United States Patent

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[54] **PROCESS FOR INSPECTING PRINTED TABLETS AND CAPSULES USING COLOR RESPONSIVE SORTING MACHINES**
4 Claims, 3 Drawing Figs.

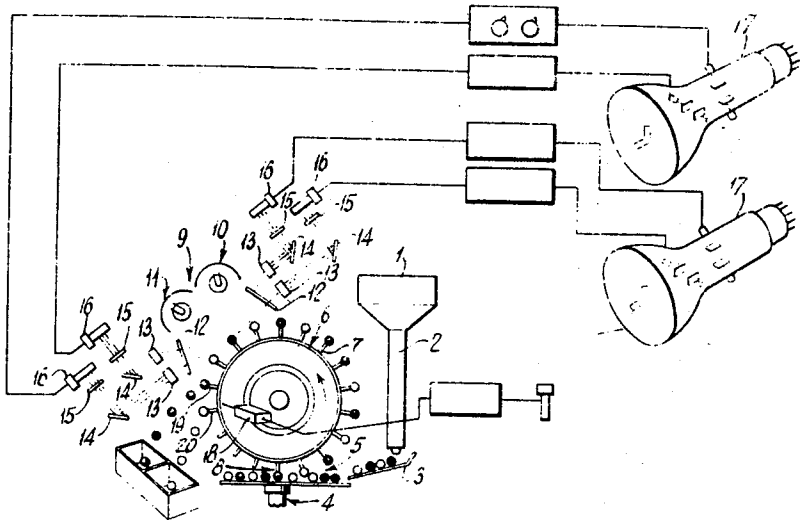
[52] U.S. Cl. 209/111.6
[51] Int. Cl. B07c 5/342
[50] Field of Search 209/111.6, 111.5; 101/2; 250/223; 356/237

[56] References Cited
UNITED STATES PATENTS

2,625,265	1/1953	Cox	209/111.6
2,879,407	3/1959	Cox	209/111.6 X

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ABSTRACT: Process for inspecting printed tablets and capsules using color-responsive sorting machines in which tablets having a coating of one color are printed with an ink of a contrasting color which corresponds to the background color against which the tablets or capsules are viewed in the viewing chamber of the color-responsive sorting machine. In this way foreign tablets are rejected.



