Sept. 15, 1936. M. C. HANSON 2,054,320

SORTING APPARATUS

Filed Feb. 15, 1932 3 Sheets-Sheet 1

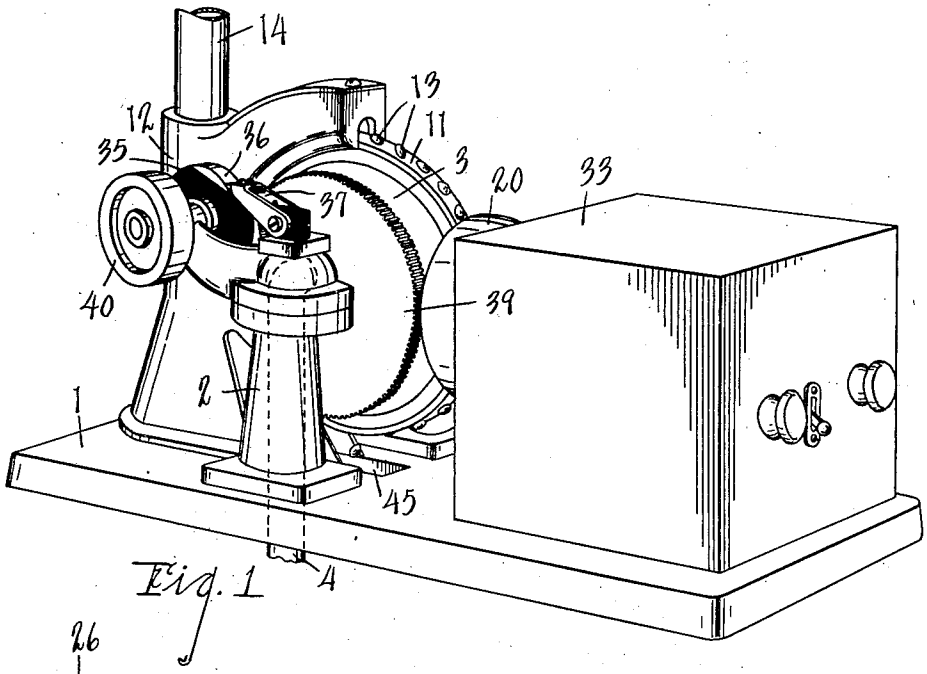


Fig. 1

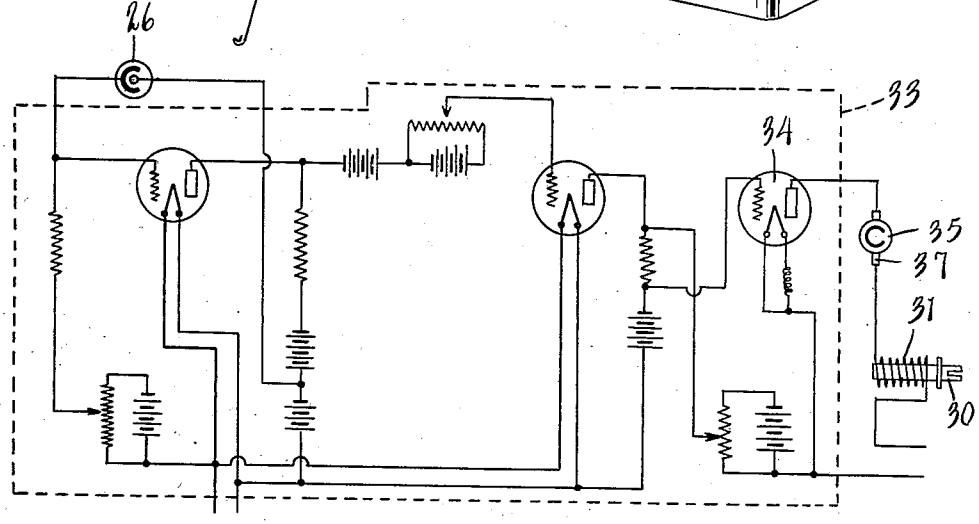


Fig. 7

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SORTING APPARATUS

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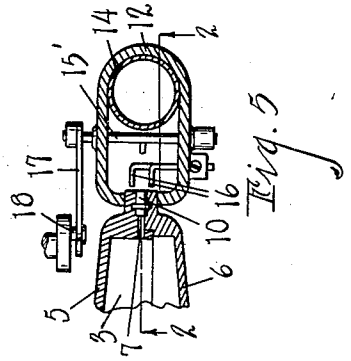


