Feb. 14, 1961 H. F. COFFEY 2,971,646

ARTICLE INSPECTION AND SORTING APPARATUS

Filed Aug. 17, 1959

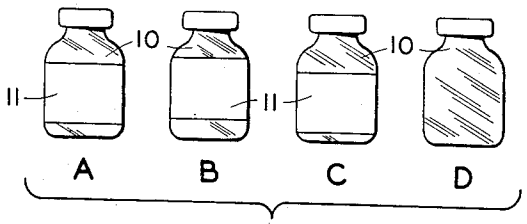


FIG. 1

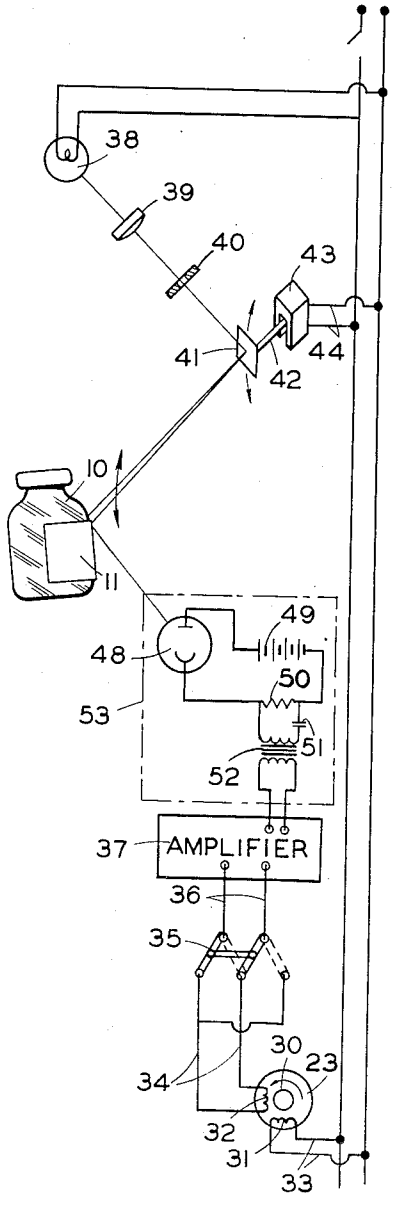


FIG. 4

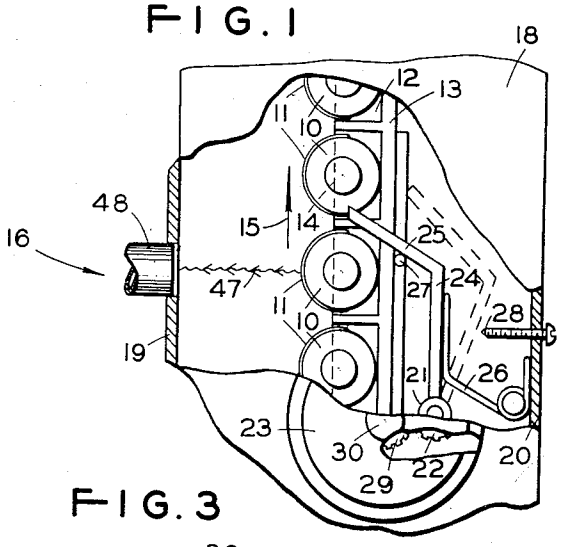


FIG. 3

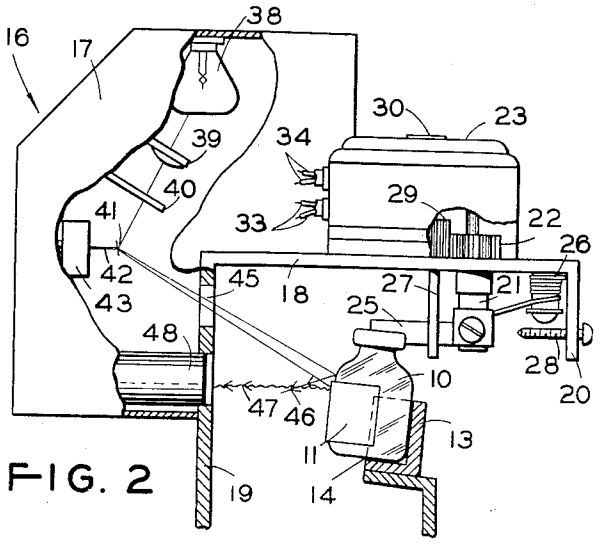


FIG. 2

INVENTOR.
HENRY F. COFFEY

BY George A. Ordway
Mad Green & Clark

ATTORNEYS

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ARTICLE INSPECTION AND SORTING APPARATUS

Henry F. Coffey, Indianapolis, Ind., assignor to Eli Lilly and Company, Indianapolis, Ind., a corporation of Indiana

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8 Claims. (Cl. 209—111)

This invention relates generally to an apparatus for controlling actuation of an A.C. magnetic induction type of electric motor and more particularly to an apparatus embodying as a component thereof such a motor and which apparatus rapidly and seriatim inspects, selects and rejects from a group of similarly labeled, like containers those containers having no labels or labels which are positioned too high, too low, or which are askew.

As is well known, it is particularly important and necessary in mass production packaging of drug products, for example, to be certain that their containers such as boxes, bottles, or vials each bear an identifying label and that the label be applied to the containers in a uniform position. In the pharmaceutical industry it is mandatory that no container be passed for shipment without bearing a label and that the labels be uniformly and properly positioned upon their respective containers.

It is an object of the present invention, therefore, to provide a label detection and sorting apparatus for rapidly sensing the presence or absence of a label, its position upon its container with respect to a predetermined standard, and the sorting and rejection of improperly or non-labeled containers from properly labeled containers on a high-speed, mass production basis.

Other objects and advantages of the invention will be apparent as the description proceeds in conjunction with the accompanying drawings, and will be more particularly pointed out in the claims which follow.

In the drawings:

Fig. 1 shows a typical example of articles which may be inspected and sorted by the use of my improved apparatus,