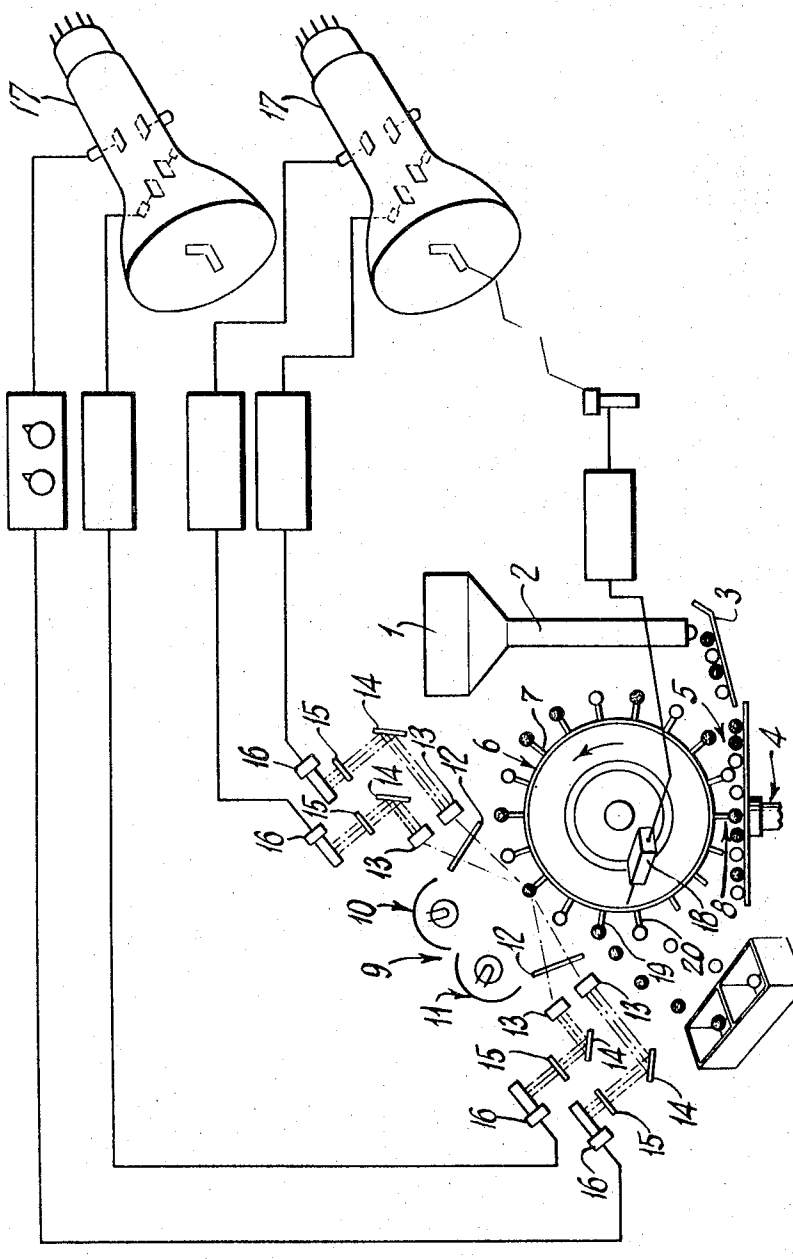


Fig. 1.

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Fig. 2.

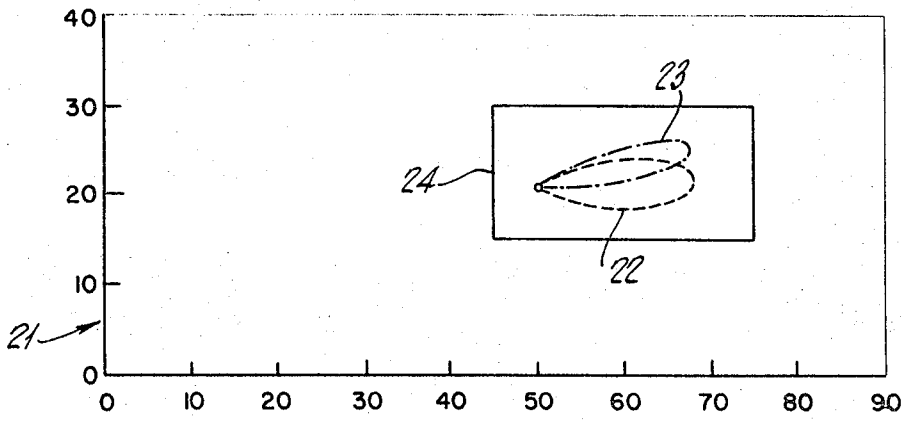
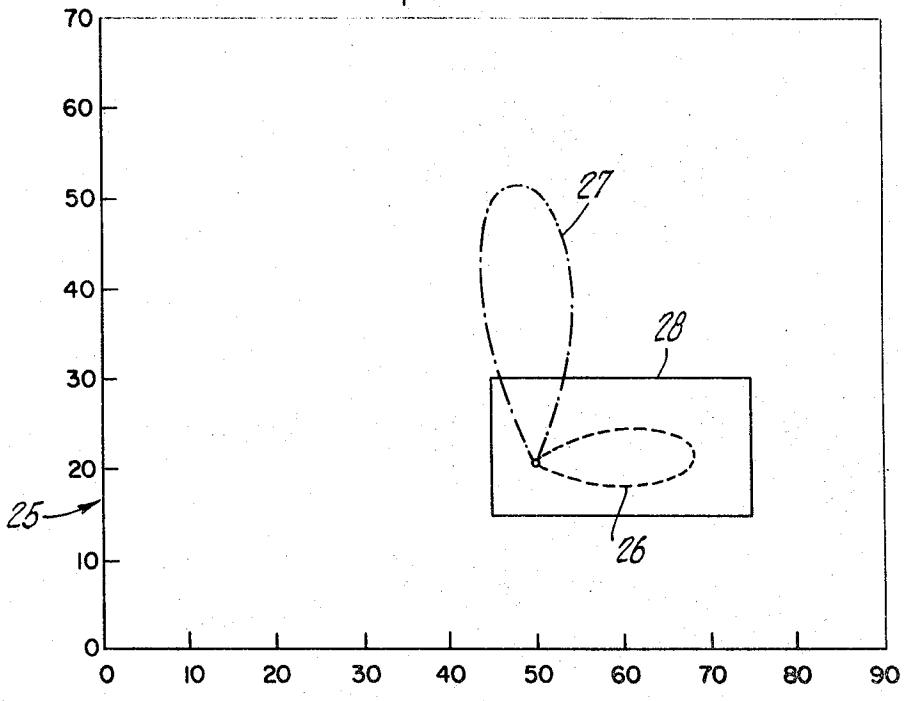


Fig. 3.



