle is comprised of straight-line elements for purposes appearing hereinafter.

The back face 7 of the label is applied to the container 1 in a conventional manner as by adhesives, not shown, so that the magnetic bands 9 are sandwiched between the label 3 and the adjacent face of the container 1.

By proper choice of the paper stock for the label, the magnetizable bands 9 preferably are made not visible through the thickness of the label and thus from the front face 6 thereof. As a result, the presence of the magnetic bands does not interfere with, obscure, or in any way detract from, the appearance of the outer face 6 of the label or the printing or design thereon. At the same time, the

entire rear face 7 of the label is available for carrying the code pattern 8 so that the magnetizable area may comprise a large fraction of the total rear face area of the label and so that sufficient stations may be used as to provide a large number of possible codes while maintaining the area of each magnetizable band relatively large.

Returning to the conveyor 2 (FIGURES 1 and 3), same comprises in the preferred embodiment shown, a substantially horizontal and horizontally moving conventional belt 11 which is flanked by suitable guide rails 12 along the sides thereof. The conveyor 2 may, for example, be the output conveyor of a container labeling apparatus, not shown. A detecting station generally indicated at 13 is provided along the belt. At detecting station 13, a section of the far guide rail 12 is removed as seen in FIGURE 3. A vertical belt 14 supported by rollers 16 for movement in parallelism with the conveyor belt 11 and in the same direction thereas replaces the removed section of the guard rail 12 and is arranged for forcing the containers 1 on the conveyor 2 into positions near or against the opposite or near guide rail 12 as such containers move through the detecting station 13. A drive motor 17 of any convenient type is provided for powering the vertical belt 14. A rigid backup plate 18 holds the inner reach of the belt 14 against the containers 1. The containers 1 are here of rectangular cross section and are arranged on the conveyor so that the labeled side thereof faces away from the vertical belt 14. Thus, the belt 14 in urging the containers 1 against the rail 12 tends to maintain same, within limits, in alignment with each other as they are transferred leftwardly by the conveyor 2. However, the detecting apparatus, hereinafter described as the present invention admits some degree of cocking or transverse displacement of the containers on the conveyor without significant loss of detection capability. The spacing of the containers on the belt need not be even. It is, however, desirable that the conveyor belt 11 run at a constant, known speed to insure proper coordination of the detecting and ejecting means hereinafter described.

A detection unit generally indicated at 21 is disposed on the near side of the conveyor 2 opposite the vertical belt 14. The detection unit 21 includes a disk 22 rotatably mounted on a horizontal axis, the location of said axis preferably being vertically centered on the labels 3 of the containers 1 being moved therepast. The disk 22 in the preferred embodiment shown has its radial face disposed at a small, horizontal angle to the opposed faces of the containers 1 moving therepast. A permanent magnet 23 or some other similar suitable magnetizing device and a magnetic pickup device or transducer 24, here a conventional magnetic sensing head, are mounted on the disk. The magnet 23 and pickup 24 are preferably diametrically opposed for purposes of balance and are preferably located at the disk periphery. The diameter of the disk is preferably substantially larger than the vertical span of the code pattern 8 so that the movement of the magnet and sensing head past the label will be at least approximately parallel thereto and substantially perpendicular to the magnetizable bands.

The disk 22 is supported for rotation on a shaft 26. The shaft 26 preferably carries a pair of slip rings indicated at 27 to which the output of the sensing head 24 is connected by wiring 30. The shaft 27 is rotatably supported and driven by a constant speed motor 28 fixedly mounted beside the conveyor 2 by any convenient means not shown. The motor 28 energizes the rotatable disk so that the velocity of the pickup 24 substantially exceeds the speed at which the container is moved leftwardly by the conveyor 2. Particularly, where the container has a curved surface comprising straight-line elements, both the alignment and speed of said disk is so related to the position of the container on the conveyor and the speed of the conveyor, that both the pickup and the magnet run substantially parallel to one of said elements for the full extent of a code pattern. Thus, the pickup and magnet can scan completely

across the code pattern area of each label at least once as the container moves therepast. Where the side rails 12 are of magnetizable or electrically conductive material, the portion of the near rail opposite the disk 22 is replaced by a nonmagnetic strip 29, for example, of a plastic such as mylar, to prevent interference with sensing of the code pattern 8 on the labels.

