April 4, 1939. D. C. COX 2,152,758

SORTING MACHINE

Filed April 5, 1937 4 Sheets-Sheet 1

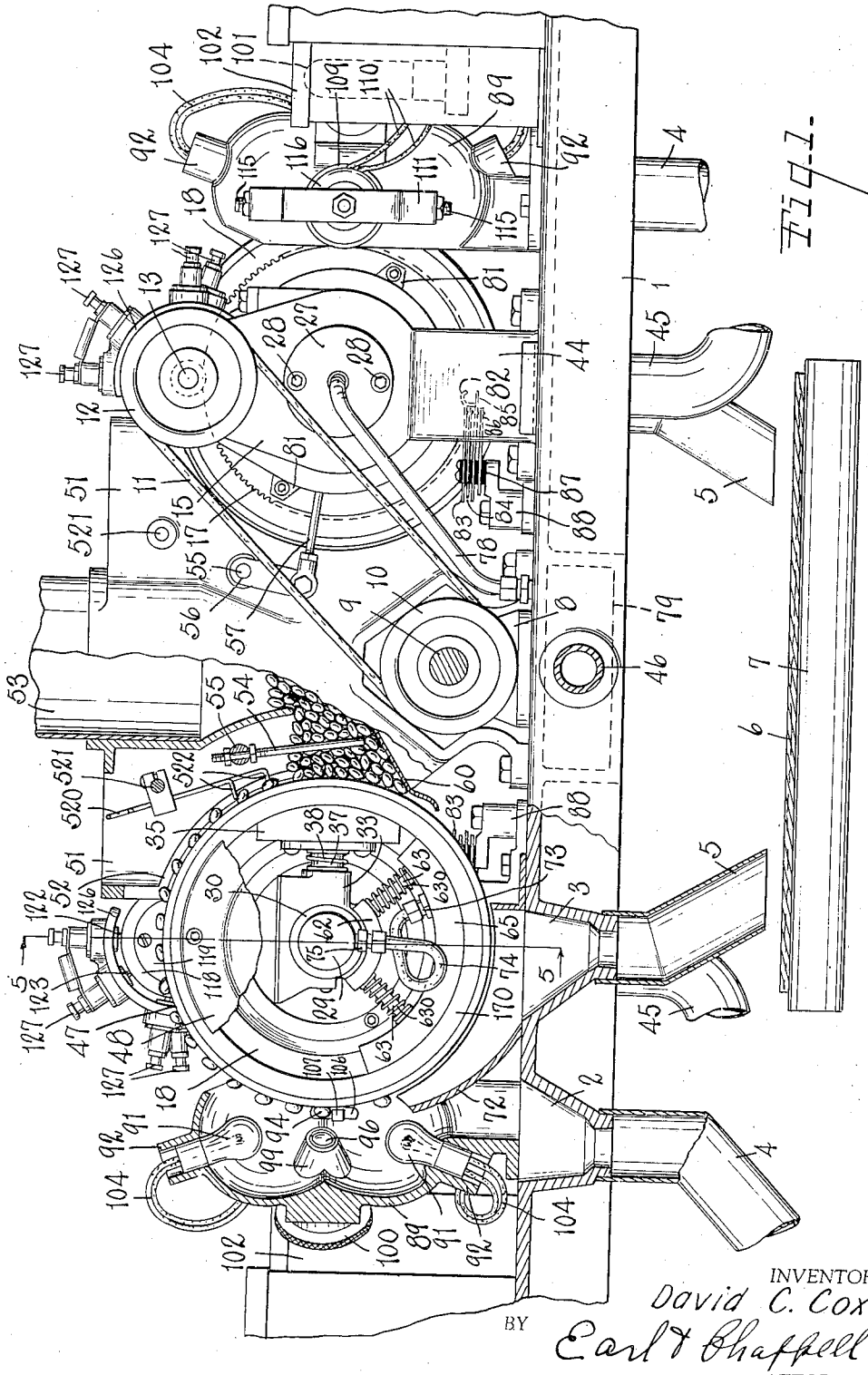


FIG. 1.

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Fig. 2.

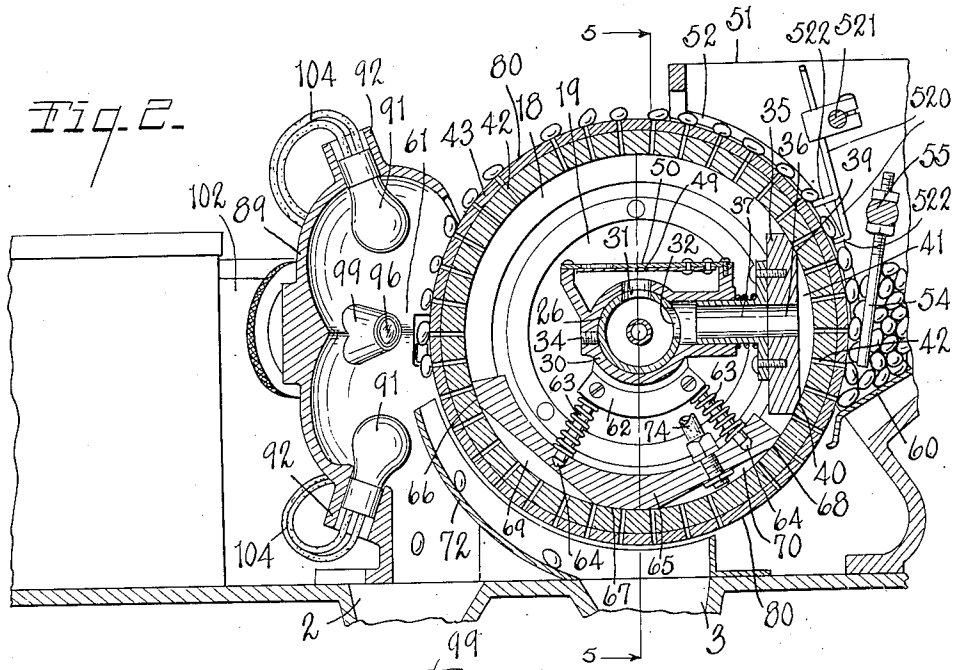
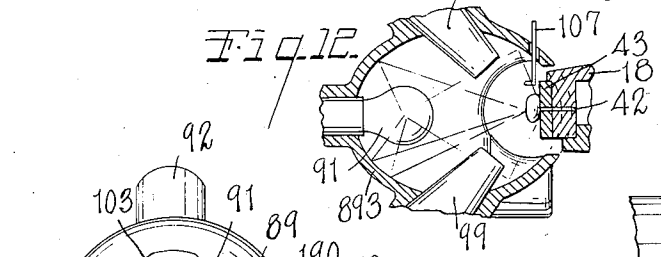


Fig. 1.