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PROCESS FOR INSPECTING PRINTED TABLETS AND CAPSULES USING COLOR RESPONSIVE SORTING MACHINES

This invention relates to optical sorting and is directed to a light-responsive system.

More particularly, this invention relates to the use of optical sorting equipment in the pharmaceutical industry.

It is an object of this invention to provide a new process for inspecting printed tablets and capsules to assure that no foreign tablets or capsules are present.

It is a further object of this invention to provide a new process for inspecting printed tablets and capsules in order to detect undercoated, scratched or soiled and offcolor products.

It is still a further object of this invention to perform these functions at a greater speed and lesser cost than that resulting from the manner in which such inspections are presently conducted.

These and other objects of this invention are accomplished by a process in which color-responsive sorting machines are adapted to receive and inspect tablets and capsules of varying composition and dosage, each of which is coated with a different color and printed with a product identification code. The product identification code is printed with an ink which contrasts with the color of the tablet coating to aid in ready identification of the drug. Single-color capsules or those which are banded with an ink which is the same color as that of the ink which is used to print the product identification code may also be inspected according to the process of this invention.

The process of this invention is carried out by using optical sorting machines such as those described in U.S. No. 2,625,265 in which the tablets (or capsules) are gravity-fed from a hopper, through a vertical feedpipe and onto a vibratory feeder. The vibratory feeder drops the tablets onto a rotary bowl feeder which transfers the tablets to a rotating vacuum drum which exposes the tablets to a bichromatic phototube system and a color-responsive control system for ejecting the tablets from the supporting drum at a reject point or allowing them to pass to the normal release point for acceptable tablets, depending on whether or not the color response falls within a predetermined color range.

The control system includes a cathode ray tube, a sentinel system, and an ejector system. The cathode ray tube is arranged to have its beam deflect to represent the color of the viewed object in rectilinear coordinates representing two different light intensities. The sentinel system is arranged for viewing the cathode ray screen and operating the ejecting means whenever the color response falls outside a predetermined range which is represented by a mask placed over the screen of the cathode ray tube. The trace movement for rejected tablets is exposed to a photomultiplier tube which activates a rejector circuit, comprising a rotating timer carrying condensers which are charged whenever the sentinel system indicates a defective tablet. The charge of the condensers is utilized to activate the ejecting mechanism after the article-supporting drum has reached the desired position.

A preselected background is used in the viewing chamber as a light and voltage reference for the tablets. By printing the tablets with an ink of a color which is compatible with the background color, the response of the cathode ray will remain within the acceptable range and printed tablets which are perfectly acceptable will not be rejected.

A better understanding of the invention will be afforded by the following detailed description in conjunction with the accompanying drawings, in which:

FIG. 1 is a schematic diagram of sorting apparatus for carrying out my invention;

FIG. 2 is a diagram which shows the cathode ray tube response curves for unprinted, coated tablets and printed, coated tablets when the tablets are printed with an ink which corresponds to the preselected background color; and

FIG. 3 is a diagram which shows the cathode ray tube response curves for unprinted, coated tablets and printed, coated tablets when the tablets are printed with an ink which does not correspond to the preselected background color.

In the form of apparatus represented by way of illustration, there is a mechanism for successively picking up tablets to be inspected and presenting them to the bichromatic photoelectric-viewing system in a viewing chamber. There is also a color-response control system for either ejecting the articles or passing them according to whether or not the color response falls within a predetermined range.

