# United States Patent [19]

**Senesky**

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[45] **Feb. 5, 1974**


[54] **METAL CAP SORTER**


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[73] Assignee: **Owens-Illinois, Inc.,** Toledo, Ohio



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[21] Appl. No.: **181,018**

[52] **U.S. Cl.** ..... **209/111.6,** 356/186

[51] **Int. Cl.** ..... **B07c 5/342**

[58] **Field of Search** .... 209/111.6, 111.7; 356/18 G, 356/186, 191, 209



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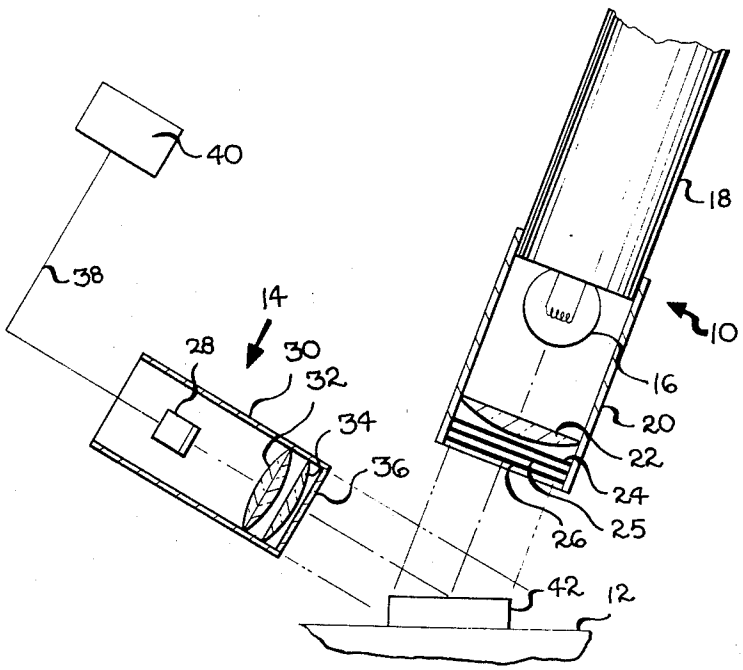
[57] **ABSTRACT**

Apparatus and method for sorting foreign closures from a stream of closures being fed into a capping machine. A light source is positioned at an acute angle with respect to the horizontal plane defined by the top panel of a metal closure. A light sensing unit is positioned at an angle with respect to the horizontal plane less than the angle of spectral reflection of the light from the light source. It has been found that each of a plurality of metal closures has unique light-scattering properties which may be measured by the light sensing unit positioned off of the angle of reflection of the light source. By introducing a plurality of closures into the light beam, a level may be established for each of the closures. By setting an electronic logic unit sensitive to the scattered light level of a particular desired closure, foreign closures which fall above or below this preset level may be rejected by a rejection mechanism. The rejection mechanism most frequently takes the form of a puff of compressed air to blow foreign closures from a line of closures being fed into a capping machine. The apparatus further includes a series of filters positioned over the light source to reduce the amount of light to an intensity level to which the light sensing unit is responsive.