The permanent magnet 23, rotated by the disk 22, sweeps over the label of the opposed container and magnetizes each of the magnetizable bands on the back of such label. As a result, the pickup 24, as it is swept by the disk across the magnetized label, produces a series of electrical pulses whose number and spacing in time conform to the number and spacing of the bands 9 in the code pattern 8. These pulses are delivered to a decoding device generally indicated at 31 which connects to the slip rings 27 through suitable brushes 32 bearing thereon and a cable 33.

The decoding device 31 preferably comprises conventional logic circuitry for comparing the code pattern represented in the number and repetition of the signals generated by the pickup 24 as it sweeps past a container on the conveyor 2 with the desired code pattern 8 on the correct label. The decoding device 31 is fed by a photocell 34 energized by an opposed light source 36, the photocell and light source being obliquely disposed on opposite sides of the conveyor. The photocell 34 lies just to the left of the path of the pickup 24 and the light source 36 is disposed just to the right of the pickup when the latter is scanning a container label. Thus, a container will come between the light source 36 and photocell 34 just after moving into the path of the pickup.

A container ejector system generally indicated at 37 is controlled by the decoding device 31 in response to signals of the photocell 34 and pickup 24 as hereinafter described and includes, in the preferred embodiment shown, a pressure fluid cylinder 38 fixedly mounted by any convenient means not shown opposite an opening 39 (FIGURE 3) in the guard rails 12 at a location downstream of, that is, to the left of, the detection unit 21. The piston of the pressure fluid cylinder 38 supports an ejector plate 41 arranged for contacting and transversely removing an opposed container 1 from the conveyor in response to suitable signals from the decoding device 31. Although it is contemplated that the decoding device 31 may be of any desired type capable of detecting incorrect labels on the basis of signals from photocell 34 and the pickup 24 for causing ejection of incorrectly labeled containers from conveyor 2, a particular preferred circuit is described below.

Thus, the decoding device 31 here illustrated includes a series of delay lines generally indicated at 42 (FIGURE 2) there being one such delay line for each station 11 on the back of the label 3. Thus, in the particular embodiment shown there are ten stations 11 in sequence on the back of the label corresponding to the delay lines numbered 1 through 10 in FIGURE 2. An eleventh station scanned by the pickup 24 before the others corresponds to a further delay line, labeled the "KEY" delay line, at the end of the first ten delay lines above mentioned. In this embodiment, the key station is always provided with a magnetic band. In addition a still further delay line, labeled the "SAFETY" delay line follows the KEY delay line. However, the SAFETY delay line does not have corresponding stations for a magnetizable band on the label. With the exception of the KEY delay line, the delay lines are all connected through conventional "NOT" logic circuits indicated schematically at 43. The outputs of the NOT circuits and of the KEY delay line connect in groups, here of three, to conventional "AND" logic circuits 44. A manually actuable cutout switch 46 is connected in parallel with each of the NOT circuits 43 except for that connected to the SAFETY delay line. The output of the AND circuits 44 connects to a secondary AND circuit 47, the output of which feeds through a time delay 48 and a further

NOT circuit 49 to one input of a final AND circuit 51. The other input of the final AND circuit 51 connects to the output of an amplifier 52 in turn energized from the photocell 34. A further output of the amplifier 52 and the output of the final AND circuit 51 feeds the input of a memory unit 53. The output of the memory unit 53 connects to the energizing coil 54 of a solenoid valve 56 (FIGURE 1) actuable in response to the energization of the coil 54 for extending the piston rod of the ejector cylinder 38 and thereby removing a container 1 from the conveyor 2.

Operation

Although the operation of the present invention has been indicated to some extent hereinabove, same will be now summarized to assure a complete understanding of the invention.