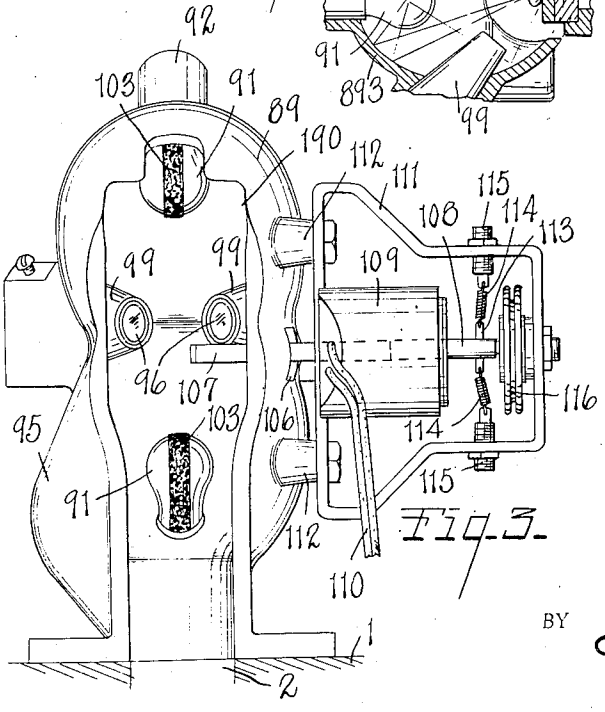


Fig. 3.

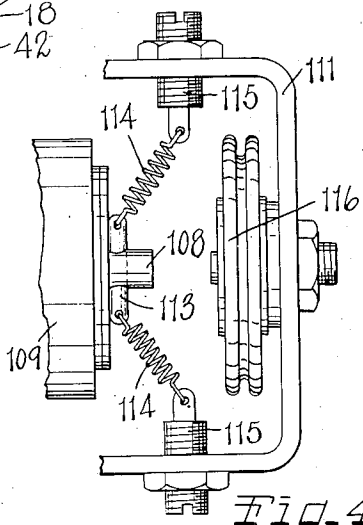


Fig. 4.

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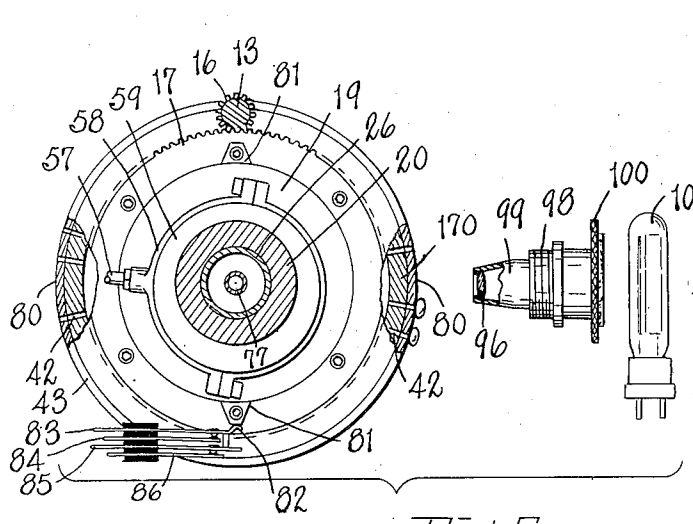


Fig. 6.

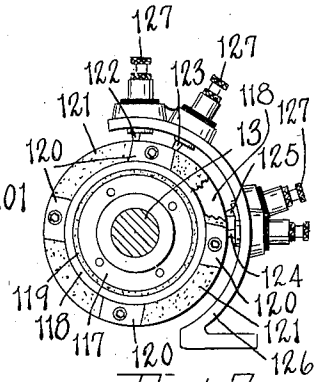


Fig. 7.

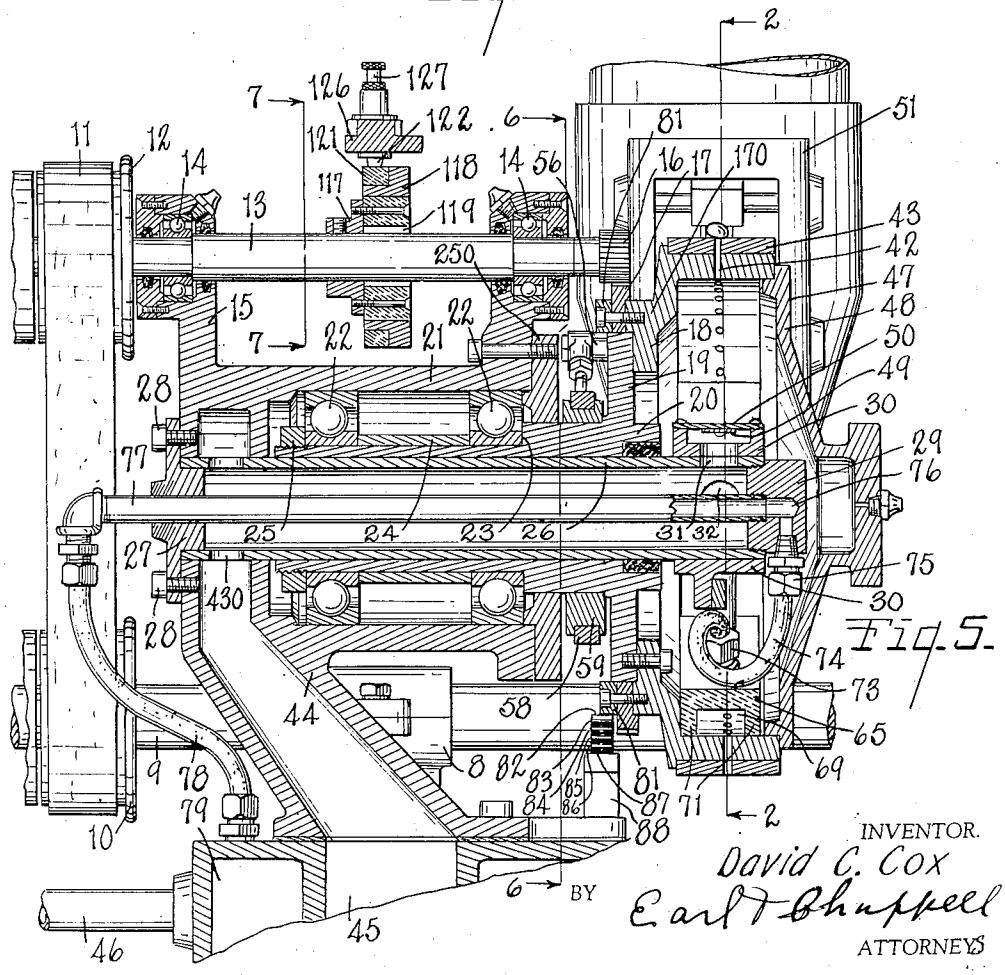


Fig. 5.

