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Chapman

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[54] **OPTICAL UNIT FOR USE IN A LIGHT-SENSITIVE SORTING MACHINE**

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.**.....**240/51.11 R,** 209/111.7, 250/223

[51] **Int. Cl.**.....**B07c 5/342,** G06m 7/00, H01j 39/12

[58] **Field of Search**.240/47, 51.11, 11.2, 218, 111.5; 209/111.5, 111.6, 111.7; 250/223; 356/103, 104

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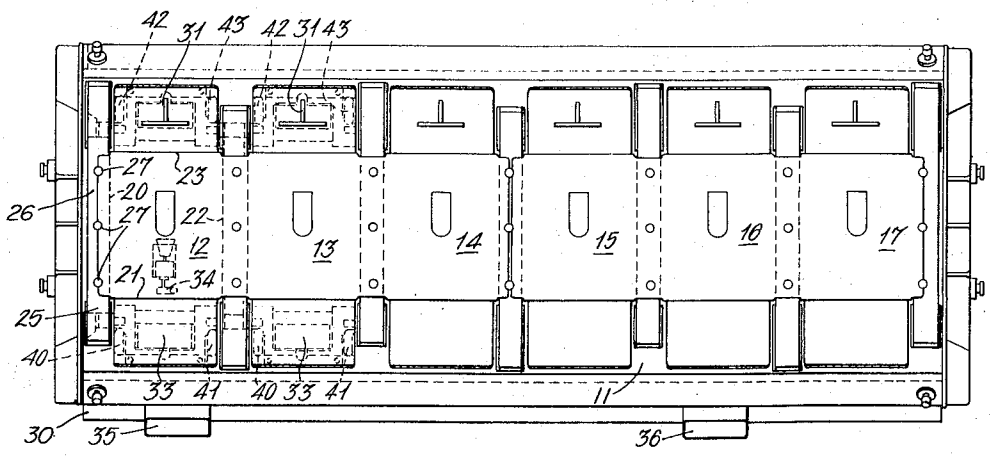
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[57] **ABSTRACT**

An optical unit for use in a light-sensitive sorting machine comprising a chamber having a plurality of adjacent vertically extending channels therethrough through which may fall matter to be sorted, a plurality of fluorescent light-producing means for directing visible light onto matter falling through the channels, at least one of the fluorescent light-producing means being arranged to direct the visible light into a plurality of the said channels, and optical viewing means which view the matter falling through each channel.