Fig. 5

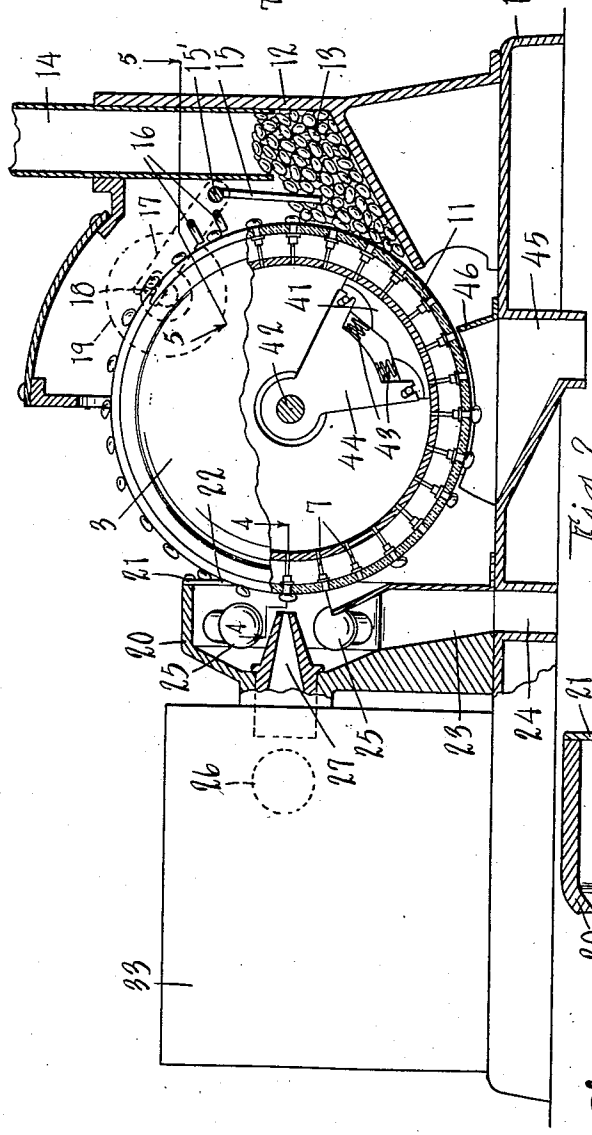


Fig. 2

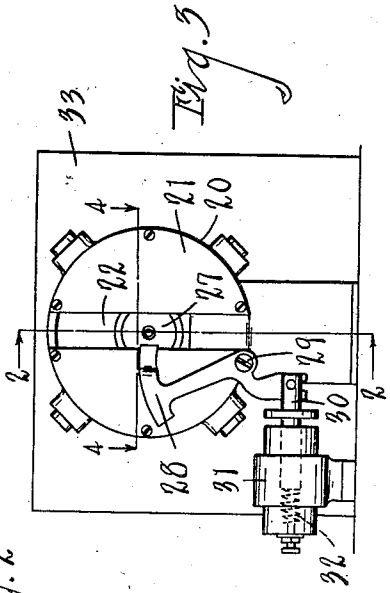


Fig. 3

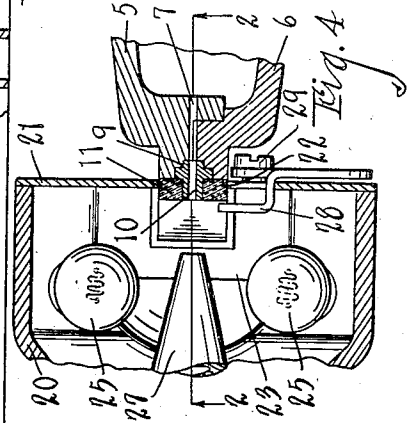


Fig. 4

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SORTING APPARATUS

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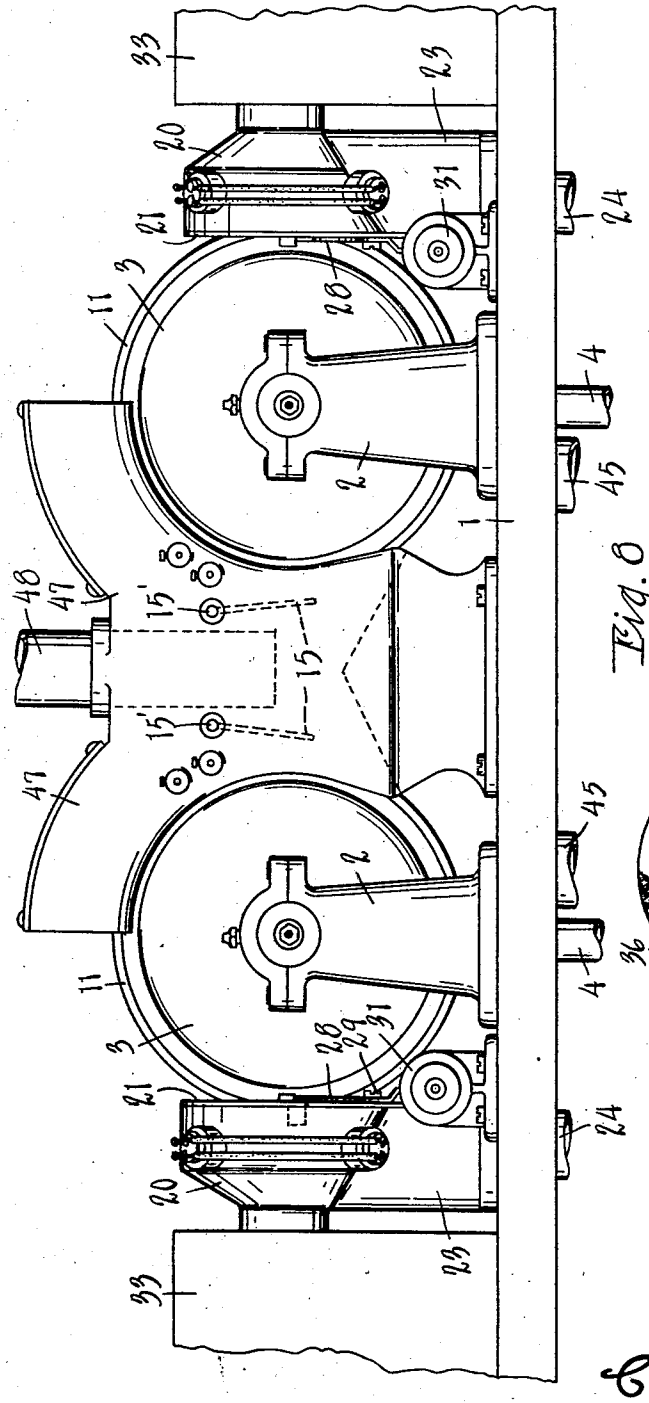


Fig. 6

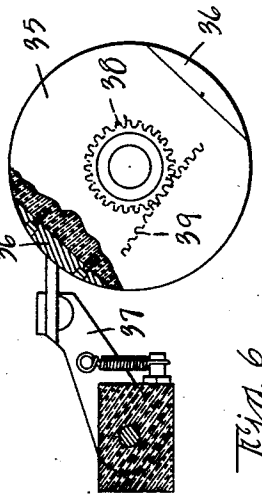


Fig. 6

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Patented Sept. 15, 1936

2,054,320

UNITED STATES PATENT OFFICE

2,054,320

SORTING APPARATUS

Martin C. Hanson, Grand Rapids, Mich., assignor to Electric Sorting Machine Company, Grand Rapids, Mich.

Application February 15, 1932, Serial No. 593,145

31 Claims. (Cl. 209—111)

The main objects of this invention are:

First, to provide a sorting machine or apparatus which is well adapted for use in sorting beans, removing the fractured and discolored beans, and which is of very large capacity.

Second, to provide a machine of this character which is very simple and compact in structure and requires little care or attention in operation.

