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SORTING APPARATUS

Filed Oct. 31, 1945

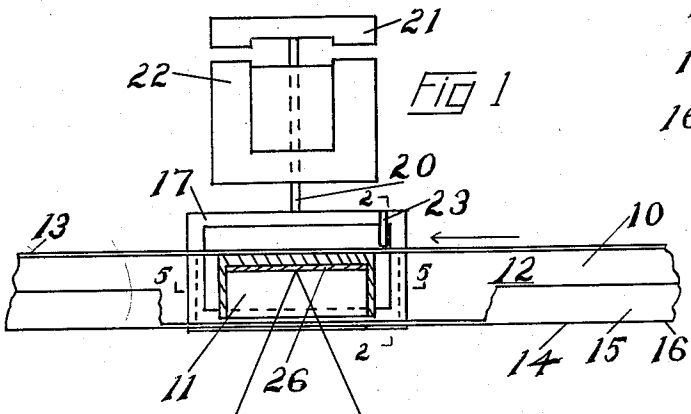


Fig 1

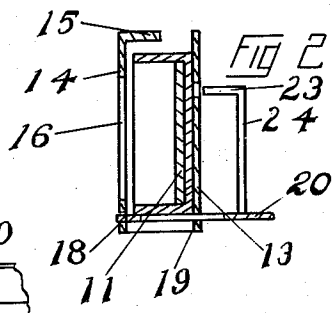
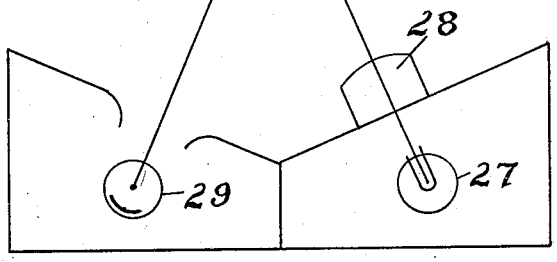