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SORTING MACHINE

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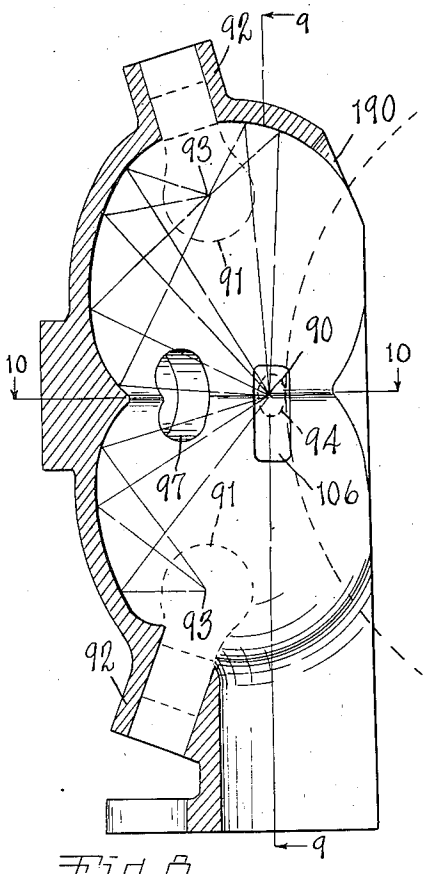


Fig. 8.

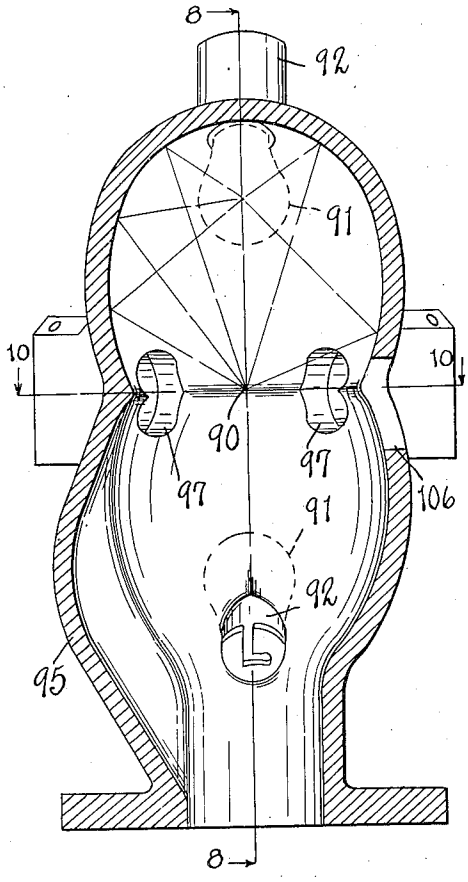


Fig. 9.

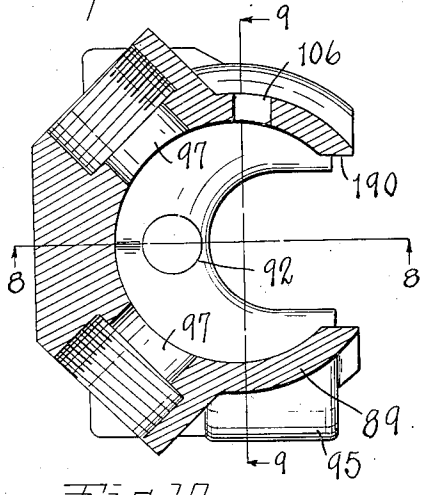


Fig. 10.

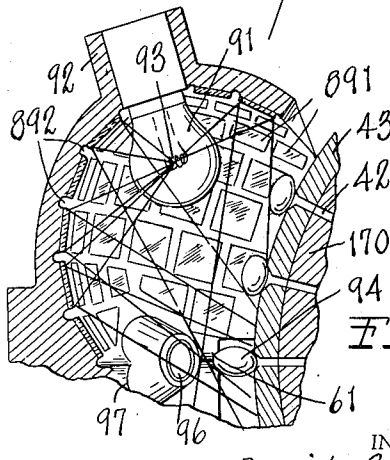


Fig. 11.

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Patented Apr. 4, 1939

2,152,758

UNITED STATES PATENT OFFICE

2,152,758

SORTING MACHINE

David C. Cox, Grand Rapids, Mich., assignor to Electric Sorting Machine Company, Grand Rapids, Mich.

Application April 5, 1937, Serial No. 135,012

17 Claims. (Cl. 209—111)

This invention relates to improvements in sorting machines.

This invention relates to improvements in electric sorting machines of the type disclosed in the patent to Hanson No. 2,054,319, of September 15, 1936, and in my pending applications Serial No. 711,374 filed February 15, 1934, and Serial No. 49,727 filed November 14, 1935, and more particularly relating to improvements in the provisions for retaining objects to be sorted on the rotating conveyor wheel and for releasing the same therefrom, and the ejecting mechanism and actuating devices therefor.

The main objects of this invention are:

First, to provide an electric sorting machine or system for sorting objects, such as beans and the like and off-color objects, whereby culls are eliminated, the machine being characterized by its accuracy and efficiency in operation.

Second, to provide a machine of the type described, characterized by novel and improved suction conveyor equipment for enabling objects to be picked up from a hopper and transported past a viewing and ejecting station and for facilitating the discharge of the objects after passing that station.

Third, to provide a novel and improved conveyor.

Fourth, to provide a sorting machine having a novel and improved mechanism for ejecting imperfect objects from a conveyor, the ejector being armature-operated and characterized by provisions rendering the initiation of its actuating movement completely free from resistance, yet returning the ejector to its original position rapidly and efficiently.

Fifth, to provide an equalized ejector mechanism which is capable of exceedingly rapid operation in either direction of its movement.

Sixth, to provide a sorting machine of the type described, embodying electric judging means for initiating actuation of an ejector mechanism, together with improved timing means for regulating the ejector operation so that it occurs at a fixed point in the machine cycle, according to whether an impulse is imparted to the judging means.