When the labels 3 of the above-described embodiment are prepared, each is supplied with magnetic bands 9, preferably by printing with a magnetizable ink as above described, at preselected ones of the stations 11 on the back face 7 of the label. The resulting code pattern 8 formed by the arrangement of magnetizable and non-magnetizable stations uniquely identifies the particular product to be packaged in the container 1 intended to carry the label 3. Thus, the code pattern 8 on the back of the label corresponds directly to the design and printed information on the front of the label in turn providing a visual identification of the product. Thereafter, the label is applied to the container 1 usually by means of suitable adhesive. The labeled containers are then placed in sequence on the conveyor 2, which may, for example, be an existing conveyor running from a labeling device to a filling device, the labels facing transversely of the conveyor in the direction of the detection unit 21.

The conveyor 2 moves the containers 1 leftwardly (FIGURES 1 and 3) toward the disk 22, the vertical belt 14 maintaining the containers adjacent the near rail 12 and generally parallel thereto. As the containers move leftwardly each eventually reaches a position opposite the portion of the disk nearest the conveyor. Rotation of the disk 22 scans the magnet 23 across the label 3 to magnetize the bands 9 on the back thereof through the thickness of the label. The rotating disk then scans the pickup 24 across the magnetized label, the pickup being energized as it passes over each magnetized band to produce a series of pulses whose number and repetition rate conform to the magnetized code pattern 8. These signals are delivered through slip rings 27 on motor shaft 26 to the decoding device 31.

Since the sensing head is rotating at constant speed, a known time elapses between its passage between adjacent magnetized bands 9, the time depending on the distance between such adjacent bands. It is the varying distances between magnetized bands and the number of said bands, characteristic of the code pattern on the particular label being scanned, that provides the necessary interval between signals required by the decoding device in its comparison function.

Reading is initiated by the first or KEY band on the label, which serves to activate the logic circuit for receiving the ensuing code. The pulses generated by the sensing head 24 are fed into the input end of the delay line set 42 and travel rightwardly therealong particular delay lines corresponding to the time elapsing between signals at a rate corresponding to the scanning rate of the pickup 24 across the label 3. Thus, as the pickup head passes the last station 11, the KEY pulse will be lodged in the KEY delay line and the pulses read from succeeding bands of the code pattern 8 will lie in corresponding ones of the delay lines. The remainder of the decoder 31 is not activated until a pulse is present in the KEY delay line. On the other hand, the SAFETY delay line prevents spurious actuation of the decoder 31 after the KEY pulse leaves the KEY delay line. Thus, the decoder

is activated by the delay line set only when the KEY pulse is in the delay line set. As shown in FIGURE 2, the NOT cutout switches 46 are closed for each delay line corresponding to a magnetic band on the desired label for which the circuit is preset. Correct signals are thereby permitted to bypass the NOT units 43 and enter the AND unit 44 serving that particular bank. If all the inputs to the AND unit 44 receive signals or are connected to an unshunted NOT unit, such AND unit 44 will conduct. Similarly, if all the inputs to the secondary AND unit 47 are energized it will produce an output. Lack of a signal in a delay line whose associated cutout switch 46 is closed prevents an output from the corresponding AND unit 44 and, hence, from the AND unit 47. On the other hand, a signal from a wrong label will encounter an open cutout switch 46 and therefore will enter the corresponding NOT unit 43, which will transmit an incorrect signal to its AND unit 44. The last decoding AND unit 47 receives signals from its subsidiary AND units 44 for transmission to the last decoding NOT unit 49. If a proper signal is received, the last decoding NOT unit 49 converts the correct AND signal to one that will inactivate the ejector system and permit the correctly labeled container to pass. A wrong signal from the last decoding AND unit to the last decoding NOT unit will result in no inactivating signal therefrom and the ejector circuit will function to eject the mislabeled container from the line.

More particularly, as the bottle 1 moves across the path of the pickup 24, it breaks the light beam between the light source 36 and photocell 34. As a result the amplifier 52 applies a signal to memory unit 53 and to final AND unit 51. If the last NOT unit 49 also supplies an output to said AND circuit 51, the AND circuit 51 supplies a signal to the memory 53 which cancels the signal from the amplifier to the memory. Thus, the memory will not actuate the ejecting system. On the other hand, should the last NOT unit 49 fail to energize AND unit 51, the latter will have no output and the memory unit 53 will, when the wrongly labeled bottle 1 moves into position opposite the cylinder 38, energize the cylinder to eject the wrongly labeled bottle from the conveyor.