**2 Claims, 2 Drawing Figures**



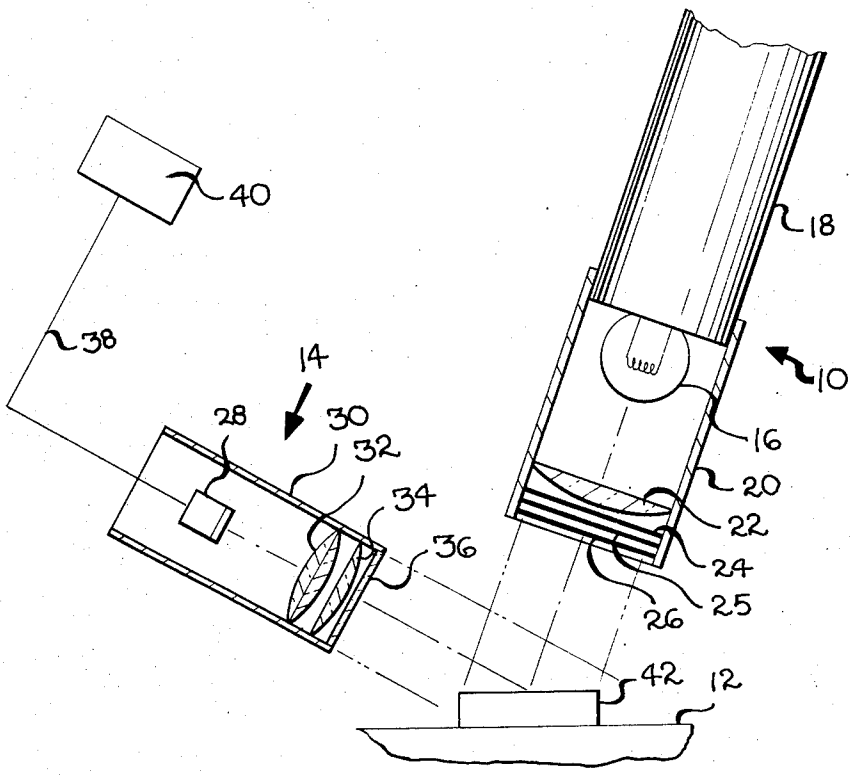



FIG. 1

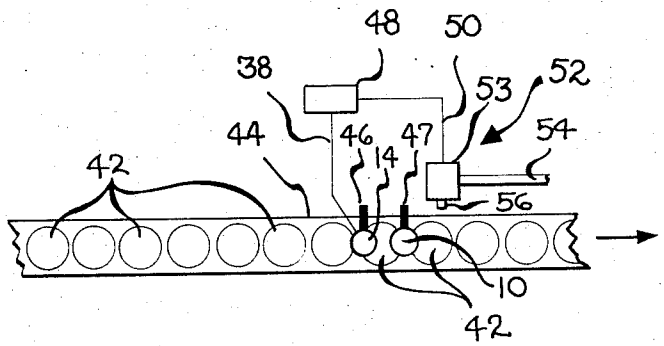



FIG. 2

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# METAL CAP SORTER

## BACKGROUND OF THE INVENTION

This invention generally relates to the sorting of closures for containers. More specifically, this invention relates to the sorting of metal closures utilizing the unique light-scattering properties of each individual closure. Most particularly, this invention relates to the sorting of foreign closures from a plurality of desired closures by measuring the light scattered from the top panel of the closure and rejecting those closures whose scattered light value is above or below the unique value for the desired closure.

In the manufacture of metal closures, it is not unusual for foreign closures to be introduced into a group ofclosures being made. This may occur due to the proximity of presses stamping out different closures which may allow closures from adjacent presses to become intermmixed. The intermixing is seldom of a large magnitude, but foreign caps, if introduced into a capping machine in a bottling plant, can cause the capping machine to jam. In addition, closure hoppers in bottling plants are frequently used for more than one type of closure. It often occurs that a closure from a previous bottling run may remain trapped within the hopper or within the feed system, thereby allowing such foreign closure to be introduced into a subsequent capping operation. The effect, in such a case, is also to cause a majamming of the capping machine, which would have been set up to accept only the closure for the current capping operation. At the present nt time, foreign caps are detected only by a human operator standingby the cap feed line and visually observing foreign caps and removing them from the feed line. This, of course, is an inefficient and expensive process, since the human operator is subject to error and may on occasion miss the presence of foreign caps. The present invention presents an apparatus which automatically sorts caps and rejects any foreign caps from the line feeding the capping machine. SUMMARY OF THE INVENTION

I have found that painted metal closures possess unique light-scattering properties which may be measured, evaluated, and utilized to reject foreign closures from a continuing stream of closures being fed to a capping machine. A light source is positioned at an acute angle with respectto a horizontal plane designed by the top panel of a closure A light-sensitive detection unit is then positioned opposite the light source at an angle less than the angle of spectral reflection of the light from the light source. Individual closures are then placed into the path of the light beam andtheir scattering properties are measured by the light sensitive detection unit. Having once determined the unique scatteringvalue of the closure, an electronic logic unit may be set to reject closures which give scattered light values s above or below the unique preset level. By connecting the electronic gate to a rejection unit, foreign closures may be rejected as a stream of closures are passed one-at-a-time under the light source.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view of the apparatus of the present invention as it is used to determine the unique llightt-scattering properties of each closure;