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

A structure embodying the features of my invention is clearly illustrated in the accompanying drawings, in which:

Fig. 1 is a perspective view of an apparatus or machine embodying my invention, the suction pipe being partially broken away as is also the discharge spout for the rejected material.

Fig. 2 is a fragmentary view mainly in vertical section on line 2—2 of Figs. 3, 4 and 5.

Fig. 3 is a front elevation of the lamp housing showing the operative relation of the selector mechanism thereto.

Fig. 4 is an enlarged fragmentary section on line 4—4 of Figs. 2 and 3.

Fig. 5 is a fragmentary section on line 5—5 of Fig. 2 showing details of the hopper.

Fig. 6 is an enlarged fragmentary view showing details of the commutator.

Fig. 7 is a diagrammatic view of the electrical equipment of the apparatus.

Fig. 8 is a fragmentary side elevation of a modified form or embodiment of my invention.

The embodiment of my invention illustrated is an adaptation of and in some respects an improvement upon the sorting apparatus shown in my application for Letters Patent filed October 20, 1930, Serial No. 489,798.

The structure illustrated in the drawings comprises a base 1 of suitable dimensions to support the operating parts. On this base are pedestals 2 supporting the drum-like conveyor 3, which has a suitable hollow journal communicating with the suction pipe 4.

The conveyor in the embodiment illustrated is made up of a pair of castings 5 and 6, see Fig. 4, having shouldered joint, the casting 5 having a series of radial bores or suction passages 7 therein which terminate in shouldered seats 9 for the tips 10. These tips project through a rim 11 which is of a uniform neutral color, preferably white. The color, however, might advantageously be varied, depending upon the articles to be sorted. This rim is of hard surfaced material such, for example, as some of the pyroxylin or synthetic resin products, which permits a ready cleansing and provides a smooth durable uniformly colored surface. The tips 10 are of metal or other suitable material to protect the rim from wear.

At one side of the conveyor is a feed hopper 12, the articles being sorted, such as beans, being illustrated at 13 therein. This hopper is provided with a feed spout 14 which projects into the hopper the desired distance to determine the normal level of the material 13 therein. The hopper is open at one side to receive the conveyor so that a portion of its periphery sweeps upwardly through the hopper in supporting relation to the contents of the hopper so that the beans are picked up by the suction orifices. An agitator 15 depends into the hopper in close proximity to the periphery of the conveyor so that the beans are agitated and brought into proper relation to the conveyor.

A pair of stripper fingers 16 is mounted within the hopper above the material level thereof so that the beans are carried upwardly between these fingers and, in the event of a cluster of beans having collected on one of the orifices the excess beans are knocked off. Further, these fingers serve in a measure to position the beans on the conveyor.

The agitator 15 is mounted on a rockshaft 15' having an arm 17 engaged by the crank pin 18 on a gear conventionally shown at 19 cooperating with the driving means for the conveyor, which, as stated, is not illustrated.

Opposite the hopper I mount a lamp housing 20, preferably of general cylindrical shape, provided with a face plate 21 having a slot 22 therein into which a portion of the periphery of the conveyor projects so that the articles on the conveyor are successively carried into the housing. The lamp housing has a discharge passage 23 with a chute 24 for the rejected beans leading therefrom. The lamps 25 are arranged in uniformly spaced radial relation in the housing 20, there being a pair of lamps on each side of the vertical plane of the conveyor.

A color-sensitive element, such as the photo-electric cell 26, is disposed to successively focus on the articles as they are carried through the lamp housing by the conveyor. The tapered focusing tube 27 is disposed centrally of the lamp housing and projects into close proximity to the articles on the conveyor.

This photo-electric cell or color-sensitive element is the control for the electrically actuated selector means, which in the embodiment illustrated consists of a pivoted tappet or strike 28 pivoted

at 29 on the lamp housing, its lower end being connected to the armature 30 of a solenoid or electromagnet 31. A spring 32 acts to retract the tappet.