The disk 22 containing the permanent magnet 23 and transducer 24 rotates in close proximity to but out of contact with the coded label. The magnet may be positioned on the disk in any convenient location that will bring the magnet sufficiently close to the code pattern to impart magnetic properties thereto. The transducer is so positioned on the disk as to cut the lines of force emanating from the magnetized bands in code pattern 8. The allowable tolerance between the sensing head 24 and magnetic code depends on the strength of the magnetic field of the code pattern and the sensitivity of the sensing head. A distance of 0.06 inch separating the container label and sensing head has been found to be satisfactory in the usual case. It is apparent that more than one magnet and more than one sensing head can be employed where desired.

In the embodiment of FIGURES 1-6 the parallel bands 9 are horizontal. However, the bands can be oriented in any direction so long as the pickup and bands have relative movement substantially at right angles to the bands and along the plane of the label. The number of and interval between the bands or bars follows a binary counting system, the number of possible codes from n number of bars (including the key bar) being $(2^n - 1)$. The above number of possible codes assumes that the KEY station is provided with a magnetizable band in every label code pattern and moreover assumes that at least one magnetizable band, in addition to the KEY band, is present in each code.

Although a rotary motion of the disk bearing the transducer is shown for scanning the code pattern, any form giving similar relative motion between the transducer and code pattern will suffice.

Magnetization is shown in FIGURE 1 as being induced by a magnet affixed to the rotating disk. It is apparent that magnetization could be accomplished by other methods, including a magnet positioned upstream of the inspection point.

The illustrated embodiment shows the apparatus of this invention as applied to automatic labeling equipment in which bottles on a conveyor pass an inspection point where the present device is operative. It is clear, however, that the inventive concepts embodied herein can be adapted to various uses in which a succession of coded objects can be made to pass a given check point. The adaptability of this apparatus is such that it can be employed more widely than devices requiring contact between the code surface and transducer.

Particularly, where the bottle or the container carries its label on a curved surface thereof, and said bands are perpendicular to the straight-line elements comprising said curved surface, it will make no difference to the effectiveness of the detecting apparatus which portion of said curved surface is presented to the detecting head. Thus, so long as some portion of the band carrying surface of a container is adjacent the rail 29 of the conveyor, the detecting apparatus will work equally well. Further, it will make no difference if the label is axially positioned slightly upwardly or slightly downwardly from its intended location and will further make no difference to the effectiveness of the scanning operation if a label is located on the bottle somewhat at an angle with respect to the central axis of the bottle. Thus, the scanning operation herein described and the detecting operation resulting therefrom, will be effective and reliable even with labels misplaced on a container to a degree substantially greater than that normally allowed for esthetic reasons to such containers. Thus, if there is being inspected a bottle of circular cross section which has a label fully surrounding same and similar to the label 3, same can be handled by this embodiment of the invention since there will always be a portion of the label near and facing the detecting means in any rotational position of such a circular bottle.

It will be further recognized that the speed at which the detecting head crosses the pattern portion of said label will be a function of the width of said portion of said label and the speed at which said conveyor is moving. Particularly, said head will travel across the pattern portion of said label at a sufficient speed, taken in consideration with the simultaneous movement of the bottles along or with the conveyor, that said detecting head will run substantially parallel to the straight line element of the outer surface most nearly adjacent said detecting head, the distance of said detecting head from such element being at no time in excess of the distance at which said detecting head can operate effectively. At normal conveyor speeds, such as from 10 to 60 feet per min., this is easily accomplished by rotating the magnetizing and detecting heads on a disk of about 10 inches in diameter at a speed of about 1800 r.p.m.