FIG. 2 is a plan view of tthe apparatus of the present invention as it would be utilized in conjunction with the feeding of a series of closures to a capping machine.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

In the preferred embodiment of the invention shown in FIGG. 1 a source of lightt **10** is positioned over a stationary flat surface **12** at an acute angle by suitable support means (not shown). In addition, a light sensing unit **14** is also positioned over the flat surface **12** at an acute angle less than the spectral angle of reflection of light from the light source **10** by the same support means used to carry the light source **1010.** In this preferred embodiment, the light source **10** is positioned at an angle of 70° with respect to the plane of the flat surface **12.** The sensing unit **14** is positioned at an angle of 30° with respect to the flat surface **12.** The light source **10** is made up of a c number of components. A 12 volt incandescent lamp **16** is held in place in a suitable lamp holder **18.** A lens tube **20** is telescopingly engaged over the lamp holder **18.** t The lens tube **20** serves to carry a plano-convex lens **22** which is used to focus the light emanating from the incandescentlamp **16.** In addition, a series of three filters **24, 25** and **26** are positioned near the end of the lens tube **20.** The filter **24** is a Roscolene No. 871; the filter **25** is a Roscolene 874; and the filtter **26** is a Roscolene No. 878. tThe filters **24, 25** and **26** are all manufactured by Rosco Laboratories, Inc., Port Chester, N.Y. The net effect of the filters **24, 25** and **26** is to filter out all the light emanating from the incandescent lamp **16** except that light falling within the 4800 to 4600 Angstrom wavelength range. Th This light is green in color. The particular color oof light transmitted by the light sourcе**10** is not critical for proper o operation of this invention. The filters **24, 25** and **26** serve merely to reduce the intensity of light issuing from the light source **10** to a level which is acceptable to a photo transistor **28** mounted within the light sensing unit **14.** The light sensing unit **14** itself is also made up of several component parts. A support tube **30** forms the major framework for the sensing unit **14.** Mounted within the support tube **30** is the phe photo transistor **28** which is an LS–600 photo transistor manufactured by the General Sensors Corporation of Athens, Texas. The photo transistor **28** is of the type whose resistance varies s a function of the amount of light incident on it. Also mounted within the support tube **30** is a double convex lens **32** and a plano-convex lens **34** which are used to focus incoming light on the photo transistor **28.** In addition, an infrared filter **36** is mounted at the entrance to the mounting tube **30.** The purpose of the infraredfilter **36** is to filter out all wavelengths above 7500 Angstroms. This was found necessary because of the effect oof various ambient light sources on the sensitivity and discrimination of the photo transistor **28.** That is, some random light-scatteringeffects were found in the infrared region, due to lighting in the environment in which the present invention is used. The output of the photo transistor **28** is through a suitable electric wiring network **38 8** into an ohmeter **40** in the embodiment shown in FIG. **1.** The configuration shown in FIG. **1** may beused to measure the uniique light-scattering properties of a plurality of cllosures **42** for use in determining a level of acceptance or rejection when inspecting a plurality of moving closures **42.** I have found that,

when a closure **42** is pis placed within the light emananting from the light sourcce **10,** a certain percentage of the light incident on the closure **42** is reflected back at the angle of incidence as would normally be expected from physical principles. However, in addition to this well-known and expected spectral reflection, there is also a certain degree of light scattering present. I have determined that the amount of light scattered is a pproperty unique to the closures which I have investigated. It is, therefore, possible to determine the unique light-scattering properties of a plurality of unlike closures using this apparatus. In operation, a closure **42** is placed within thelight emanating from the light source **10,** and the response of the photo transistor **28** is observed on the ohmeter **40.** The characteristics of the photo transistor **28** are such that its resistance varies dependingon the amount of light incident upon it. Because of the unique light-scattering properties of each specific closure, the resistance of the photo transistor **28** will be different for different types of closures. The results obtained for eleven different types of closures are shown in Tables 1 and 2.