Fig 2



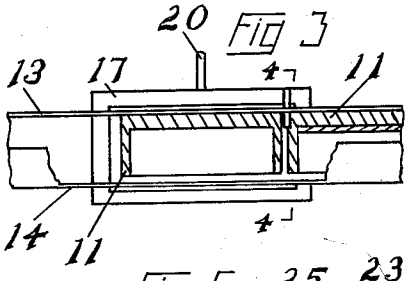


Fig 3

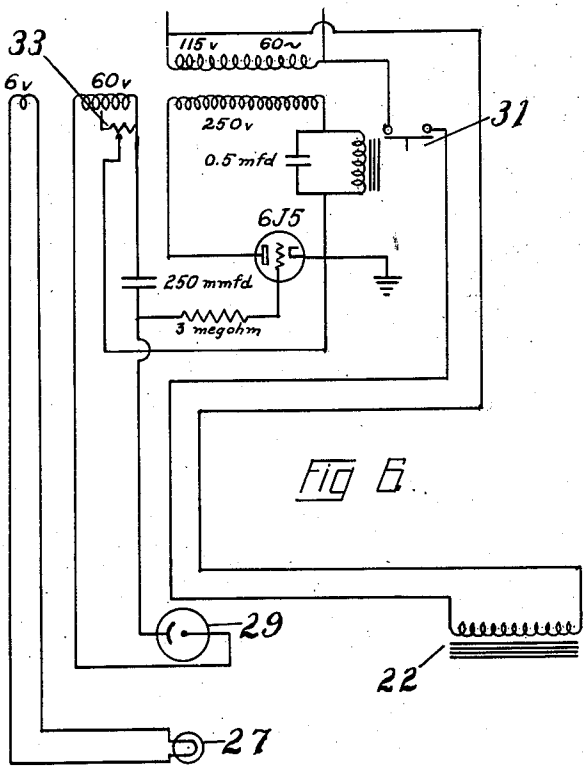


Fig 6

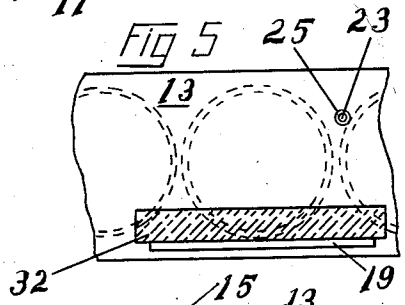


Fig 5

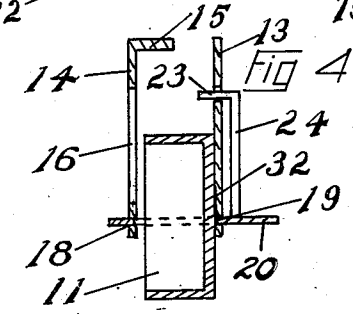


Fig 4

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SORTING APPARATUS

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This invention relates to apparatus for determining and sorting articles of different light-reflecting characteristics, and more particularly to apparatus for examining bottle caps and rejecting linerless caps.

The intermittent occurrence of linerless bottle caps in bottling machines has been a source of considerable trouble since it has been impractical, in the absence of a personal inspection of each bottle cap, to determine whether a cap has a liner. The operation of such bottling machines is automatic and the fact that a linerless cap has been used may not be revealed until considerable damage is done as in the case of whisky, which is immediately cased after bottling. If one linerless cap has been used with consequent leakage, the entire case of whisky may be ruined as regards sale purposes.

An object of this invention is the provision of novel means for determining and sorting articles such as bottle caps in accordance with their light-reflecting characteristics, advantage being taken of the fact that the liners used in such caps reflect light to a much greater degree than the caps alone.

A further object of this invention is the provision of a novel sorting machine for articles such as bottle caps wherein the operation is performed accurately and sufficiently rapid as not to interfere with the continued operation of the bottling machine to which the caps are being fed.

Other objects and advantages of this invention will appear from the following drawings, wherein:

Fig. 1 is a diagrammatic plan of a preferred embodiment of my invention.

Fig. 2 is a section taken on the line 2—2 of Fig. 1 showing the trap in closed position and a bottle cap in position, the latter being shown in section.

Fig. 3 is a plan view partly broken away of the trap showing it in open position.

Fig. 4 is a section taken on the line 4—4 of Fig. 3 and showing a cap in its falling position.

Fig. 5 is a fragmental elevation of the rear face of the chute or conveyor showing a preferred arrangement of reflective and non-reflective surfaces, bottle caps being shown in dotted lines.

Fig. 6 is a wiring diagram of the apparatus of Fig. 1.

In the preferred embodiment shown in the drawings, 10 is an inclined chute or conveyor down which the articles to be sorted, such as bottle caps 11 roll, the chute being formed with a floor 12, a rear wall 13, a front wall 14, and an

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overhanging ledge 15. Front wall 14 is preferably formed with a series of openings 16 to facilitate access to the caps in the chute in event of their jamming. The conveyor is sufficiently narrow to retain the articles, such as the bottle caps shown in the illustration, in an upright position. The chute inclines downwardly from the right so that the direction of cap flow is from right to left as viewed in Fig. 1.

Portions of the front wall of the chute are removed to set up an inspection station and provide for insertion of a trap assembly including a trap 17 arranged to slide in slots 18 and 19 in the side walls of the chute and to cover an opening in the bottom of the chute large enough for a cap to fall therethrough. An arm 20 connects the trap with the moving element 21 of a solenoid 22, the latter being suitably mounted in a housing at the rear of the chute, not shown. A pin 23 is secured to move with trap 16 so that when the trap moves forward in the position shown in Figs. 3 and 4 to uncover the bottom opening and release a bottle cap, the pin projects into the path of the succeeding caps and prevents movement of the caps into the trap until the latter is closed. Pin 23 is secured to trap 17 by an upright 24 which positions the pin opposite an aperture 25 in wall 13 at a point spaced from the line of contact of the adjacent caps so that the pin will always enter in the space between two adjoining caps. Pin 23 is of sufficient length to engage the succeeding cap before the trap fully opens to discharge a linerless cap.