Modification

FIGURES 7, 8 and 9 relate to a modified method and apparatus embodying the portion of the present invention relating to the use and positioning of the magnetic ink relative to a sensing head. FIGURES 7 and 8 disclose a labeling machine for small round containers which includes means for magnetizing and detecting the identity of the label. The labeling machine 71 of FIGURES 7 and 8 may be of any convenient type capable of applying a label to a rolling container. Briefly, however, the particular machine 71 disclosed to illustrate this modification includes a frame generally indicated at 72 which carries an upstanding lower pedestal 73. A table 74 carried by the pedestal 73 pendently supports a drive motor 76. An upstanding post 77 is carried by the table 74. A drive roller 78 is rotatably mounted on the rightward end of a rocker bar 81 pivotally mounted on a post 77 and is energized by the drive motor 76 through a belt 79. A pair of idler

rollers 82 are mounted on a crossbar 83 at the top of the post 77 and are driveably engaged at the undersides thereof by the drive roller 78, the drive roller 78 being held against the idler rollers 82 by means generally indicated at 84 bearing on the leftward end of the rocker bar 81. The idler rollers are arranged to support thereupon and therebetween a circular container indicated in broken lines at 86 and to rotate same for labeling. Positioning means 85 axially locate the bottle 86 with respect to the idler rollers 82.

An upper pedestal 87 is fixedly supported on the machine frame 72 in spaced relation above the lower pedestal 73.

A pressure bar 88 is supported adjacent one end thereof on the lower end of the upper pedestal 87 for limited pivotal movement and extends rightwardly as seen in FIGURE 7 therefrom over the bottle 86 to be labeled. The pressure bar 88 carries a pressure roller 89 rotatably thereon. The pressure roller is adapted to contact the upper surface of the bottle 86 and urge same firmly against the idler rollers 82, at least the idler rollers 82 being made out of high friction material capable of efficiently driving the bottle 86 rotatably. The pressure roller 89 may be urged against the bottle 86 by any convenient means, here a spring 90.

The rightward (FIGURE 7) end of the pressure bar 88 includes an extension 91 which curves downwardly in spaced relation around the bottle 86. The extension 91 carries a magnetizing member 92, here a permanent magnet and, in spaced relationship thereto and therebelow, a magnetic pickup head or transducer 93 of any conventional type. The pickup head 93 has wires 94 extending therefrom for connection to a suitable decoding unit such as the unit 31 described hereinabove with respect to FIGURES 1 and 3. It is in providing the extension 91 and more importantly the magnetizing member 92 and the pickup 93 that the apparatus 71 differs from previously known rotary labeling machines.

In operation, a label 96 (FIGURE 7), generally corresponding to the label 3 hereinabove described except as hereinafter discussed, is horizontally fed by any conventional means not shown rightwardly into the bite between the pressure roller 89 and bottle 86 to be labeled, the label 93 being supplied with a suitable adhesive on the lower surface thereof so that it adheres to the peripheral surface of the bottle 86 as it is pressed thereagainst by the pressure roller 89. Thus, as the bottle is rotated in a clockwise direction by the idler rollers 82, drive roller 78 and motor 76, the portion of the label adhering thereto is moved past the magnet 92 and pickup 93 as discussed further hereinafter. After labeling, the bottle can be ejected by any conventional means, not shown, and another may be fed into the place thereof.

The inner face of the label 96 is provided with magnetizable bands 97 (FIGURE 9) generally as discussed hereinabove with respect to labels 3 of FIGURES 1 through 6. However, in the particular embodiment shown, the containers or bottles 86 are relatively small, for example, being 30 to 50 cubic centimeters in internal volume. Also, the circumference of the bottles 86 is relatively large compared to the length thereof. Since the length of such a bottle is quite small there is room for relatively few circumferentially extending, magnetizable bands of the size and spacing discussed hereinabove with respect to the embodiment of FIGURES 1 through 6. Thus, the magnetizable bands 97 are placed on the label so that they extend axially of the bottle and are spaced circumferentially therearound whereby, without reducing the band width or spacing, substantially more bands can be applied than would be possible in the case of axially spaced, circumferentially extending bands. As a result of the relatively large number of bands, a relatively large number of code combinations is possible.

Thus, as the label 96 bearing the magnetizable bands 97 is applied to the bottle 86 by the pressure roller 89,

further rotation of the bottle moves the bands circumferentially past the magnetizing member 92 at a constant speed whereby such bands are magnetized. Substantially immediately thereafter the rotating bottle moves the bands successively past the pickup 93 which, due to the relative movement between same and the label, produces a series of impulses related in number and spacing uniquely to the code pattern on the back of the label determined by the magnetized bands 97. The signals from the pickup 93 may be fed to a suitable coding device such as that illustrated at 31 in FIGURES 1 and 3 from which a further signal may be obtained indicating as by a suitable alarm or the like whether the label is correct or incorrect or for operating suitable ejection mechanism, not shown, to remove the incorrectly labeled bottle from the normal sequence of subsequent processing.