An amplifying unit indicated generally by the numeral 33 is provided, preferably including a relay 34, and I have found the mercury-vapor relay "Thyratron" to be quite satisfactory in this relation. Between this amplifying unit and the solenoid I provide a commutator or cut-out 35, the contacts thereof being indicated at 36 and the brush being shown at 37. This is in circuit, as stated, between the amplifying unit and the solenoid, so that the current is positively cut off at predetermined points. The commutator element 35 is driven in synchronism with the conveyor, being geared thereto by the gears 38 on the commutator shaft meshing with a gear 39 on the conveyor. The commutator shaft is provided with a pulley 40 which is preferably in practice belted to an electric motor, not illustrated.

With this arrangement the conveyor may be continuously driven at a considerable peripheral speed and at the same time the action of the selecting mechanism is sufficiently rapid so that the selected or discolored beans are dislodged from the conveyor within the lamp housing and fall into the chute 24. The good beans are carried along until the suction orifices reach the valve 41, which is mounted within the conveyor on a spindle 42 disposed axially of the conveyor. Springs 43 carried by the valve support 44 urge the valve yieldingly against the inner periphery of the conveyor so that the orifices are successively brought into operative relation to the valve, and as soon as the suction is cut off the beans fall into the discharge chute 45. A scraper might be employed for this purpose, or the wall 46 of the chute would serve the purpose, although I prefer to use the valve since it prevents any particle, hull or the like being carried beyond the discharge point.

My sorting apparatus is, as stated, of very large capacity and is highly efficient.

In Fig. 8, I illustrate a double unit having a pair of conveyors 3 associated with a single hopper 47 which has openings in its opposite end walls to receive the peripheries of the pair of conveyors. The feed spout 48 depends centrally into the opening and an agitator 15 is provided on each side of the spout in operative relation to the conveyors. Otherwise, the apparatus is substantially that of the single unit.

The "Thyratron" is used in association with the circuit for operation by direct current. For this reason, after the Thyratron is once excited or actuated, it continues to glow and the current continues to pass through the circuit until the latter is broken. The commutator or circuit breaker accomplishes this by mechanically breaking the circuit regularly between orifices. If the Thyratron or similarly operating relay could be worked on an alternating current circuit, the commutator would not be essential, because the Thyratron would be cut off and would not pass current between the A—C cycles. This latter method of operation would not be as accurate, however, because it would be possible for discolorations in the background or fluctuations in light between the orifices to set the ejecting mechanism in motion.

While I have disclosed the commutator or circuit breaker interposed betwen the relay or Thyratron and the electro-magnet, it is to be understood that the commutator or circuit breaker may be located at any place in the circuit since it is only necessary for the circuit to be broken and made as desired as the orifices pass before the aperture.

I have illustrated and described my improvements in an embodiment which I have found highly successful in commercial use. I have not attempted to illustrate and describe other embodiments or adaptations which I contemplate as it is believed that this disclosure will enable those skilled in the art to embody or adapt my improvements as may be desired.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. In a sorting machine, the combination with a feed hopper, of a rotatable drum-like conveyor disposed so that a portion thereof sweeps upwardly through the material within said feed hopper and having an annular series of suction orifices, a cylindrical lamp housing disposed so that a portion of the conveyor sweeps downwardly therethrough as the conveyor rotates, said housing having a discharge chute at the bottom thereof, lamps disposed radially within said housing on opposite sides of the path of said suction orifices, a photo-electric cell disposed to focus on the portion of said conveyor within said lamp housing and centrally relative to said lamps to focus successively on the articles carried by the conveyor, a pivoted tappet adapted to disengage selected articles from said conveyor within said lamp housing whereby they are discharged through said discharge chute thereof, and an electromagnet controlled by said photo-electric cell operatively connected to said tappet.

2. In a sorting machine, the combination with a rotatable drum-like conveyor having a peripherally disposed series of suction orifices, a cylindrical lamp housing disposed so that a portion of the periphery of the conveyor sweeps downwardly therethrough as the conveyor rotates, said housing having a discharge at the bottom thereof, lamps disposed radially within said housing on opposite sides of the vertical plane of said conveyor, a photo-electric cell disposed to focus on the periphery of said conveyor within said lamp housing and centrally relative to said lamps to focus successively on the articles carried by the conveyor, a tappet adapted to remove selected articles from said conveyor within said lamp housing whereby they are discharged through said discharge thereof, an electromagnet operatively connected to said tappet, a relay operatively associated with said photo-electric cell and electromagnet, a commutator interposed between said relay and electro-magnet and driven in synchronism with said conveyor, and a valve disposed within said conveyor at the rear of said lamp housing to successively close said suction orifices.