Objects relating to details and economies of the invention will appear from the description to follow. The invention is defined in the claims.

Preferred embodiments of the invention are illustrated in the accompanying drawings, in which:

Fig. 1 is a fragmentary view in front elevation, being partially broken away and partially in section to illustrate details of the machine.

Fig. 2 is a fragmentary view in vertical section on line 2—2 of Fig. 5, illustrating the conveying mechanism in association with the article pickup and discharge, and the improved illuminating and viewing arrangements of the machine.

Fig. 3 is an enlarged view in front elevation of the lamp housing and the ejector mechanism associated therewith, illustrating the relation of the illuminating lamps and photoelectric viewing elements thereto.

Fig. 4 is a fragmentary enlarged view similar to Fig. 3, more clearly illustrating the ejector actuating mechanism and elements associated therewith for retracting the same, the ejector actuating armature being indicated in ejecting position.

Fig. 5 is a fragmentary view mainly in vertical section on line 5—5 of Figs. 1 and 2.

Fig. 6 is a diagrammatic view partially broken away and in section on a line corresponding to line 6—6 of Fig. 5 illustrating the details of construction of the rotary conveyor and the relation thereto of the photoelectric viewing means.

Fig. 7 is a detail view in section on line 7—7 of Fig. 5, illustrating details of the regulating and timing commutator.

Fig. 8 is a view of the improved lamp housing employed in the machine in transverse vertical section on line 8—8 of Figs. 9 and 10, the position of the illuminating lamps, conveyor, and objects carried thereby being indicated in dotted lines.

Fig. 9 is a view of the lamp housing in section on line 9—9 of Figs. 8 and 10.

Fig. 10 is a view of the housing in horizontal section on line 10—10 of Figs. 8 and 9.

Fig. 11 is a fragmentary view of a modified form of lamp housing in section corresponding to that of Fig. 8.

Fig. 12 is a view in horizontal section, illustrating another modified form of lamp housing which may be used with my invention.

This invention comprehends a conveyor which is unfailing in its operation of picking up articles from a bin or hopper and of holding them on the conveyor during its rotation, the said means exerting a pronounced gripping effect on articles in the hopper at the pickup station whereby they are withdrawn from the hopper regardless of the frictional resistance of other articles in the hopper.

Other improvements included in the invention are in the provision of a relatively light ejector

blade driven by an armature and novel retracting means presenting little or no resistance to the initiation of the ejecting stroke yet serving to withdraw the ejector rapidly upon the completion of the stroke and comprising spring structure mounted on the armature in a manner to eliminate the possibility of binding effects.

Further details of improvements characterizing the invention will appear in the specification.

Referring to the drawings, particularly Fig. 1, the reference numeral 1 indicates a table having provision in the form of troughs or depressions 2 and 3, the former for receiving culls ejected from the machine by mechanism to be hereinafter described, and the latter for receiving acceptable objects. The troughs deliver to suitable chutes 4, 5, the chute 5 leading to a traveling conveyor belt 6 carried by rollers 7 in a well known manner.

The table 1 has suitably supported thereon a bearing member or pedestal 8 for a drive shaft 9 provided with pulleys 10 for operating the rotating parts of the mechanism through belts 11 as will be hereinafter described. In Fig. 1, only a single belt is illustrated which drives a single sorting apparatus; however, it will be understood that two duplicate sorting mechanisms are shown in that figure and that similar drive means for each is provided in the form of a drive belt 11 coacting with a pulley 10.

The belt 11 passes around a pulley 12 mounted on a shaft 13 which is carried by ball bearings 14 in extensions of a frame 15 which is mounted on the table 1. As illustrated in Fig. 5, the shaft 13 carries on its end a pinion 16 meshing with a ring gear 17 suitably secured to the flange 170 of a drum conveyor plate 18. The conveyor plate 18 is in turn secured to the radial flange 19 of a rotating sleeve 20.

The sleeve 20 extends into a cylindrical bearing housing 21 formed in the frame 15, being rotatably mounted in the housing by means of ball bearings 22 which are maintained in engagement at one end thereof with a shoulder 23 on the sleeve by spacer 24 and by nut 25 threadedly engaging the sleeve. A plate 250 bolted to the frame 15 closes the bearing housing.

The sleeve is rotatable on a shaft or spindle 26 fixedly mounted in the frame and closed at one end by a plug 27 secured to the frame by screws 28. The other end of the spindle is closed by a plug 29 threadedly engaging the spindle interiorly and having communicating passages 76 drilled therein for a purpose to be hereinafter described.

Referring to Fig. 2, at the end adjacent the plug 29, the spindle 26 has fixedly secured thereto a suction fitting 30 which surrounds the spindle, and the spindle and fitting are drilled to provide a suction opening 31 therethrough. The spindle 26 is also drilled at 32 in line with a projecting radial passageway 33 formed in the fitting 30. The fitting 30 is held in mounted position on the spindle 26 by a set screw 34.

A segmental suction head 35 having a mouth 36 in line with the passageway 33 is slidably mounted in the passageway by means of a tubular stem or neck 37 secured to the shoe and slidably received in the passage member. A coil spring 38 encircles the stem and urges the head outwardly against the inner periphery of the flange 170 on the conveyor plate 18, the head being formed so as to provide a seal between the rounded ends 39 and 40 thereon, whereby a relatively high vacuum may be maintained in the space 41. The head 35 has radial side walls on either side of a row of perforations 42 formed in the peripheral wall of the conveyor and a continuous article supporting rim 43 surrounding the conveyor, the walls sealing the space at either side of the perforations whereby suction may be created and maintained in space 41.

The hollow spindle 26 is connected to a suitable means for creating a vacuum, apertures 430 being formed in the spindle near the end thereof adjacent the plug 27 and the hollow frame pedestal 44 leading to a vacuum chamber 45 in the table 1—see Fig. 5. The conduit 46 leads to a suitable pump for creating a vacuum in the chamber 45, cylinder 46 which may be termed a suction header, and drum 47.

The apertures 31 in the suction fitting 30 and the spindle 26 communicate with the interior of the conveyor drum, indicated generally by the reference numeral 47, which drum is closed by a disk 48 secured to and rotating with the plate 18. Therefore a partial vacuum exists inside the drum throughout a large portion of its volume. The partial vacuum in the drum 47 need not be as great as that in the space 41 since it only serves the purpose of maintaining the articles against the seats of the holes 42 and it may be regulated by a valve plate 49 adjustably mounted on an apertured plate 50 extending over and covering the space directly above the fitting 30, as illustrated in Figs. 2 and 5.