10 Claims, 4 Drawing Figures



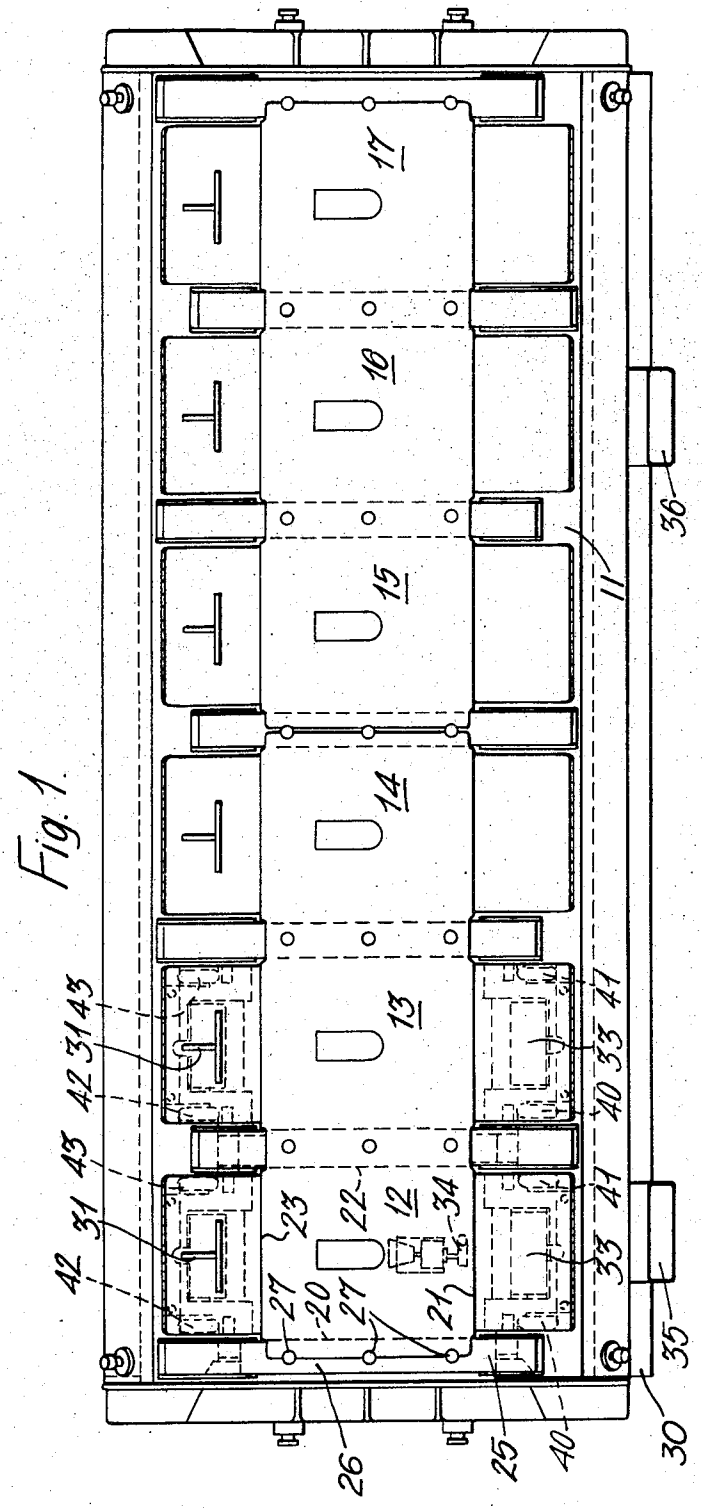


Fig. 1

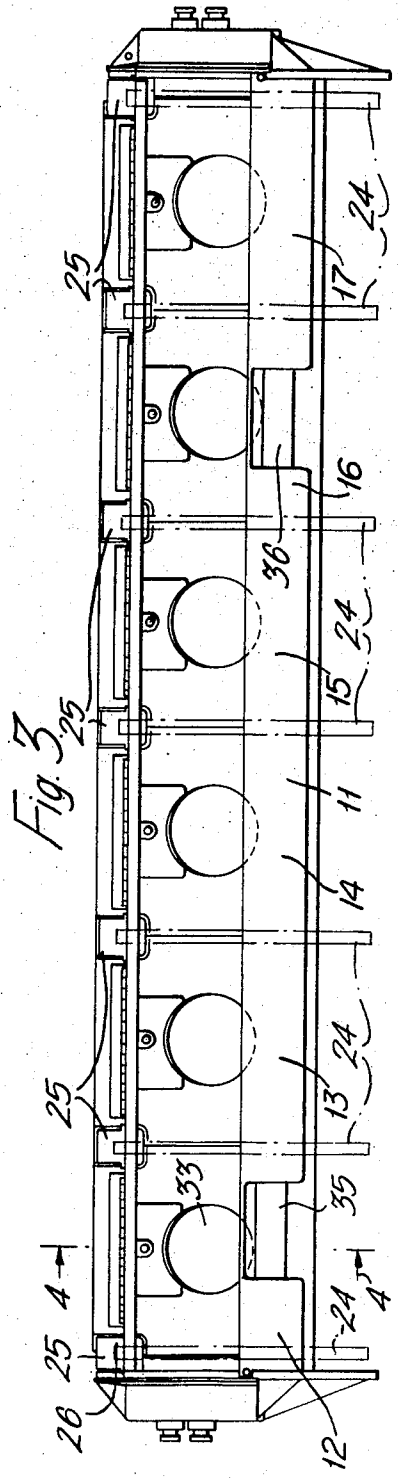


Fig. 3

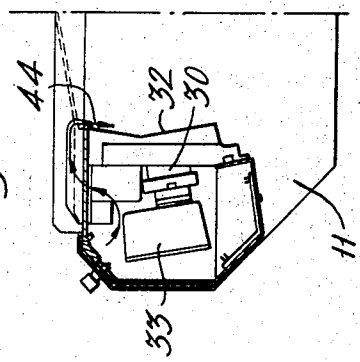


Fig. 4

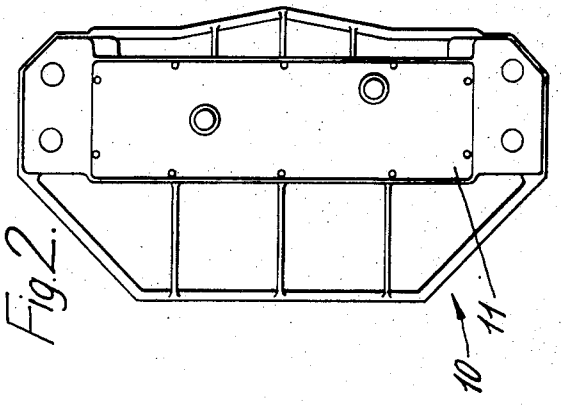


Fig. 2

OPTICAL UNIT FOR USE IN A LIGHT-SENSITIVE SORTING MACHINE

This invention concerns an optical unit for use in a light sensitive sorting machine.