The arrangement of the apparatus used in the process of this invention may best be understood by reference to FIG. 1 in which there is shown a product feed hopper 1 in which the tablets to be inspected are placed. The tablets are fed through a vertical feedpipe 2 and onto a vibratory feeder 3 which then drops the tablets onto a rotary bowl feeder 4. The centrifugal force acting on the tablets 5 in the rotary bowl feeder moves them toward the outer edge of the rotary bowl feeder so that the tablets are fed one at a time to the rotating drum 6 which is fitted with a plurality of holding ferrules 7 arranged in a straight line around the periphery of the drum. A vacuum is maintained in the ferrules at the "pickup" point 8 of the drum's rotation, thereby causing each ferrule to pick up one tablet from the bowl. As the drum rotates the individual tablets are passed through the viewing chamber 9 which consists of two intersecting optical systems 10, 11, each with its own light source and lens system where each tablet is illuminated and viewed against a preselected background by the phototubes through the optical system including the mirrors and filters. When the reflected beam of light reaches the striped mirror 12 it is split into two separate components or beams. Each beam is passed through a separate filter 13 which selects the desired critical hue based on the reference color. The light intensities are then reflected by the mirror 14 and pass through the filter 15 so that they may be projected on the phototubes 16 which generate electrical impulses which correspond to the intensity or brightness of each beam of light. The resultant electrical impulses are projected on the screen of the cathode ray tube 17, one resulting in horizontal displacement and the other resulting in vertical displacement from the normal "at rest" position. Acceptable tablets actuate the light spot and cause it to travel in a fixed path, whereas unacceptable or foreign tablets would cause the light spot to travel a different path from the normal one. The path followed by the light spot when acceptable tablets are processed may be observed and ascertained over a short period of time whereupon a mask may be prepared out of cardboard, paper or any other suitable material and placed on the cathode ray tube over an area which corresponds to the light spot's path for acceptable tablets plus a margin.

In operation acceptable tablets will cause the light spot to travel a path which is within the area covered by the mask, as may be seen in FIG. 2, and unacceptable or foreign tablets will cause the light spot to travel a path which emerges from the mask, as may be seen in FIG. 3, thereby activating the sentinel system to reject the foreign or defective tablet. This is accomplished by activating a solenoid 18 which controls an air ejector at the rejection station 19. When the air ejector is activated it releases an airblast which ejects the tablet. Acceptable tablets are released from the holding ferrules at a station 20 further along the rotating path of the presentation wheel as the suction is automatically cut off in the holding ferrules at this point. FIG. 2 illustrates the screen 21 of a cathode ray tube and shows the path 22 traced by the light spot for an unprinted coated tablet, and the path 23 traced by the light spot when a tablet printed with an ink which corresponds to the preselected background color. It may be observed from FIG. 2 that while the two tracings do not coincide with one another they do follow similar paths which may be readily masked by a cardboard mask 24.

FIG. 3 illustrates the screen 25 of the cathode ray tube and shows the path 26 traced by the light spot for an unprinted coated tablet and the path 27 traced by the light spot for a coated tablet which is printed with an ink which does not correspond to the background color. It may be observed from FIG. 3 that the response curve of the tablet printed with an ink

which does not correspond to the preselected background would emerge from the area 28 of the screen covered by the mask thereby activating the ejector. Similarly, foreign tablets or chipped tablets would cause the light spot to travel a path which would emerge from the mask resulting in the activation of the ejector.

The proper colors are selected by printing the tablet with an ink which is the same color as the color of the background disc utilized in the viewing chamber. Because the tablets are coated with a bright color such as yellow, blue or pink, a contrasting color such as grey is usually used as both the background color and the ink for printing the tablets with the code.

The inspection process of this invention may be performed on capsules using the above-described apparatus by modifying the holding ferrules of the machine so that they conform to the shape of capsules.

What is claimed is:

1. A process for inspecting printed tablets and capsules in order to detect the presence of tablets and capsules of differing composition and dosage form from those of the desired composition and dosage form by using a color-responsive sorting machine which comprises the steps of:

a. printing tablets or capsules having a coating of one color with an ink of a contrasting color which corresponds to the background color against which the tablets or capsules are viewed in the viewing chamber of the color-responsive sorting machine;

b. feeding the tablets or capsules, one at a time, to a rotating drum;

c. passing the tablets or capsules through the viewing chamber where each tablet or capsule is illuminated and viewed against the background color by phototubes;

d. projecting electrical impulses, which correspond to the brightness of the light reflected from the tablets or capsules, on the screen of a cathode ray tube which has a masked area; and

e. ejecting from the drum those tablets or capsules which generate electrical impulses which emerge from the masked area of the cathode ray screen.

2. A process as in claim 1 wherein the tablets are printed with a grey ink.

3. A process as in claim 1 wherein the tablets or capsules are fed from a vibratory feeder to a rotary bowl feeder which transfers the tablets or capsules to the ferrules of the rotating drum.

4. A process as in claim 1 wherein the rejected tablets or capsules are ejected from the drum by charging a condenser which activates an ejecting mechanism.

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