From the description of the construction of the suction drum, it will be seen that objects, such as beans, will be picked up from the hopper 51 which has face flanges 52 concentric with the rim 43 providing a slot in the hopper face of a width sufficient to accommodate a row of articles such as beans aligned with the openings 42.

A pair of angled article positioning members 520 are mounted on a rod 521 between the walls of the hopper 51, the angled extensions or fingers 522 thereof extending between the flanges 52 and into the hopper opening adjacent the conveyor rim 43, being placed on opposite sides of the row of holes 42 to position the articles on the conveyor rim.

The vacuum existing in the space 41 is sufficiently great to cause a bean to be gripped to the conveyor over each hole and transported from the objects in the hopper 51. The vacuum in the drum 47 is merely sufficient to resist displacement of the articles from the rim as they are carried to the viewing station.

The hopper 51 is fed from a feed conduit 53 leading to a storage bin. An agitating finger 54 is suitably clamped to a rockshaft 55 mounted for rocking movement in the hopper walls and extending outwardly therethrough on one side at 56, Fig. 5, where it is suitably connected to a link or connecting rod 57. The connecting rod is joined at its other end to a ring 58 surrounding a disk 59 rigidly and eccentrically secured to the rotatable sleeve 20. Accordingly, rotation of the sleeve 20 causes the rockshaft 55 to rock the agitator finger 54 to agitate the articles in the hopper so that they do not become wedged or unduly compacted. An inclined flexible member 60 forms the effective bottom of the hopper and serves to prevent the articles from jamming between the hopper and conveyor rim 43.

After the beans carried by the conveyor have passed a viewing field or station, to be hereinafter described and indicated generally by the reference numeral 61 in Figs. 1 and 2, it is necessary to remove the objects which have not been ejected from the conveyor by the ejecting

mechanism to be likewise hereinafter described. Such means will now be described.

The fitting 30 has rigidly mounted thereon a thrust abutment 62 carrying pins 63 slidably engaging recesses 64 drilled in a divided segmental shoe 65 which constitutes a discharge valve and a clearance means. The said shoe is supported by these pins in a sliding engagement with the inner side of the peripheral wall of the conveyor at the curved surfaces 66, 67 and 68 so that the compartments 69, 70 are provided between the shoe and the conveyor. The shoe has side walls indicated at 71 in Fig. 5 and extending into continuous sliding contact with the inner peripheral surface of the flanges so that the spaces 69 and 70 are sealed from the remainder of the drum and from each other. Springs 630 surrounding the pins 63 yieldingly urge the shoe 65 outwardly.

Space 69 being separated from the source of vacuum, it will be apparent that atmospheric pressure exists therein, wherefore when the portion of the rim supporting an article passes the space 69, the object will drop therefrom into a collector chute 72 leading to the trough 3 and the belt conveyor 6, whereby the said objects are removed. Space 70 is subjected at suitable intervals, by the opening of a manually controlled valve, not shown, to a positive pressure through a fitting 73 mounted in the shoe 65 which fitting is connected to a flexible hose 74 in turn joined to a further fitting 75 communicating with the intersecting passages 76 drilled in the plug 29. The plugs or closures 27 and 29 carry an axially arranged pipe 77 extending exteriorly of the spindle 26 through the plug 27 and connected on the exterior to a flexible hose 78 which communicates with a pressure chamber 79 formed in the table 1 and supplied with air under pressure from a suitable source (not shown). Therefore, upon passing the space 70, the openings 42 will be subjected to a blast serving to clear the same of any matter clogging their outlets—for example, hulls of beans or the like.

The rim 43 is suitably tinted on its outer periphery to provide a reference background of the proper color, as described in my copending application, Serial No. 49,727, filed November 14, 1935, and likewise carries a pair of normalizing spaces 80 enabling the amplifying circuit of the machine to be given a setting appropriate to the effective lighting, as described in that application. The number of such blank spaces may be varied as desired.

A pair of contact lugs 81 positioned according to the blank spaces 80 on the rim and fixed to ring gear 17, as illustrated in Figs. 5 and 6, rotate with the conveyor drum 47, periodically engaging a switch finger 82 to complete an electrical contact between pairs of spring switch members 83, 84, and 85, 86 carried by an insulating mounting 87 which is secured to a support 88 bolted to the table 1. The spring switches are joined to conductors (not shown) leading to the electrical amplifying mechanism for the purpose of accomplishing the normalizing operation as described in my copending application Serial No. 49,727, filed November 14, 1935, whereby the said mechanism is periodically given an appropriate setting according to effective lamp brightness after the spaces 80 on the rim have been viewed.

I will now describe the improved structure for illuminating and viewing objects at the station 61, reference being had to Figs. 2, 3, 6, 8 and 11.

The lamp housing, generally indicated by the reference numeral 89, is preferably mounted on the side of the conveyor drum 47 opposite the hopper 51, although this position may, of course, be altered at will and overlaps the drum on either side, having upper and lower recesses 190 receiving the drum. The housing is formed internally in the shape of a pair of intersecting ellipsoids with the imaginary plane of intersection passing through one of the foci of each of the ellipsoids. In other words the ellipsoids have one common focus and are so positioned relative to the path of travel of an article on the conveyor rim 43 that the article passes through the theoretical common focus which is indicated by the reference numeral 90 in Figs. 8 and 9. Illuminating lamps 91 are placed in socket-like holders 92 formed in the double ellipsoidal housing 89 so that the theoretical point of radiation of each of the lamps lies on a focus indicated by the reference numeral 93 of each of the ellipses. The result is that the light rays, as shown in Figs. 8 and 9, converge on the article 96 on the conveyor rim from all directions, the rays being indicated by broken lines in Figs. 8 and 9.

The slight bulge or enlargement 95 formed at one side in the housing, as shown in Fig. 9, is provided to allow more room for ejected articles to pass to a point of discharge after they are ejected from the conveyor and to prevent their accidental glancing or rebounding into the collector or chute 72.

A pair of lenses 96 are mounted in openings 97 in the housing on the line of intersection of the ellipsoids and on either side of the common focus, as illustrated in Fig. 9, the mounting being made by a sleeve 98 threadedly engaging in the opening in the lamp housing and carrying a lens support 99 which is adjustable by the knurled disk 100 whereby the focusing of the lenses is accomplished, Fig. 6. Aligned with each lens is a photoelectric tube 101 carried in light-sealed mounting 102.