Fig. 2 is a side elevation of the apparatus, certain parts being broken away for clearness,

Fig. 3 is a fragmental top plan view thereof, certain of the parts also being broken away for clearness, and

Fig. 4 is a schematic layout of the apparatus together with wiring diagram therefor.

While the invention may be used for quality-control inspection and sorting of labeled objects as is disclosed herein for exemplification purposes only, it will be readily recognized that it has many applications for use in controlling a function-performing operation of an A.C. magnetic induction motor wherever there exists upon or in connection with an article or object adjoining, contrasting, light-reflective surface areas such as, for instance, the contrast in light-reflective qualities that are present between an area of the container per se and an adjoining area of the label or of an area of indicia on said label and an adjacent background area thereof.

Referring to Fig. 1 and reading from left to right, A shows an ampoule or vial **10** having a label **11** correctly positioned on said vial, B represents a vial upon which label **11** is too high, C indicates a vial whereon the label is too low, and D shows an unlabeled vial. In the type of sorting which will hereinafter be described, only vials having labels positioned as shown in A will be accepted and retained, and vials having labels positioned as in B and C or no label as in D will be rejected.

The articles or vials **10**, following the labeling operation at the labeling machine (not shown), are deposited in successive pockets **12** provided in an endless conveyor **13** only the upper stretch of which is shown in the drawings. Preferably conveyer **13** is disposed at a slight angle from the vertical as clearly shown in Fig. 2 to slightly tilt vials **10** within the pockets and the depth of pockets **12** are preferably substantially only about one-half the diameter of the vials so that the forward edge **14** of the base of the pocket acts as a fulcrum edge for rocking the vials out of the pocket in the event a vial is to be rejected. Conveyer **13** is arranged to transport the articles continuously in a horizontal, linear path in the direction of arrow **15** (Fig. 3) past the inspection device indicated generally at **16**.