While much of the foregoing description, and the drawings referred to therein, have assumed for purposes of illustration that the signalling material would be a magnetizable material placed on the back of the label, it should be reiterated that at least the broader scanning aspects of the invention can be carried out by any material energizable to radiate energy and which can be placed on the label in a manner which is invisible when viewed from the front thereof, including for example, a normally invisible but fluorescently energizable ink placed on bars on the front of the label in the same manner as above described with respect to the magnetizable ink placed on the rear thereof. Particularly, said bars will be of substantial width and spaced widely from each other in a manner above described and will be placed perpendicular to a straight line lying in the surface of the container and the scanning head will be caused to follow a path spaced from but substantially parallel to said selected straight line.

Although a particular preferred embodiment of the invention has been disclosed above for illustrative purposes it will be understood that variations or modifications thereof which lie within the scope of the appended claims are fully contemplated.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A process for identifying an incorrect object in a plurality of successively presented objects, comprising the steps of:

- providing a supply of labels having a code pattern of substantially parallel bars extending substantially across the label, said code pattern being correlated with the indicia on said label;
- applying the coded labels to said objects and causing the labeled objects successively to pass a checkpoint while moving in a line of travel generally parallel to said substantially parallel bars;
- traversing the code pattern of each labeled object as it passes said checkpoint with a detecting head responsive to said code pattern to generate a series of signals in the detecting head whose number and repetition rate correspond to the number and spacing of the bars in said code pattern;
- interpreting the number and repetition rate of said generated signals with respect to the code pattern corresponding to the indicia desired for said object; and
- rejecting any object having a nonconforming code pattern, whereby a label erroneously introduced into a stack of labels and applied therefrom onto an object will be identified and the object carrying such label can be removed from a processing line.

2. The process defined in claim 1, wherein said code pattern of each labeled object is traversed in close proximity thereto but out of contact therewith by said detecting head.

3. The process defined in claim 1, wherein said substantially parallel bars are formed of a magnetic material.

4. The process defined in claim 1, wherein said substantially parallel bars are placed on the back of said labels.

5. The process defined in claim 1, wherein said substantially parallel bars are made of a magnetizable material and placed on the back of said labels.

6. A process for the prevention of mislabeling in labeled packages, which comprises:

providing a supply of labels having a code pattern of substantially parallel bars extending substantially across the label, said code pattern being correlated with the indicia on said label;

applying the coded labels to said packages and causing the labeled packages successively to pass a checkpoint while moving in a line of travel generally parallel to said substantially parallel bars;

traversing the code pattern of each labeled package as it passes said checkpoint with a detecting head responsive to said code pattern to generate a series of signals in the detecting head whose number and repetition rate correspond to the number and spacing of the bars in said code pattern;

comparing the number and repetition rate of said generated signals with those obtainable from the code pattern corresponding to the indicia desired for said package; and

rejecting any package having a nonconforming code pattern whereby a label erroneously introduced into a stack of labels and applied therefrom onto a package will be identified and the package carrying such label can be removed from a filling line.

7. The process of claim 6, wherein said detecting head is caused to traverse said package in close proximity thereto but out of contact therewith.

8. The process of claim 6, wherein said substantially parallel bars are made of a magnetic material.

9. The process of claim 6, wherein said substantially parallel bars are made of a magnetic material and are applied to the back of said labels.

10. A method for detecting an incorrect object in a plurality of successively presented objects, each having a surface comprising a plurality of substantially parallel straight-line elements, comprising the steps of:

applying a material to said object in a predetermined pattern of at least substantially parallel bars arranged substantially perpendicularly to said elements;

said material being energizable to radiate a detectable signal and said parallel bars being arranged as a coded identification for a particular type of object;

creating a relative movement between a detecting head and said parallel bars, the path of said relative movement being substantially parallel to and adjacent a selected one of said elements;

effecting energization of said material and causing said detecting head to react to said signal and to produce an output pattern corresponding to the number and spacing of said bars; and

comparing said output pattern to a predetermined pattern for determining whether said object is correct.