Each of the lamps 91 is provided with a relatively light-impervious area or zone 103 to the end that direct glare of the light rays on the articles being viewed is prevented, the entire illumination thereof being as a result of rays reflected uniformly thereon. The lamps are energized by feed wires 104 and the photoelectric cells 101 are likewise suitably connected to the amplifying circuit.

A modified form of lamp housing is illustrated in Fig. 11, which embodiment relies for its effectiveness on the principle of directing parallel beams rather than converging rays of light on the article at the viewing station with the effect of illuminating the same through overlapping areas of light rather than through an infinite number of converging points of light. I have found that this principle of lighting is very effective in the elimination of false effects due to shadows, etc. In carrying the idea into practice, I employ a large number of mirrors or other reflecting surfaces 891 suitably secured to the housing 89 in a manner not to interrupt the reflecting area of each surface. Channels 892 separate the mirrors and are deep enough to eliminate any reflecting tendency of the housing itself. The rays of light emanating from the lamps 91 and the limits of the beams reflected from the mirrors 891 are indicated in broken lines in Fig. 11, and it will be seen that an article at the viewing station 61 is completely bathed in uni-

form light. The article being viewed in Fig. 11 is illustrated as being in an up-ended position to clarify the effect of the individual mirror system of illumination. The article is illuminated throughout substantially its entire area. There is no point which is relatively intensively lighted and the resulting tendency to mask the effect of a discolored portion of the article is not possible as might be the case were the light rays focused by use of a perfect ellipsoidal reflecting surface.

In Fig. 12 I illustrate a lamp housing 893 suitable for illuminating articles on the conveyor, the said housing being internally in the form of a single ellipsoid or approximately so, articles on the conveyor rim 43 being transported through one focus thereof while lamp 91 is set at the other focus thereof, and the lens mountings 99 are placed in the side walls, the major axis of the ellipsoid extending at right angles to the conveyor periphery as distinguished from the previously described housing having double ellipsoidal surfaces wherein the major axes are obliquely disposed to the conveyor periphery. The housing illustrated in Fig. 12 is a simplified adaptation of the principle of my invention. However, I find it provides very satisfactory illumination of articles for the purpose of my invention. My invention also broadly contemplates forming the inner elliptical surfaces of the housing 893 of a plurality of separate mirrors such as those indicated by the reference numeral 891 of Fig. 11.

The improved ejector mechanism of the invention will now be described. Referring to Figs. 3 and 4, an aperture 106 is provided in the lamp housing on one side thereof and at a point slightly below the viewing station and the lenses 96. The ejector blade or tappet 107 operates centrally of the aperture 106, extending transversely of the rim of the conveyor 43. The blade is preferably formed of aluminum so as to be quite light and readily actuated by an iron armature or core 108 connected to the rear end thereof. The armature slides in an electromagnet, generally indicated by numeral 109, which is energized by lead 110 as determined by impulses originating in the photoelectric viewing means, suitably amplified, and controlled by a commutator to be hereinafter described. The magnet is carried by a bracket 111 rigidly mounted to the lamp housing on bosses 112.

For the purpose of retracting the ejector after its inward ejecting stroke rapidly and smoothly and at the same time without imposing a serious starting load on the ejector, a retractor mechanism is employed consisting of a pin 113 having a free sliding fit in a diametral hole drilled through armature 108, the pin having coil springs 114 at the ends thereof attached to anchor screws 115 which threadedly and adjustably engage the bracket 111. A resilient bumper 116 is carried by the rear end of the bracket to absorb the impact thereof on its return stroke.

By the above construction, it will be seen that since the springs 114 are substantially aligned with the pin 113 in normal position, they impose no resistance to starting movement of the armature and will act as a buffer at the end of the inward or ejecting stroke of the ejector blade. They will also return the armature at the same speed at which it was initially projected. A further important feature of the ejecting structure just described lies in the fact that the pin centralizes the reaction of the springs 114 by virtue of the loose fit of the pin in the armature. Accordingly, there will be no binding action if the anchor screws 115 should be screwed in the bracket at different distances.

In Figs. 5 and 7, an improved commutator is disclosed for timing and controlling the supply of current to magnet 109 to actuate the ejector blade 107 after an imperfect or discolored article passes the viewing field, the commutator being mounted on and driven by the shaft 13 in timed relation to the rotation of the conveyor drum. The effect of the commutator is to connect the magnet to a relatively low resistance each time an article passes from a point between the lenses 96 to a point beside the ejector blade 107 whereby if an impulse is originated in a photoelectric cell, the same may be amplified and transmitted to the magnet. Until the time that the article reaches the ejector blade, however, the magnet is connected to the amplifying means through a path of relatively high resistance so that the impulse reaching the magnet is not sufficient to energize it. When the article is in position for ejection the relatively high resistance is short circuited and the full impulse reaches the magnet.

The commutator structure consists of a disk 117 rotatable with the shaft 13 and carrying a conducting ring 118 but insulated from the conducting ring by a strip 119. Four conducting segments 120 are in electrical connection with the ring 118 and the segments are uniformly separated from one another by segments 121 of non-conducting material. Segments 120 and 121 form a continuous circular periphery for the commutator on which contacts 122, 123 and 124 ride. The contact 125 is a supply contact riding in continuous contact with the conducting ring 118. An arcuate support 126 is suitably attached to the frame of the machine and carries contacts 122, 123, 124, and 125, as well as terminal binding posts 127 associated with each of the same.

The contacts 122, 123 are adapted to be connected by a relatively high resistance, not shown, whereby when the said contacts are not bridged by a conducting segment 120, the impulse reaching magnet 109 is insufficient to actuate blade 107. However, when the segment 120 bridges contacts 122, 123 the relatively high resistance is short circuited and the magnet sufficiently energized to actuate the blade. The segments are appropriately spaced and the rotation of the commutator timed so that the short circuiting action will occur at the exact time that an article on the conveyor reaches the ejecting blade, provided an impulse has been originated by the photoelectric viewing means. A suitable condenser, not shown, is connected between contacts 124, 125 whereby sparking at the commutator is minimized.

From the foregoing, the operation of the machine as well as the refinements made possible in the operation should be clear. Articles to be sorted are picked up from the hopper 51 by substantial suction effective through openings 42 and are carried on the rim to viewing station 61 where they are completely and uniformly illuminated so that shadows will not produce an improper energization of the photoelectric tube, or, on the other hand, fail to energize the tube when a cull is present. Of course, the photoelectric cell views the article in comparison with the reference background provided by the rim 43. Periodical normalizing action to make an appropriate adjustment or setting according to the effective brightness of the illuminations is provided by the blank spaces 80 on the conveyor rim whereby the machine is rendered invulnerable to

variations in illumination caused by variations in lamps 91, outside influences, etc., in accordance with the description in my copending application Serial No. 49,727.