Each cap 11 is normally provided with a liner 26 of either white plastic material or other highly reflective material such as metal foil. Since the bottle caps are normally of a dark and poor reflecting material and a color such as dark brown, advantage is taken of this contrast in light-reflecting characteristic in sorting and eliminating the linerless caps. A light source 27 with a lens assembly 28, for focusing the light upon the interior of the cap when at the inspection station or position of halt, is provided in combination with a photo-electric cell 29 or similar light sensitive device arranged in the path of the reflected beam, the cell being arranged to operate the solenoid and its connected trap through the wiring assembly of Fig. 6.

As the cell 29, relay 31, lamp 27, and other electrical apparatus are conventional and their method of operation well known, the wiring diagram of Fig. 6 is believed self-explanatory. It has been found desirable to arrange the wiring so that the sensitivity of relay 31 can be varied by

adjusting the 5000 ohm variable resistor **33** across the 60 v. transformer tap, the sensitivity preferably being set to a value slightly under the sensitivity required to cause the relay to operate from linerless caps.

The face of rear wall **13** of the chute (Fig. 5) is preferably dark with the exception of a narrow strip **32** of highly reflective material directly back of the cap when in the inspection station, and so positioned that as a rejected cap falls through the trap, the reflective strip will become exposed to the light source and cell when the cap is about 90% out. The combination of the non-reflective and reflective surfaces on the back wall of the chute in this predetermined relation insure that once the trap is opened by a linerless cap, the trap will remain open because of the dark background of the wall **13**, until the cap is almost entirely discharged. At that point, the reflective surface **32** acts upon the cell to initiate the return of the trap to its closed position, the inertia of the trap and solenoid insuring sufficient time for the cap to complete its exit from the trap. The next cap cannot roll into the inspection station until the trap is closed because of the action of pin **23** which moves with the trap, and thus is operated by the light sensitive device.

In operation, the trap is assembled with a conventional feed chute to a bottling machine. In such a chute the caps are taken off the bottom of the chute at predetermined intervals at a rate of 115 to 120 caps per minute, allowing about 0.5 second for the periodic advance, inspection, and possible rejection of a cap. As the successive caps pass through the inspection station, they halt for about 0.5 second during which their interiors are subject to the light beam. If a liner is in the cap, sufficient light is reflected back to cell **29** and the trap remains closed. When a linerless cap appears, the reflected beam to the cell is reduced in degree so that the relay **31** operates the solenoid **22** to open the trap and discharge the cap.

In this operation, pin **23** engages the succeeding cap before the trap fully opens and remains in engagement until the trap is closed, thereby preventing jamming at the inspection station or the loss of caps containing liners through the trap.

In actual operation, it has been found that inspection and rejection can be accomplished in about 0.3 second, the action being sufficiently rapid so that no trouble is experienced when two linerless caps are encountered in succession at flows less than 120 caps per minute.

At higher rates of flow, two trap assemblies may be built into the chute and arranged to operate upon different caps at spaced stations. In this way, the rate of flow will be limited only by the speed of operation of the traps.

It is not necessary that the caps come to a halt at the inspection station or trap as it has been found that even with a continuous flow of caps as when the chute is filled initially, the linerless caps will be caught and discharged. It is only necessary that the caps travel at a rate to intercept the light beam and affect the reflection thereof. This may be accomplished in 0.1 second or less.

The momentary break in the feed of caps caused by the elimination of a linerless cap does not affect the feed to the bottling machine as a considerable reservoir of inspected caps is maintained in the machine end of the chute. Any gap caused by the discharge of linerless caps is immediately closed up by a temporary increase in the rate of flow of caps past the inspection station which rate continues until the lower part of the chute is filled again.

While this invention has been illustrated in connection with the sorting of bottle caps, it is to be understood that it is applicable to any type of sorting mechanism for articles wherein the criterion is the light reflecting characteristic.

Having described our invention, we claim:

1. An apparatus for sorting articles according to their light-reflecting characteristics which comprises: guide means along which articles are advanced for inspection; a trap in the guide means at the point of inspection of the articles; means to direct a beam of light on each article at the point of inspection; light-responsive means in the path of light reflected from each article as it reaches the point of inspection; means operable by said light-responsive means arranged to open said trap means and eject any article failing to reflect a predetermined degree of light, and simultaneously to stop the advance of articles to be inspected while an article is being ejected; and light reflective and non-reflective areas on the back panel of the guide means at the point of inspection, the light reflective area being positioned to reflect sufficient light to the light responsive means to initiate its operation at a predetermined position in the discharge of an article from the trap.