11. The method defined in claim 10, wherein said straight-line elements define a curved surface and said detecting head moves past said bars in a path substantially parallel to a somewhat randomly selected one of said straight-line elements.

12. The method defined in claim 10, wherein said object is a label positioned in a container.

13. The method defined in claim 10, in which the object is a label placed on the surface of a container, said surface being generated from a plurality of straight-line elements.

14. The method defined in claim 10, wherein said object is a container moving in a direction substantially parallel to the longitudinal direction of said bars and said detecting head crosses said bars at such a speed

13

with respect to the speed of said movement that same follows a single element of said surface sufficiently close as not to be spaced from said bars at said element a distance exceeding the spacing tolerance at which said detecting head is capable of operating.

15. A method for detecting incorrect labels on objects, comprising the steps of:

providing a supply of labels having applied to the back face thereof a magnetizable material in a preselected pattern representing a coded identification for a particular kind of object, said labels being capable of identifying the particular kind of object other than by said magnetic material;

affixing the labels to objects to be identified thereby with the back face of the label facing the object;

magnetizing the magnetizable material on each label; magnetically detecting the magnetized pattern on the back of the label of each labeled object; and

signalling the presence of an object bearing a label whose magnetized material pattern deviates from said preselected pattern.

16. The method of claim 15, wherein said objects include a surface comprising a plurality of straight line elements generated by transverse movement of a straight line, wherein said magnetizable material is arranged in a plurality of substantially parallel bars positioned perpendicularly to said elements and where said signalling is carried out by passing a detecting head transversely to said parallel bars along a path substantially parallel to and adjacent a selected one of the straight-line elements comprising said surface.

17. The method defined in claim 15, in which the label is affixed to the object by rotating the object and causing the label to become wrapped therearound, in which the magnetizable material on the label is magnetized by rotating it with the object past a magnetizing device and in which the detection is carried out by further rotating the label with the object past a detecting device.

18. A method for detecting incorrect identifying labels on objects, comprising the steps of:

applying magnetizable material in a preselected pattern including several elongated, generally parallel bands to the back of each label, such pattern being unique to identifying labels of a single kind;

affixing the labels to objects in a generally upright condition with the back of each label facing its object so that the magnetic material is hidden from view by the label;

magnetizing the magnetizable material on each label; successively moving said objects past a detecting station with the labels thereof facing in generally the same direction and the bands aligned substantially parallel with the direction of movement;

repeatedly scanning a magnetic detector past the detecting station in a direction substantially transverse to the direction of movement of said objects and generally parallel to the face of the labels thereon for causing said detector to sense the pattern of said magnetic material through said label and to develop an electrical signal related thereto; and

electrically comparing said electrical signal with predetermined conditions and upon failure of such signal to meet such conditions, causing the labeled object associated therewith to be removed from the collection of objects.

19. Apparatus for detecting incorrect labels on containers presented thereto, the labels on such containers carrying magnetizable material on the back thereof arranged to form an identifiable code pattern, comprising in combination;

means for energizing a labeled container so as to provide movement of the label thereof past a point; a magnetizing element disposed at such point and arranged in close-spaced relationship to the path of

14

the label for magnetizing the magnetic material through such label; and

a magnetic detecting device fixed adjacent to the magnetizing device and also in close-spaced relationship for detecting the presence of magnetized material through the label.

20. Apparatus for detecting incorrect labels on containers successively passing a checkpoint, the labels on such containers carrying magnetizable material on the back side thereof arranged to form an identifiable code pattern, comprising in combination;

a rotatable disk positioned adjacent to and out of contact with the path of such moving containers and in close opposition to the path of the labels thereon;

means for rotating said disk;

a magnet mounted on said disk whereby rotation of said disk causes said code pattern to become magnetized in response to passage of said magnet therepast;

a magnetic pickup mounted on said disk for rotation therewith so that rotation of said disk causes said pickup to traverse the magnetic field of said magnetic code pattern on the opposed label for generating a series of signals whose number and spacing correspond to said magnetic code pattern; and

comparison means responsive to the generated signals for comparing the number and repetition rate pattern of said signals with the code pattern of a desired label.