If an imperfect article is present, an actuating impulse is generated in the photoelectric cell and transmitted through an amplifying hook-up including a grid-controlled gaseous discharge tube, as described in the above mentioned copending application, to magnet 109, the effect of the impulse being practically nullified by a relatively high resistance until the resistance is short-circuited by one of the commutator segments 120. The short-circuiting action occurs at the instant when the article is adjacent the hammer blade 107, whereupon the same is projected transversely of the rim to eject the imperfect article into the trough 2. Accordingly the blade may be positioned outside of the viewing field 61. Perfect or acceptable articles retained on the rim are dropped therefrom when the rim passes space 69, being received by the collector 72 and discharged onto the conveyor 6. Upon passing the pressure space 70, the holes 42 in the conveyor are subjected to a considerable blast to rid them of clogging material and then pass to the hopper 51.

Impulses originating in the photoelectric tubes 101 are amplified and transmitted to the commutator, thence to the electromagnet through circuits similar to those shown and described in my copending application Ser. No. 49,727, identified above, and are therefore not duplicated here, inasmuch as the action thereof and the advantageous features characterizing the same are all present in the machine of this invention.

I have shown preferred embodiments of my invention but further adaptations and modifications will be apparent to those skilled in the art, and I desire to claim the same specifically as well as broadly, as pointed out in the appended claims.

Having thus described the invention, what is claimed as new and desired to secure by Letters Patent, is:

1. A sorting machine comprising a rotary conveyor, means for holding articles on said conveyor, photoelectric means for viewing the articles at a certain point in their travel, means for ejecting certain of said articles from said conveyor, comprising an ejector blade, means controlled by said potoelectric means for actuating said ejector blade, comprising an armature secured to the blade and an armature actuating magnet in circuit with the photoelectric means, and means for cushioning the armature on completion of the ejecting stroke and for thereafter retracting the armature and blade, comprising a pin mounted for slidable movement transversely of the armature, a fixed bracket, adjustable anchoring means carried by the bracket, and coil tension springs connected to opposite ends of said pin and to said anchoring means.

2. A sorting machine of the type described having a rotating drum-like conveyor adapted to transport articles past an article viewing station, photoelectric viewing and illuminating means, a hopper operatively associated with said conveyor, a suction header about which said conveyor rotates and having outlets inside said conveyor, a hollow segmental suction head slidingly engaging the inner periphery of said conveyor and forming therewith a suction chamber, said conveyor having a peripherally spaced series of articles seating holes opening therethrough to the chamber, said suction head connecting said chamber with an outlet in said header, means including another outlet in said header operative to create a partial vacuum in holes throughout a portion of the travel of said conveyor to hold articles thereon during the travel of the conveyor after leaving the hopper, and means sealing a predetermined volume of said conveyor from said vacuum to form an atmospheric pressure chamber, comprising a segmental hollow shoe.

3. A sorting machine of the type described having a rotating drum-like conveyor adapted to transport articles past an article viewing station, photoelectric viewing and illuminating means, a hopper operatively associated with said conveyor, a suction header about which said conveyor rotates and having outlets inside said conveyor, a hollow segmental suction head slidingly engaging the inner periphery of said conveyor and forming therewith a suction chamber, said conveyor having a peripherally spaced series of article seating holes opening therethrough to the chamber, said suction head connecting said chamber with an outlet in said header, means including another outlet in said header operative to create a partial vacuum in holes throughout a portion of the travel of said conveyor to hold articles thereon during the travel of the conveyor after leaving the hopper, and a valve within said conveyor with which said article sealing holes successively coact.

4. In a sorting machine, the combination with a feed hopper, of a rotatably mounted drum-like conveyor having an annular series of suction orifices, said conveyor being disposed so that a portion thereof sweeps through the hopper in contact with the material to be sorted, a suction head disposed within said conveyor in opposed relation to the hopper and coacting with the wall of the conveyor to form a suction chamber into which the suction orifices successively open while in operative relation to said hopper, means for creating suction within said suction head, means for creating a less degree of suction within said conveyor acting to create a partial vacuum within the conveyor sufficient to hold articles to said conveyor while permitting easy disengagement thereof, a light sensitive means operatively associated with said conveyor and to which the articles translated by said conveyor are successively subjected, an ejector means for ejecting selected objects from said conveyor operatively associated with said light sensitive means, a valve disposed at the rear of said ejector means to successively cut off the suction on the suction orifices, blast means disposed at the rear of said valve and comprising a pressure space into which the suction orifices successively open, and a nozzle directed in the path of travel of the orifices.

5. In a sorting machine, the combination with a feed hopper, of a rotatably mounted drum-like conveyor having an annular series of suction orifices, said conveyor being disposed so that a portion thereof sweeps through the hopper in contact with the material to be sorted, a suction head disposed within said conveyor in opposed relation to the hopper and coacting with the wall of the conveyor to form a suction chamber in which the suction orifices successively open while in operative relation to said hopper, means for creating suction within said suction head, means for creating a less degree of suction within said conveyor acting to create a partial vacuum within the conveyor sufficient to hold articles to said conveyor while permitting easy disengagement thereof, a light sensitive means operatively associated with said conveyor and to which the ar-

ticles translated by said conveyor are successively subjected, an ejector means for ejecting selected objects from said conveyor operatively associated with said light sensitive means, and a valve disposed at the rear of said ejector means to successively cut off the suction on the suction orifices.

6. In a sorting machine, the combination with a feed hopper, of a rotatably mounted drum-like conveyor having an annular series of suction orifices, said conveyor being disposed so that a portion thereof sweeps through the hopper in contact with the material to be sorted, a suction head disposed within said conveyor in opposed relation to the hopper and coacting with the wall of the conveyor to form a suction chamber into which the suction orifices successively open while in operative relation to said hopper, means for creating suction within said suction head, means for creating a less degree of suction within said conveyor acting to create a partial vacuum within the conveyor sufficient to hold articles to said conveyor while permitting easy disengagement thereof, a light sensitive means operatively associated with said conveyor and to which the articles translated by said conveyor are successively subjected, and an ejector means for ejecting selected objects from said conveyor operatively associated with said light sensitive means.