According to the present invention there is provided an optical unit for use in a light-sensitive sorting machine comprising a chamber having a plurality of adjacent vertically extending channels therethrough through which may fall matter to be sorted, a plurality of fluorescent light-producing means for directing visible light onto matter falling through the channels, at least one of the fluorescent light-producing means being arranged to direct the visible light into a plurality of the said channels, and optical viewing means which view the matter falling through each channel.

As will be appreciated, since the optical unit of the present invention employs fluorescent light-producing means, as opposed to the tungsten light sources which are conventionally used in light-sensitive sorting machines, the light directed towards the matter being sorted is of a diffuse nature and there is therefore no need to provide lamp guards for preventing direct illumination of this matter.

Moreover, not merely may the fluorescent light-producing means readily be arranged to have a life expectancy very much larger than that of conventional tungsten light sources, e.g. a life expectancy of up to 5,000 hours, but also these fluorescent light producing means may be arranged to have a high light-producing efficiency and thus to run cool, so extending the life of the fluorescent light-producing means in tropical enviroments.

Furthermore, by reason of the fact that, in contrast to the conventional tungsten light sources, such fluorescent light-producing means run cool, the danger that any dust within the unit will become baked upon the fluorescent light-producing means, or on light reflecting surfaces of the unit, is reduced.

The said at least one fluorescent light producing means may be disposed between two adjacent channels.

The fluorescent light-producing means may comprise vertically extending fluorescent tubes. Such an arrangement provides a large degree of top and bottom lighting for the matter falling through the channels. Preferably, at each of opposite sides of each channel, there is provided a replaceable light-producing component which may be readily inserted into and withdrawn from the optical unit, each said light-producing component comprising a sealed, at least partially translucent, container which contains fluorescent tubes the light from which may pass through translucent portions of the container. As will be appreciated such an arrangement provides ease of servicing.

The said container may, for example, be fabricated wholly from a translucent synthetic resin material.

Each said channel may be substantially rectangular in cross section, the sides of the channel which are not provided with the said fluorescent light-producing means being respectively provided with the optical-viewing means and with a background holder member, the background holder member being adapted to hold a background against which the matter falling through the channel may be viewed by the optical viewing means. Thus the position of each background holder member may be adjusted so as to adjust the effective reflectivity thereof.

Preferably, common air supply means are provided for supplying flows of dust-removing air past the optical viewing means of all the channels. Moreover, the said common air supply means may also supply flows of dust-removing air past the background holder members of all the channels. The said flows of air preferably pass from the top to the bottom of each channel.

The optical unit is preferably readily insertable into and withdrawable from the said sorting machine.

The invention also comprises a light-sensitive sorting machine provided with an optical unit as set forth above, the optical unit being a friction fit in the machine.

The invention is illustrated, merely by way of example, in the accompanying drawings, in which:

FIG. 1 is a plan view of an optical unit according to the present invention for use in a light-sensitive sorting machine,

FIG. 2 is an end view of the optical unit shown in FIG. 1,

FIG. 3 is a side view of the optical unit shown in FIG. 1, and

FIG. 4 is a sectional view taken on the line 4—4 of FIG. 3.

In the drawings there is shown an optical unit **10** which may readily be inserted into and withdrawn from a light-sensitive sorting machine (not shown) by reason of being a friction fit in the latter.

The optical unit **10** comprises a chamber **11** having a plurality, e.g. six as shown, of adjacent vertically extending channels **12** to **17** therethrough which are open at their top and bottom and through which may fall matter to be sorted, e.g. agricultural produce or mineral matter.

Each of the channels **12** to **17** is substantially rectangular in cross section having sides **20** to **23**. At each of the opposite sides **20**, **22**, of each channel **12** to **17** there is provided a replaceable light-producing component **24** which may readily be inserted into and withdrawn from a holder **25** in the optical unit **10**. Each of the light-producing components **24** comprises a sealed container **26** which is fabricated wholly from a translucent synthetic resin material which may or may not be transparent, such for example, as methyl methacrylate, the translucent container **26** containing three vertically extending visible light producing, fluorescent tubes **27** each of which extends substantially from the top to the bottom of its respective channel. Thus the light from the fluorescent tubes **27** may pass through the translucent wall of the container **26** so as to be directed onto any matter to be sorted which falls through the respective channel. It will, moreover, be noted that with the exception of the light-producing components **24** at the ends of the unit **10**, each of the remaining light-producing components **24** is disposed between an adjacent pair of channels so as to direct light into both of the channels of the said pair.

Those sides **21**, **23** of each channel which are not provided with the light-producing components **24**, are respectively provided with a lens tube **30**, for viewing the matter falling through the channel, and with a background holder **31**. The latter is provided for holding a background (not shown) against which the matter falling through the respective channel may be viewed by the respective lens tube **30**. The position of each of the background holder members **31** may be adjusted

(not shown) towards and away from the center of the respective channel so as to adjust the effective reflectivity thereof. The background held by the background holder member **31** is selected to have a color corresponding to that which it is desired should be possessed by the matter falling through the channel.