TABLE 1

| Sample NUMBER | DESCRIPTION |
|---|---|
| 1 | 34 mm diameter closure —20 mm wide center panel separated by a 1 mm deep groove which is 1 mm wide — outer section is painted blue with aluminum lettering — center section is aluminum with blue lettering |
| 2 | 37 mm diameter closure —painted yellow |
| 3 | 47 mm diameter closure — 31 mm diameter center panel set off by a raised bead 3 mm wide and 2 mm high — closure painted brown |
| 4 | 47 mm diameter closure — raised bead 2 mm wide and 2 mm deep about circumference of closure periphery — painted yellow |
| 5 | 47 mm diameter closure — painted white background with red lettering |
| 6 | 41 mm diameter closure — painted blue |
| 7 | 34 mm diameter closure — physically identical to number 1, but painted white overall |
| 8 | 37 mm diameter closure — painted white background with green lettering |
| | 3 mm diameter closure — burnished aluminum |
| 10 | 37 mm diameter closure — painted matte gold |
| 11 | 37 mm diameter closure — painted white background with blue lettering |

TABLE 2

| SAMPLE NUMBER | RESISTANCE READING BY OHMETER |
|---|---|
| 1 | 20 K Ω |
| 2 | 10 K Ω |
| 3 | 16 K Ω |
| 4 | 11 K Ω |
| 5 | 9,5 K Ω |
| 6 | 12 K Ω |
| 7 | 8 K Ω |
| 8 | 12.5 K Ω |
| 9 | 9 K Ω |
| 10 | 6 K ⁻ |
| 11 | 9 K Ω |

In Table 1, if no physical description of the top panel of the closure is given, the top panel was a smooth flat surface. Particular note should be paid to Sample Nos. 1 and 7. These closures are identical except for the type of paint on the top of the closure. It is believed that the scattering effect is a function of the type of paint and its color on the top of each closure. It should also be noted that Samples 2, **8, 10** and 11 are also identical in size and configuration, but are unlike in the type of paint placed on the top of the closure. It will be noted from Table 2 that closures 9 and 11 gave identical results seeming to contradict the unique light-scattering properties attributed to each specific closure. However, closure 9 was an unpainted closure having a brushed aluminum top. The direction in which the burnishing marks appear on the top of closure No. 9 appear to have a significant effect on the light-scattering properties of such a closure. Therefore, this apparatus is not usable with respect to such closures but may be used with any painted closure to discriminate and select one specific closure from other unlike closures if the top surfaces of the closures are paintedto present a uniform reflecting surface.

Turning now to FIG. **2,** a plurality of supposedly identical closures **42** are conveyed toward a capping machine in the direction shown by the arrow by a suitable conveying means **44.** The conveying means **44** may be a belt-type conveyor or may be an inclined chute down which the closures **42** slide. As the closures progress, they pass under a light source **10** and a sensing unit **14,** as shown in FIG. **1,** which are supported from the conveying means **44** by suitable support brackets **46** and **47.** An elevational view of FIG. **2** would show a configuration of the light source **10** and the sensing unit **14** as identical to that shown in FIG. **1,** with the closures passing under the two units **10** and **14** with their top surface essentially parallel to the conveying means **44.** In FIG. **2,** the ohmeter **40** has been replaced by a logic and discrimination unit **48** which receives the output from the photo transistor**28** through the electrical wiring network **38.** The logic and discrimination unit **48** is of the type well known in the electronic arts which will give no output so long as the input furnished through the electrical wiring network **38** remains within a specified preset value. In the operation of the present invention, the preset value is determined by the resistance caused by light scattering of the specific closure which is to be fed into the capping machine. Any foreign or unlike closures which may be transported by the conveying means **44** will cause the photo transistor **28** to give an output different than that preset in the logic and discrimination unit **48.** Should this occur, an output from the logic and discrimination unit **48** will be transferred by electrical wiring means **50** to a rejection means **52.** In this preferred embodiment, the rejection means **52** comprises a normally closed air solenoid valve **53** and a directional nozzle **56** connected to an output port of the solenoid valve **53.** However, the rejection means **52** could take the form of a reciprocating rod, a swinging gate or similar device suitable for removing an individual unlike closure **42** from the stream of closures **42.** Air under pressure is furnished through a pipe **54** to the solenoid valve **53.** Upon signal from the logic and discrimination unit **48,** the solenoid valve **53** will open, allowing compressed air to flow outward through the nozzle **56.** The blast of high-pressure air emanating from the nozzle **56** will blowa foreign closure **42** from the conveying means **44** and prevent its entry into the capping machine and subsequent jamming of the capping machine.