7. In a sorting machine, the combination with a feed hopper, of a rotatably mounted drum-like conveyor having an annular series of suction orifices, said conveyor being disposed so that a portion thereof sweeps through the hopper in contact with the material to be sorted, means for creating zones of greater and lesser suction in said conveyor, and means adjacent the zones of lesser suction for dislodging material picked up from the hopper at said zone of greater suction.

8. A sorting machine of the class described comprising a conveyor adapted to transport articles from a loading station to viewing and discharging stations and provided with a spaced series of suction orifices, a hopper operatively associated with said conveyor, photoelectrically controlled ejector means operatively associated with said conveyor, a suction head operatively associated with said conveyor at said hopper so that the suction orifices are successively subjected to said suction head for providing a substantial suction to engage articles with the conveyor, means for providing a reduced suction on said suction orifices at the rear of the loading station, means at the rear of the viewing and ejector station for successively cutting off the suction from said orifices, and means at the rear of said suction cut-off means for subjecting the orifices to a blast of air.

9. A sorting machine of the class described comprising a conveyor adapted to transport articles from a loading station to viewing and discharging stations and provided with a spaced series of suction orifices, a hopper operatively associated with said conveyor, photoelectrically controlled ejector means operatively associated with said conveyor, a suction head operatively associated with said conveyor at said hopper so that the suction orifices are successively subjected to said suction head for providing a substantial suction to engage articles with the conveyor, means for providing a reduced suction on said suction orifices at the rear of the loading station, and means at the rear of the viewing and ejector station for cutting off the suction from said orifices.

10. A sorting machine of the class described comprising a conveyor adapted to transport articles from a loading station to viewing and discharging stations and provided with a spaced series of suction orifices, a hopper operatively associated with said conveyor, means operatively associated with said conveyor for acting on said articles, a suction head operatively associated with said conveyor at said hopper so that the suction orifices are successively subjected to said suction head for providing a substantial suction to engage articles with the conveyor, and means for providing a reduced suction on said suction orifices at the rear of the loading station.

11. A sorting machine having a conveyor adapted to transport articles, a hopper operatively associated with said conveyor, means for fixing articles to said conveyor and removing the same from said hopper, comprisng a suction head slidingly engaging the said conveyor during a portion of the travel thereof and forming therewith a suction chamber, said conveyor having spaced article seating holes opening to the chamber, means to create a partial vacuum communicating with said holes throughout another portion of the travel of said conveyor to hold articles thereon during the travel of the conveyor after leaving the hopper, means sealing a predetermined volume of said conveyor from said vacuum, and means for clearing said holes after passing said sealing means.

12. A sorting machine comprising a conveyor for carrying articles to be sorted, an ejector blade, means for actuating said ejector blade comprising an armature secured to the blade, an armature actuating magnet, and means for cushioning the armature on completion of the ejecting stroke and thereafter retracting the armature, comprising a pin mounted for transverse floating movement relative to said armature and springs connected with said pin and restrained at their ends for cushioning the ejecting stroke and for retracting the armature, said springs being arranged so as not to resist the initial movement of the armature.

13. A sorting machine comprising a conveyor provided with suction means for carrying articles to be sorted in series past an inspection station, photoelectric inspecting means at such station, an ejector, means controlled by said photoelectric means for actuating said ejector comprising an armature, an armature actuating magnet in circuit with said photoelectric means, and means for cushioning the armature on completion of the ejecting stroke and thereafter retracting the armature comprisng a pin slidably mounted relative to said armature and springs operatively associated with said pin for cushioning the ejecting stroke and for retracting the armature, said springs being arranged so as not to resist the initial movement of the armature, and a buffer cushioning the return stroke of said armature.

14. In a sorting machine, a rotating drum-like conveyor adapted to transport articles, an ejector for ejecting imperfect articles from the conveyor, comprising an ejector blade moving past the conveyor into contact with an article, electromagnetic means for actuating said ejector, comprising an armature, and an electromagnet adapted to actuate the armature, means for cushioning the blade at the extremity of its operative stroke and for thereafter retracting the blade, means for energizing said magnet comprising a photo-

electric element viewing the articles, means for imparting impulses originating in said element to said magnet, and means timing and controlling the energization of said magnet under the influence of said impulses, comprising a commutator, said impulses normally traversing a highly resistive path to said magnet whereby they are rendered insufficient to actuate the armature in opposition to said cushioning and retracting means, said commutator periodically short circuiting said path whereby said impulses may actuate the armature.

15. In a sorting machine, in combination, a rotating drum conveyor for transporting articles past an article viewing station, a hopper operatively associated with said conveyor at one point in its travel, means for picking up articles from said hopper and holding the same on the conveyor during the travel thereof, comprising a suction head slidably engaging the conveyor internally during a portion of the travel thereof and forming a suction chamber therewith, said conveyor having spaced article seating suction holes opening to the interior thereof, means to create a partial vacuum through said holes during another portion of the travel of the conveyor to hold articles thereon after leaving the hopper while at said station, and means for sealing a predetermined volume of said conveyor from said vacuum, ejecting means operatively associated with the conveyor at another point in its travel, photoelectrically controlled means for ejecting imperfect articles from said conveyor, comprising an ejector blade, an electromagnet controlled by said photoelectrically controlled means for actuating said blade, and means for cushioning the blade on completion of the ejecting stroke under an impulse from said magnet and for retracting the blade after said stroke.

16. In a sorting machine, in combination, a suction drum conveyor adapted to pick up articles from a hopper and transport the same past a viewing station, said conveyor having a suction head slidingly engaging the same internally during a portion of the travel thereof and forming therewith a suction chamber, said conveyor having spaced article seating suction holes opening to the interior thereof, means to create a partial vacuum in said conveyor during another portion of the travel thereof, means sealing a predetermined volume of said conveyor from said vacuum, an ejector blade cooperative with said conveyor at a point in its travel, means for actuating said blade, comprising a photoelectrically controlled electromagnet, said blade having an armature actuated by said electromagnet associated therewith, and means for cushioning the ejecting stroke of the blade and for retracting the armature, comprising a pair of coil springs floatingly connected to the armature at one end thereof and adjustably anchored at the other end thereof whereby initial movement of the armature is not resisted and a uniform retractive force is imparted thereto.

17. In a sorting machine, in combination, a suction drum conveyor adapted to pick up articles from a hopper and transport the same past a viewing station, said conveyor having a suction head slidingly engaging the same internally thereof during a portion of the travel and forming therewith a suction chamber, said conveyor having spaced article seating suction holes opening to the interior thereof, means to create a partial vacuum in said conveyor during another portion of the travel thereof, an ejector blade cooperative with said conveyor at a point in its travel, and means for actuating said blade.

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