Inspection device **16** comprises a housing **17**, a portion of the bottom of which is formed by an inverted C-shaped bracket **18** having depending legs **19** and **20**. The horizontally disposed flat of bracket **18** has passing downwardly therethrough a stub shaft **21** connected at its upper end to a gear **22** provided in an A.C. magnetic induction type of electric motor **23** mounted on the upper surface of the horizontal flat of bracket **18**. The lower end of stub shaft **21** has affixed thereto a reject lever **24** having an angularly disposed, forwardly projecting arm **25** extending into the path of travel of the necks or tops of vials **10**. A coil spring **26** maintains lever **24** and its arm **25** against a depending, limiting stop pin **27** secured in the horizontal strap of bracket **18**. An adjustable screw **28** threaded in leg **20** of bracket **18** may be adjusted to limit the degree of swinging movement which may be imparted to lever **24** and arm **25** upon operation of motor **23** as hereinafter to be described. Gear **22** meshes with a gear **29** fixed upon the lower end of a drive shaft **30** of motor **23**.

Motor **23**, as shown in Fig. 4, is provided with two separate magnetic field coils **31** and **32**, coil **31** being termed herein for convenience as an operating coil and coil **32** being referred to as a control coil. The leads **33** from operating coil **31** are connected across a source of A.C. current of predetermined voltage and cycle frequency as for example 110 A.C., 60 cycles. The leads **34** from control coil **32** are connected to a pair of terminals of a double-pole, double-throw or reversing switch **35**. A pair of leads **36** connects switch **35** to the output side of an amplifier **37**, the purpose of which hereinafter appears.

The label sensing and inspection portion of the apparatus is contained within housing **17** (Fig. 2) and includes a lamp **38** which for convenience may be connected across the same source of A.C. current as operating field coil **31**. The light beam from lamp **38** is focused through a suitable lens **39** and spaced slit element **40** upon a light-weight mirror **41** affixed on the outer free end of a vibrating reed **42** of an electrical A.C. operated, vibrator or chopper **43** which is connected by leads **44** across the same source of A.C. current to which the field operating coil **31** of motor **23** is connected. Mirror **41** is arranged to cast or project a vibrating light beam reflected therefrom through an aperture **45** provided in leg **19** of bracket **18**, in such manner that the vibrating light beam scans a portion of a vial **10** which constitutes a surface area having one degree of light-reflective qualities and an adjoining marginal area of label **11** which constitutes a surface area having a contrasting or different degree of light-reflective qualities. It will be understood that if desired the vibrating light beam projected from mirror **41** could be adjusted to scan a portion of a line or other indicia imprinted on a label **11** and a portion of an ad-

joining, contrasting background surface area of label **11**. In other words, the vibrating light beam functions to sense a differential in light-reflecting contrast existing between two adjoining surface areas, i.e., either a portion of vial **10** per se with respect to an adjoining portion of the label or a portion of the label bearing a mark or indicia with respect to an immediately adjoining portion thereof bearing no mark or indicia. The light rays striking the lesser light-reflective surface area are reflected downwardly therefrom as indicated by arrows **46** in Fig. 2 whereas the light rays reflected from the greater light-reflecting surface area (the label) diffuse laterally as indicated by the arrows **47** and are projected upon a photoelectric or light-sensitive cell **48**.

Referring to Fig. 4, light-sensitive cell **48** is connected across a source of D.C. current **49** in series with a load resistor **50**, thence through a capacitor **51**, to the primary of a D.C. to A.C. conversion transformer **52**. The secondary of transformer **52** is connected to the input of amplifier **37**. The circuitry just described is enclosed by dot and dash lines designated at **53** in Fig. 4 and shall be referred to as a conversion network. The capacitor **51** and resistor **50** of network **53** operate to electrically block passage of any signal output from transformer **52** except when the vibrating light beam projected from mirror **41** is scanning adjoining, contrasting light-reflective surface areas of a correctly positioned label as shown in A in Fig. 1. In other words, whenever the vibrating light beam projected from mirror **41** scans a vial wherein the label **11** is too high (B, Fig. 1), or too low (C, Fig. 1), or there is no label (D, Fig. 1), no current shall flow to control coil **32** of motor **23**.