What I claim is:

1. A method of sorting metal closures having a painted upper surface comprising the steps of:

a moving a series of unlike closures one at a time past a fixed point;

b. illuminating the top panel of said unlike closures one-at-a-time with a light source positioned at an acute angle with respect to a horizontal plane defined by the top panel of said closures;

c. positioning a light sensing unit to receive lightscattered by said closure at an acute angle with respect to said horizontal plane less than the angle of spectral reflection of the light from said light source;

d. blocking all radiation aboge 7500 Angstroms from entry into said light sensing unit;

e. measuring the response of said sensing unit to light scattered by each of said unlike closures;

f. ceasing the movement of said unlike closures; g. connecting said light sensing unit to an electronic logic and discrimination means;

setting said electronic logic and discrimination means to produce an output in response to light level signals from said light sensing unit above and below the measured signal produced by a specific one of said unlike closures;

connecting a rejection means responsive to an output from said logic and discrimination means to said logic and discrimination means;

j. feeding a plurality of said specific closurespast said light source and said light sensing unit to present scattered light signals to said logic and discrimination means;



k. rejecting all closures which pass said light source and light sensing unit whose scattered light level falls above and below the signal level set in said logic and discrimination means.

2. Apparatus for sorting metal closures having painted top panels comprising, in combination: meansfor conveying a plurality of closures in single file; a light source positioned above said conveying means at an acute angle with respect to a horizontal plane defined by the top panel of said closures for illuminating the top panel of said closures a light sensing unit positioned above said conveying means at an acute angle with respect to said horizontal plane less than the angle of spectral reflection from said closures for sensing light scattered from said closures, said light sensing unit comprising, a support tube, a phototransistor mounted within said support tube, a lens system mounted within said support tube for focusig scattered light on said phototransistor, and a filter mounted on said support tube o remove all scattered radiation above 7500 Angstroms before said scattered radiation impinges on said phototransistor; electronic logic and discrimination means connected to said light sensing unit to give an output signal upon receipt of an indication of light scatteringabove and below a preset value; and rejection meansconnected to said electronic logic and discrimination means and operable upon receipt of an output signal from said electronic logic and discrimination means for rejecting closures exhibiting light scattering above and below said preset value.

* * * * *

# UNITED STATES PATENT OFFICE

# CERTIFICATE OF CORRECTION

Patent No. 3,789,983 Dated February 5, 1974

Inventor(s) Albert P. Senesky

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Cancel the originally printed columns 1 through 6 and substitute the corrected columns 1 through 6.

Signed and sealed this 27th day of August 1974.

(SEAL)
Attest:

McCOY M. GIBSON, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.

# METAL CAP SORTER

## BACKGROUND OF THE INVENTION

This invention generally relates to the sorting of closures for containers. More specifically, this invention relates to the sorting of metal closures utilizing the unique light-scattering properties of each individual closure. Most particularly, this invention relates to the sorting of foreign closures from a plurality of desired closures by measuring the light scattered from the top panel of the closure and rejecting those closures whose scattered light value is above or below the unique value for the desired closure.