21. The apparatus defined in claim 20, including a conveyor for carrying said containers past said disk and means associated with said conveyor for urging said containers toward the side of said conveyor toward said disk.

22. The apparatus defined in claim 20, in which said disk is arranged at an angle to said path so that said magnet and said pickup are disposed close to and opposite the path of the containers in only one relatively short segment of the rotation thereof.

23. The apparatus defined in claim 20, including container sensing means for determining when a container is positioned opposite said disk and ejector means responsive thereto for automatically ejecting a container sensed by said sensing means from said group of containers; and

said comparison means preventing automatic ejection by said ejector means when the pattern of the generated signals resulting from scanning of the label of said container corresponds to said code pattern of said desired label.

24. In combination with a machine for applying a label having a magnetizable code pattern on the back thereof to the periphery of a spinning container, the combination comprising:

a fixed support located adjacent and spaced from the perimeter of the container;

a magnetizing member affixed to said support and arranged in close-spaced relationship to and centrally of the label at a point beyond that at which the label is applied to the spinning container; and

a magnetic detecting device carried by said support at a point along the path of rotation beyond said magnetizing member and disposed in close-spaced relationship to and centrally of said label for detecting the pattern of said magnetizable material so that it can be compared with a predetermined pattern.

25. In combination with a container, a label affixed thereto comprising:

a label sheet;

visible indicia on the front face of the label sheet visually identifying the contents of said container; and a pattern of magnetizable material on the back face of said label sandwiched between said label and

15

said container which indicates in coded form the contents of the container.

26. The article defined in claim 25, in which said magnetizable material is arranged in a plurality of spaced, elongated bands of uniform width disposed at preselected ones of evenly spaced stations on the back of the label, the presence or absence of magnetizable material at each such station providing a binary code identification of the contents of said container.

27. The article defined in claim 26, in which the bands of magnetizable material extend axially of the container.

28. The article defined in claim 26, in which the bands extend circumferentially around the container.

29. The process defined in claim 1, wherein said coded substantially parallel bars are of energizable material capable when energized of radiating a detectable signal, and said energizable material is energized at said checkpoint and said detecting head is responsive to the radiation from said energized code pattern.

30. A process as set forth in claim 29, wherein said energizable material is fluorescently energizable and said detecting head is responsive to said fluorescence.

31. Apparatus for detecting an incorrect object in a plurality of successively presented objects, wherein each object bears a label having a code pattern of substantially parallel bars of energizable material on the label, said code pattern being correlated with indicia on said label comprising in combination:

means for moving each of said objects in succession past a checkpoint with said bars aligned generally parallel to the path of movement of said means;

an energizing means at said checkpoint arranged in spaced relation to the path of said labels for energizing said material and causing it to radiate a detectable signal; and

a detecting head means responsive to said radiating

16

signal for traversing said substantially parallel bars in a direction substantially transverse to the path of movement of said objects and the bars of said code pattern for interpreting said signal and rejecting any object having a nonconforming code pattern, whereby an incorrect label erroneously applied to an object will be identified and the object removed from said plurality of objects.

32. Apparatus for detecting incorrect labels on containers successively passing a checkpoint, the labels on such containers bearing normally invisible but fluorescently energizable markings arranged to form an identifiable code pattern, comprising in combination:

a rotatable disk positioned adjacent to and out of the path of such moving containers so that at least a portion of the disk is juxtaposed to the path of the labels thereon;

means for rotating said disk;

energizing means situated so that said code pattern fluoresces as it approaches said rotatable disk;

signal pickup means mounted on said disk, rotating therewith so as to traverse the energized markings and generating a signal in response thereto; and

comparison means responsive to the generated signals for comparing the number and repetition rate pattern of said signals with the code pattern of a desired label.

References Cited

UNITED STATES PATENTS

2,971,646	2/1961	Coffey	209—111.7
2,989,735	6/1961	Gumpertz	209—111.8
3,033,367	5/1962	Gumpertz	209—111.8
3,246,751	4/1966	Brenner et al.	209—111.5
3,309,711	3/1967	Sorrells et al.	209—111.5 X

ALLEN N. KNOWLES, *Primary Examiner*.