Upon a correctly positioned label being sensed by the vibrating light beam, motor **23** is energized, driving its shaft **30**, say in a counterclockwise direction and, through gears **29** and **22**, rotates stub shaft **21** to move lever **24** and its reject arm **25** from the position shown in full lines in Fig. 3 to the position shown in dotted lines therein, out of the path of travel of vials **10** permitting the properly labeled vial to pass and be advanced by conveyer **13**. Upon de-energization of motor **23** immediately following passage of the accepted vial spring **26** urges reject arm **25** back into intercepting relation with the next vial **10** and if, upon sensing by the light beam projected from mirror **41**, said next vial should reveal an incorrectly positioned or no label, reject arm **25** remains in its effective or reject position to rock that vial **10** about fulcrum edge **14** and discharge it from conveyer **13** and so on.

If the light beam reflected from mirror **41** is positioned to scan adjoining, contrasting light-reflective surface areas wherein the greater light-reflecting surface area is above a lesser light-reflective surface area (the direct opposite to the situation just described), operation of motor **23** would then drive shaft **30** in a clockwise direction unless reversing switch **35** was moved from the full line position shown in Fig. 4 to the position shown in dotted lines therein. In this manner drive shaft **30** may be driven in its correct operating direction to move reject arm **25** in the proper direction irrespective of the sequence of scan, i.e., whether the lesser light-reflective surface area is above and scanned first and the greater light-reflective surface area is below it and scanned later or vice versa.

From the foregoing it will be understood that the apparatus described could be useful in the cotnrol of any function-performing operation of an A.C. magnetic induction type of motor in any instance where there exists a differential contrast between two adjacent light-reflective surface areas adapted to be scanned by the vibrating light beam projected from mirror **41**.

While the apparatus herein shown and described is admirably adapted to fulfill the objects primarily stated, it is to be understood that it is not intended to confine the invention to the one form of embodiment herein disclosed for it is susceptible of embodiment in various forms all coming within the scope of the claims which follow.

I claim:

1. Apparatus for controlling actuation of an A.C. magnetic induction, operation-performing motor by sensing adjoining, contrasting, light-reflective surface areas; said apparatus comprising said motor having two field coils physically and phase separated by ninety degrees; an A.C. source; one of said field coils being connected to said A.C. source; a light beam; means for vibrating said light beam to scan at least adjoining portions of said contrasting, light-reflective surface areas; said vibrating means being connected to said A.C. source; a light-sensitive cell positioned to receive rays of light reflected from said scanned, adjoining portions of said contrasting, light-reflective surface areas; a D.C. source for operating said cell; a D.C. to A.C. conversion network connected with said D.C. source and said cell for passing only varying D.C.; an amplifier connected at its input to said conversion network and at its output to the other of said field coils whereby said other field coil is energized only when said light beam senses contrast between the adjoining, light-reflective surface areas scanned by said beam.

2. Apparatus for controlling actuation of an A.C. magnetic induction, operation-performing motor by sensing adjoining, contrasting, light-reflective surface areas; said apparatus comprising said motor having two field coils physically and phase separated by ninety degrees; an A.C. source; one of said field coils being connected to said A.C. source; a light beam; means for vibrating said light beam to scan at least adjoining portions of said contrasting, light-reflective surface areas; said vibrating means being connected to said A.C. source; a light-sensitive cell positioned to receive rays of light reflected from said scanned, adjoining portions of said contrasting, light-reflective surface areas; a D.C. source for operating said cell; a D.C. to A.C. conversion network connected with said D.C. source and said cell for passing only varying D.C.; the output of said D.C. conversion network being connected to said other field coil whereby the latter is energized only when contrast exists between the portions of light-reflective surface areas scanned by said vibrating light beam.

3. Apparatus for controlling actuation of an A.C. magnetic induction motor by sensing the presence and position of at least a portion of one light-reflective surface area with respect to at least a portion of an adjoining, contrasting, light-reflective surface area, such as of a label with respect to its container or a portion of indicia on a label with respect to a portion of its adjoining background; said apparatus comprising a motor having an operating coil and a control coil; an A.C. source; said operating coil being connected to said A.C. source; a light beam; means for vibrating said light beam to traverse the line of demarcation between and scan at least portions of said adjoining, contrasting, light-reflective surface areas; said vibrating means being connected to said A.C. source; a D.C. source and circuit for passing only varying D.C.; a photoelectric cell connected in said D.C. circuit and positioned to receive the light rays reflected from said adjoining, contrasting, light-reflective surface areas; the output of said D.C. circuit being connected to said control coil of said motor.