In the manufacture of metal closures, it is not unusual for foreign closures to be introduced into a group of closures being made. This may occur due to the proximity of presses stamping out different closures which may allow closures from adjacent presses to become intermixed. The intermixing is seldom of a large magnitude, but foreign caps, if introduced into a capping machine in a bottling plant, can cause the capping machine to jam. In addition, closure hoppers in bottling plants are frequently used for more than one type of closure. It often occurs that a closure from a previous bottling run may remain trapped within the hopper or within the feed system, thereby allowing such foreign closure to be introduced into a subsequent capping operation. The effect, in such a case, is also to cause a jamming of the capping machine, which would have been set up to accept only the closure for the current capping operation. At the present time, foreign caps are detected only by a human operator standing by the cap feed line and visually observing foreign caps and removing them from the feed line. This, of course, is an inefficient and expensive process, since the human operator is subject to error and may on occasion miss the presence of foreign caps. The present invention presents an apparatus which automatically sorts caps and rejects any foreign caps from the line feeding the capping machine.

## SUMMARY OF THE INVENTION

I have found that painted metal closures possess unique light-scattering properties which may be measured, evaluated, and utilized to reject foreign closures from a continuing stream of closures being fed to a capping machine. A light source is positioned at an acute angle with respect to a horizontal plane designed by the top panel of a closure. A light-sensitive detection unit is then positioned opposite the light source at an angle less than the angle of spectral reflection of the light from the light source. Individual closures are then placed into the path of the light beam and their scattering properties are measured by the light sensitive detection unit. Having once determined the unique scattering value of the closure, an electronic logic unit may be set to reject closures which give scattered light values above or below the unique preset level. By connecting the electronic gate to a rejection unit, foreign closures may be rejected as a stream of closures are passed one-at-a-time under the light source.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view of the apparatus of the present invention as it is used to determine the unique light-scattering properties of each closure;



FIG. 2 is a plan view of the apparatus of the present invention as it would be utilized in conjunction with the feeding of a series of closures to a capping machine.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

In the preferred embodiment of the invention shown in FIG. 1 a source of light **10** is positioned over a stationary flat surface **12** at an acute angle by suitable support means (not shown). In addition, a light sensing unit **14** is also positioned over the flat surface **12** at an acute angle less than the spectral angle of reflection of light from the light source **10** by the same support means used to carry the light source **10.** In this preferred embodiment, the light source **10** is positioned at an angle of 70° with respect to the plane of the flat surface **12.** The sensing unit **14** is positioned at an angle of 30° with respect to the flat surface **12.** The light source **10** is made up of a number of components. A 12 volt incandescent lamp **16** is held in place in a suitable lamp holder **18.** A lens tube **20** is telescopingly engaged over the lamp holder **18.** The lens tube **20** serves to carry a plano-convex lens **22** which is used to focus the light emanating from the incandescent lamp **16.** In addition, a series of three filters **24, 25** and **26** are positioned near the end of the lens tube **20.** The filter **24** is a Roscolene No. 871; the filter **25** is a Roscolene 874; and the filter **26** is a Roscolene No. 878. The filters **24, 25** and **26** are all manufactured by Rosco Laboratories, Inc., Port Chester, N.Y. The net effect of the filters **24, 25** and **26** is to filter out all the light emanating from the incandescent lamp **16** except that light falling within the 4800 to 4600 Angstrom wavelength range. This light is green in color. The particular color of light transmitted by the light source **10** is not critical for proper operation of this invention. The filters **24, 25** and **26** serve merely to reduce the intensity of light issuing from the light source **10** to a level which is acceptable to a photo transistor **28** mounted within the light sensing unit **14.** The light sensing unit **14** itself is also made up of several component parts. A support tube **30** forms the major framework for the sensing unit **14.** Mounted within the support tube **30** is the photo transistor **28** which is an LS–600 photo transistor manufactured by the General Sensors Corporation of Athens, Texas. The photo transistor **28** is of the type whose resistance varies as a function of the amount of light incident on it. Also mounted within the support tube **30** is a double convex lens **32** and a plano-convex lens **34** which are used to focus incoming light on the photo transistor **28.** In addition, an infrared filter **36** is mounted at the entrance to the mounting tube **30.** The purpose of the infrared filter **36** is to filter out all wavelengths above 7500 Angstroms. This was found necessary because of the effect of various ambient light sources on the sensitivity and discrimination of the photo transistor **28.** That is, some random light-scattering effects were found in the infrared region, due to lighting in the environment in which the present invention is used. The output of the photo transistor **28** is through a suitable electric wiring network **38** into an ohmeter **40** in the embodiment shown in FIG. **1.** The configuration shown in FIG. **1** may be used to measure the unique light-scattering properties of a plurality of closures **42** for use in determining a level of acceptance or rejection when inspecting a plurality of moving closures **42.** I have found that, when a closure **42** is placed