The lens tube **30**, which is protected from dust by means of a translucent cover plate **32**, thus receives light which has been directed onto the matter being sorted by the fluorescent tubes **27** and which has been either reflected by the said matter or transmitted therethrough. The light passing through each lens tube **30** is directed thereby onto a respective photoelectric amplifier **33** which is adapted to produce electrical signals representative of the light reflected by or transmitted through the said matter. These signals are employed to effect operation of an ejector **34** which is provided beneath each of the channels **12** to **17** and which is arranged to be periodically operated so as to separate undesired from desired matter.

Thus the said matter may be fed (by means not shown) through the open top of each of the channels **12** to **17**, may be viewed while passing through each of these channels, and then pass adjacent to the ejectors **34** so as to be capable of being deflected thereby if necessary. The ejectors **34** may, for example, be pneumatically operated.

The matter passing through the channels **12** to **17** entrains a certain amount of dust, while the operation of the ejectors **34** will tend to cause this dust to be thrown up into the optical unit **10**. It is important to ensure that this dust does not settle on certain parts of the unit **10** if the operation of the optical unit **10** is not to be adversely affected.

For this reason the optical unit **10** is provided with two air inlets **35**, **36** to which a supply of cool, dust-removing, air is provided. Air supplied to these air inlets **35**, **36** may pass through spaces within the optical unit **10** so as to reach slots **40**, **41**, which are adjacent to the respective photo-electric amplifiers **33**, and slots **42**, **43**, which are adjacent to the respective background holder members **31**. The slots **40** to **43** are disposed adjacent to the top of the optical unit **10** so that the flows of dust-removing air pass from the open top to the open bottom of each of the channels **12** to **17**. As indicated by the arrows **44** in FIG. **4**, flows of dust-removing air are supplied past the lens tube **30**, there also being flows (not shown) of dust-removing air past the background holder members **31** so as to prevent dust from settling on these parts.

The arrangement is thus such that the optical unit **10** itself is provided with common air supply means for supplying the flows of dust-removing air past the lens tubes and background holder members, the bulky and unhygienic hoses which would otherwise be required for supplying such flows being dispensed with.

If the optical unit is used in a sorting machine sorting foodstuffs, it is desirable that the containers **26** are not made of glass and for this reason it is preferred, as indicated above, to make them of a material such as methyl methacrylate, e.g. that sold under the Registered Trade Mark "Perspex". Such material, however, tends to become electrically charged more easily than glass itself, and thus to attract dust. It will be appreciated that the said flows of air also serve to pass over the containers **26** so as to reduce the risk of dust settling on these containers. Moreover, since these flows of air will serve a cooling purpose, this will have some tendency yet further to prolong the life of the fluorescent tubes **27**.

Means (not shown) may, if desired, be provided for adjusting the height of the optical unit within the machine.

I claim:

1. An optical unit for use in a light-sensitive sorting machine comprising a chamber having a plurality of adjacent vertically extending channels therethrough, through which may fall matter to be sorted, a plurality of fluorescent light-producing means which direct visible light onto matter falling through the channels, at least one of the fluorescent light producing means directing the visible light into a plurality of the said channels, and optical viewing means which are disposed adjacent to and which view the matter falling through each channel.

2. An optical unit as claimed in claim **1** in which the said at least one fluorescent light producing means is disposed between two adjacent channels.

3. An optical unit as claimed in claim **1** in which the fluorescent light-producing means comprise vertically extending fluorescent tubes.

4. An optical unit as claimed in claim **1**, in which, at each of the opposite sides of each channel, there is provided a sealed, at least partially translucent container which may be readily inserted into and withdrawn from the optical unit, each said container containing fluorescent tubes the light from which may pass through translucent portions of the container.

5. An optical unit as claimed in claim **4** in which the said container is fabricated wholly from a translucent synthetic resin material.

6. An optical unit as claimed in claim **1** in which each said channel is substantially rectangular in cross section, the sides of the channel which are not provided with the said fluorescent light-producing means being respectively provided with the optical-viewing means and with a background holder member, the background holder member being adapted to hold a background against which the matter falling through the channel may be viewed by the optical viewing means.

7. A optical unit as claimed in claim **6** in the position of each background holder member may be adjusted so as to adjust the effective reflectivity thereof.

8. An optical unit as claimed in claim **6** in which common air supply means are provided for supplying flows of dust-removing air past the optical viewing means of all the channels.

9. An optical unit as claimed in claim **8** in which the said common air supply means also flows of dust-removing air past the background holder members of all the channels.

10. An optical unit as claimed in claim **8** in which the said flows of air pass from the top to the bottom of each channel.

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