4. In an A.C. magnetic induction motor controlling apparatus comprising said motor having an operating field coil and a control field coil; a source of A.C. connected to said operating field coil, vibrating light beam means adapted to scan at least portions of adjoining, contrasting, light-reflective surface areas; said vibrating light beam means being connected to said A.C. source; a photoelectric cell positioned to receive light reflected from said scanned surface areas; a D.C. source; a D.C. to A.C. conversion network adapted to pass only varying D.C. therethrough; said network being interconnected with said photoelectric cell and said D.C. source; and said control field coil of said motor being connected to the output of said conversion network whereby said mo-

tor is actuated only when light-reflective contrast exists between said areas scanned by said light beam.

5. An apparatus according to claim 4 wherein said adjoining, light-reflective surface areas to be scanned by said light beam are a continuous series of similarly labeled, like containers and the scan of said beam includes a portion of the labels and an adjoining portion of the containers; conveyer means for transporting said labeled containers seriatim past said light beam for inspection thereby; container rejecting means associated with said conveyer effective in one position to reject a container from said conveyer and in another position to permit passage of a container, said container reject means being connected to said motor and operable thereby into said article-passing position only upon actuation of said motor.

6. An apparatus according to claim 4 wherein said adjoining, light-reflective surface areas to be scanned by said light beam are a continuous series of similarly labeled, like containers and the scan of said beam includes a portion of indicia on the labels and an adjoining portion of the containers; conveyer means for transporting said labeled containers seriatim past said light beam for inspection thereby, container rejecting means associated with said conveyer effective in one position to reject the container from said conveyer and in another position to permit passage of a container, said container reject means being connected to said motor and operable to its article-passing position only upon actuation of said motor.

7. An apparatus for sorting a series of similarly labeled, like containers for absence or presence and position of labels upon said containers; said apparatus comprising a conveyer for transporting said labeled containers seriatim in a path past an inspection station; a reject lever associated with said conveyer and normally effective in one position to engage and remove containers from said conveyer and movable into another position for permitting passage of said containers; an A.C. source; vibrating light beam means at said inspection station positioned to scan a portion of each of said containers and an adjoining portion of each of their respective labels as said containers move past said light beam; said light beam means being connected to said A.C. source; a D.C. source; a photoelectric cell positioned at said inspection station to receive light reflected from the scanned portions of said labels and containers; a D.C. to A.C. conversion network; said cell and said network being interconnected to said D.C. source; an A.C. magnetic induction motor having an operating coil and a control coil; said operating coil being connected to said A.C. source and said control coil being connected to the output of said D.C. to A.C. conversion network; and said motor having its rotor connected in operative association with said reject lever to move said lever from its container reject position to its container pass position only when said control coil is energized.

8. An apparatus for sorting a series of similarly labeled, like containers for absence or presence and position of labels upon said containers; said apparatus comprising a conveyer for transporting said labeled containers seriatim in a path past an inspection station; a reject lever associated with said conveyer and normally effective in one position to engage and remove containers from said conveyer and movable into another position for permitting passage of said containers; an A.C. source; vibrating light beam means at said inspection station positioned to scan a portion of indicia on said labels and an adjoining background portion of said labels as said containers move past said light beam; said light beam means being connected to said A.C. source; a D.C. source; a photoelectric cell positioned at said inspection station to receive light reflected from the scanned portions of said labels and containers; a D.C. to A.C. conversion network; said cell and said network being interconnected to said D.C. source; an A.C. magnetic induction motor having an operating coil and a control coil; said operating coil being connected to said A.C. source and said control coil being connected to the output of said D.C. to A.C. conversion network; and said motor having its rotor connected in operative association with said reject lever to move said lever from its container reject position to said container pass position only when said control coil is energized.

No references cited.