within the light emanating from the light source **10**, a certain percentage of the light incident on the closure **42** is reflected back at the angle of incidence as would normally be expected from physical principles. However, in addition to this well-known and expected spectral reflection, there is also a certain degree of light scattering present. I have determined that the amount of light scattered is a property unique to the closures which I have investigated. It is, therefore, possible to determine the unique light-scattering properties of a plurality of unlike closures using this apparatus. In operation, a closure **42** is placed within the light emanating from the light source **10**, and the response of the photo transistor **28** is observed on the ohmeter **40.** The characteristics of the photo transistor **28** are such that its resistance varies depending on the amount of light incident upon it. Because of the unique light-scattering properties of each specific closure, the resistance of the photo transistor **28** will be different for different types of closures. The results obtained for eleven different types of closures are shown in Tables 1 and 2.

TABLE 1

| SAMPLE NUMBER | DESCRIPTION |
|---|---|
| 1 | 34 mm diameter closure —20 mm wide center panel separated by a 1 mm deep groove which is 1 mm wide — outer section is painted blue with aluminum lettering — center section is aluminum with blue lettering |
| 2 | 37 mm diameter closure — painted yellow |
| 3 | 47 mm diameter closure — 31 mm diameter center panel set off by a raised bead 3 mm wide and 2 mm high — closure painted brown |
| 4 | 47 mm diameter closure — raised bead 2 mm wide and 2 mm deep about circumference of closure periphery — painted yellow |
| 5 | 47 mm diameter closure — painted white background with red lettering |
| 6 | 41 mm diameter closure — painted blue |
| 7 | 34 mm diameter closure — physically identical to number 1, but painted white overall |
| 8 | 37 mm diameter closure — painted white background with green lettering |
| 9 | 3 mm diameter closure — burnished aluminum |
| 10 | 37 mm diameter closure — painted matte gold |
| 11 | 37 mm diameter closure — painted white background with blue lettering |

TABLE 2

| SAMPLE NUMBER | RESISTANCE READING BY OHMETER |
|---|---|
| 1 | 20 K Ω |
| 2 | 10 K Ω |
| 3 | 16 K Ω |
| 4 | 11 K Ω |
| 5 | 9.5 K Ω |
| 6 | 12 K Ω |
| 7 | 8 K Ω |
| 8 | 12.5 K Ω |
| 9 | 9 K Ω |
| 10 | 6 K Ω |
| 11 | 9 K Ω |

In Table 1, if no physical description of the top panel of the closure is given, the top panel was a smooth flat surface. Particular note should be paid to Sample Nos. 1 and 7. These closures are identical except for the type of paint on the top of the closure. It is believed that the scattering effect is a function of the type of paint and its color on the top of each closure. It should also be noted that Samples 2, 8, 10 and 11 are also identical in size and configuration, but are unlike in the type of paint placed on the top of the closure. It will be noted from Table 2 that closures 9 and 11 gave identical results seeming to contradict the unique light-scattering properties attributed to each specific closure. However, closure 9 was an unpainted closure having a brushed aluminum top. The direction in which the burnishing marks appear on the top of closure No. 9 appear to have a significant effect on the light-scattering properties of such a closure. Therefore, this apparatus is not usable with respect to such closures but may be used with any painted closure to discriminate and select one specific closure from other unlike closures if the top surfaces of the closures are painted to present a uniform reflecting surface.