2. The combination with a chute for conveying bottle caps having cap liners of light reflecting character, of means for selecting and discharging linerless caps from the chute, said means comprising: a trap on the chute at a predetermined point of inspection of the bottle caps; means to direct a beam of light on the liner of each cap at the point of inspection; light responsive means in the path of light reflected from the liner; means operable by the light responsive means arranged to open said trap means and eject any cap failing to reflect a predetermined degree of light and simultaneously to stop the advance of articles to be inspected while a cap is being ejected, the rear face of the chute at the point of inspection being formed with light reflective and non-reflective areas, the light reflective area being positioned to reflect light to the light-responsive means at a predetermined position in the discharge of a cap from the trap.

3. An apparatus for sorting defective articles from articles having a light reflecting surface which comprises: an inclined chute for supporting said articles in rolling position to advance by gravity in a stream; an inspection station having a light reflecting portion adapted to be covered by said articles; article ejecting means adjacent said inspection station; means to direct a beam of light on said reflecting portion; light sensitive means in the path of reflected light from said reflecting portion actuated by a reflected light beam to maintain said ejecting means in ready position; and holding means actuated by said light sensitive means upon diminishing of reflected light to arrest the next adjacent article while the defective article is being ejected to uncover said reflecting portion.

4. An apparatus for sorting articles according to their light reflecting characteristics, comprising: guide means along which the members are advanced; an inspection station having a non-reflecting area adapted to be covered by an article to be inspected; article ejecting means adjacent said inspection station; means to direct a

beam of light on each article as it reaches the inspection station; light sensitive means in the path of reflected light from each article to actuate said ejecting means to eject an article at said station which fails to reflect a predetermined degree of light; means actuated by said light sensitive means to retain the next adjacent article while a non-reflecting article is ejected; and a reflecting member at the station positioned to be uncovered by ejection of an article to actuate the light-sensitive means to deenergize the ejecting means and return the retaining means to non-retaining position.

5. An apparatus for sorting articles according to their light reflecting or non-reflecting character, comprising: means to advance said articles in progression to an inspection station; a light sensitive means; article ejecting means, adjacent said station normally maintained in position to allow articles to pass through the station and operated by the light sensitive means upon diminishing of reflected light to eject non-reflecting articles from the station; detaining means operated by said light sensitive means to detain the article next adjacent the station while a non-reflecting article is ejected; and a reflecting member at the station positioned to be covered by an article at the station and operative when uncovered to actuate the light sensitive means to return the detaining means to non-detaining position.

6. An apparatus for sorting articles according to their light reflecting or non-reflecting character, comprising: means to advance said articles in progression to an inspection station; article ejecting means adjacent said station normally maintained in position to allow articles to pass through the station; a light source to direct a light beam upon an article at the station; a light sensitive means positioned to receive light reflected from the station and arranged to operate the ejecting means upon diminishing of the reflected light thereto; means operated by the light sensitive means to detain the article next adjacent the station while a non-reflecting article is

ejected; and means including a reflecting area at said station positioned to be covered by an article at the station; and operating when uncovered to reflect light to the light sensitive means to return the rejecting means to normal position and release said detaining means.

7. An apparatus for sorting defective non-reflecting articles from articles having a light reflecting surface which comprises: means for advancing said articles in procession; an inspection station along the path of movement of said articles having a non-reflecting portion adapted to be covered by an article at said station; article ejecting means adjacent said station; means to direct a beam of light on said station; photoelectric means in the path of reflected light from articles at said station; means actuated by said photoelectric means upon diminution of reflected light thereto to actuate the ejecting means to eject a defective article and arrest the next adjacent article to the station while a defective article is being ejected; and a light reflection portion at said station positioned relative to the non-reflecting portion in the direction of ejecting movement of said article to reflect light to the light sensitive means to return the rejecting and arresting means to normal position.

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