Turning now to FIG. **2**, a plurality of supposedly identical closures **42** are conveyed toward a capping machine in the direction shown by the arrow by a suitable conveying means **44.** The conveying means **44** may be a belt-type conveyor or may be an inclined chute down which the closures **42** slide. As the closures progress, they pass under a light source **10** and a sensing unit **14**, as shown in FIG. **1**, which are supported from the conveying means **44** by suitable support brackets **46** and **47.** An elevational view of FIG. **2** would show a configuration of the light source **10** and the sensing unit **14** as identical to that shown in FIG. **1**, with the closures passing under the two units **10** and **14** with their top surface essentially parallel to the conveying means **44.** In FIG. **2**, the ohmeter **40** has been replaced by a logic and discrimination unit **48** which receives the output from the photo transistor **28** through the electrical wiring network **38.** The logic and discrimination unit **48** is of the type well known in the electronic arts which will give no output so long as the input furnished through the electrical wiring network **38** remains within a specified preset value. In the operation of the present invention, the preset value is determined by the resistance caused by light scattering of the specific closure which is to be fed into the capping machine. Any foreign or unlike closures which may be transported by the conveying means **44** will cause the photo transistor **28** to give an output different than that preset in the logic and discrimination unit **48.** Should this occur, an output from the logic and discrimination unit **48** will be transferred by electrical wiring means **50** to a rejection means **52.** In this preferred embodiment, the rejection means **52** comprises a normally closed air solenoid valve **53** and a directional nozzle **56** connected to an output port of the solenoid valve **53.** However, the rejection means **52** could take the form of a reciprocating rod, a swinging gate or similar device suitable for removing an individual unlike closure **42** from the stream of closures **42.** Air under pressure is furnished through a pipe **54** to the solenoid valve **53.** Upon signal from the logic and discrimination unit **48,** the solenoid valve **53** will open, allowing compressed air to flow outward through the nozzle **56.** The blast of high-pressure air emanating from the nozzle **56** will blow a foreign closure **42** from the conveying means **44** and prevent its entry into the capping machine and subsequent jamming of the capping machine.

What I claim is:

**1.** A method of sorting metal closures having a painted upper surface comprising the steps of:

a. moving a series of unlike closures one at a time past a fixed point;

b. illuminating the top panel of said unlike closures one-at-a-time with a light source positioned at an

acute angle with respect to a horizontal plane defined by the top panel of said closures;

c. positioning a light sensing unit to receive light scattered by said closure at an acute angle with respect to said horizontal plane less than the angle of spectral reflection of the light from said light source;

d. blocking all radiation above 7500 Angstroms from entry into said light sensing unit;

e. measuring the response of said sensing unit to light scattered by each of said unlike closures;

f. ceasing the movement of said unlike closures;

g. connecting said light sensing unit to an electronic logic and discrimination means;

h. setting said electronic logic and discrimination means to produce an output in response to light level signals from said light sensing unit above and below the measured signal produced by a specific one of said unlike closures;

i. connecting a rejection means responsive to an output from said logic and discrimination means to said logic and discrimination means;

j. feeding a plurality of said specific closures past said light source and said light sensing unit to present scattered light signals to said logic and discrimination means;

k. rejecting all closures which pass said light source and light sensing unit whose scattered light level falls above and below the signal level set in said logic and discrimination means.

2. Apparatus for sorting metal closures having painted top panels comprising, in combination: means for conveying a plurality of closures in single file; a light source positioned above said conveying means at an acute angle with respect to a horizontal plane defined by the top panel of said closures for illuminating the top panel of said closures; a light sensing unit positioned above said conveying means at an acute angle with respect to said horizontal plane less than the angle of spectral reflection from said closures for sensing light scattered from said closures, said light sensing unit comprising, a support tube, a phototransistor mounted within said support tube, a lens system mounted within said support tube for focusing scattered light on said phototransistor, and a filter mounted on said support tube to remove all scattered radiation above 7500 Angstroms before said scattered radiation impinges on said phototransistor; electronic logic and discrimination means connected to said light sensing unit to give an output signal upon receipt of an indication of light scattering above and below a preset value; and rejection means connected to said electronic logic and discrimination means and operable upon receipt of an output signal from said electronic logic and discrimination means for rejecting closures exhibiting light scattering above and below said preset value.

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