3. In a sorting machine, the combination with a rotatable drum-like conveyor having an annular series of suction orifices, a cylindrical lamp housing disposed so that a portion of the conveyor sweeps downwardly therethrough as the conveyor rotates, said housing having a discharge at the bottom thereof, lamps disposed radially within said housing on opposite sides of the path of said suction orifices, a photo-electric cell disposed to focus on the portion of said conveyor within said lamp housing and centrally relative to said lamps to focus successively on the articles carried by the conveyor, a tappet adapted to remove selected articles from said conveyor within

said lamp housing whereby they are discharged through said discharge thereof, an electromagnet operatively connected to said tappet, a relay operatively associated with said photo-electric cell and electromagnet, and a commutator interposed in the circuit of said relay and electromagnet and driven in synchronism with said conveyor.

4. In a sorting machine, the combination with a feed hopper, of a rotatable conveyor disposed so that a portion thereof sweeps upwardly through the material within said feed hopper and having an annular series of suction orifices, a lamp housing disposed so that a portion of the conveyor sweeps downwardly therethrough as the conveyor rotates, said housing having a discharge chute at the bottom thereof, illuminating means within said housing, a photo-electric cell disposed to focus successively on the articles carried by the conveyor while within said lamp housing, a tappet adapted to remove selected articles from said conveyor within said housing whereby they are discharged through said chute, an electromagnet controlled by said photo-electric cell and operatively connected to said tappet, and means at the rear of said lamp housing acting to discharge the articles from said conveyor.

5. In a sorting machine, the combination of a rotatable conveyor having an annular series of suction orifices, a lamp housing disposed so that a portion of the conveyor sweeps downwardly therethrough as the conveyor rotates, said housing having a discharge chute at the bottom thereof, illuminating means within said housing, a photo-electric cell disposed to focus successively on the articles carried by the conveyor while within said lamp housing, a tappet adapted to remove selected articles from said conveyor within said housing whereby they are discharged through said chute, an electromagnet operatively connected to said tappet, a relay operatively associated with said photo-electric cell and electromagnet, a commutator interposed in the circuit of said relay and electromagnet and driven in synchronism with said conveyor, and means at the rear of said lamp housing acting to discharge the articles from said conveyor.

6. In a sorting machine, the combination with a feed hopper, of a conveyor disposed so that a portion thereof sweeps upwardly through the material within said feed hopper and having a series of suction orifices, a lamp housing disposed so that a portion of the conveyor sweeps downwardly therethrough as the conveyor rotates, illuminating means within said housing, a photo-electric cell disposed to focus successively on the articles carried by said conveyor while within said lamp housing, a tappet adapted to disengage selected articles from said conveyor, and an electromagnet controlled by said photo-electric cell and operatively connected to said tappet, the suction being maintained on the articles carried by the conveyor until they are released by or carried past the tappet.

7. In a sorting machine, the combination of a conveyor having a series of suction orifices, a lamp housing disposed so that a portion of the conveyor sweeps downwardly therethrough as the conveyor rotates, illuminating means within said housing, a photo-electric cell disposed to focus successively on the articles carried by said conveyor while within said lamp housing, a tappet adapted to disengage selected articles from said conveyor, an electromagnet operatively connected to said tappet, an amplifying means including a mercury vapor relay operatively associated with said photo-electric cell and electromagnet, and a commutator interposed in the circuit of said relay means and electromagnet and driven in synchronism with said conveyor.

8. A sorting machine comprising a rotatable conveyor having an annular series of suction orifices, a feed hopper disposed so that a portion of the conveyor sweeps upwardly therethrough, a pair of stripper fingers disposed above the material level of the hopper for removing excess articles from said conveyor, a discharge tappet for removing selected articles from said conveyor, and means for electrically actuating said tappet including a color-sensitive element positioned so that it is successively focused upon the articles carried by the conveyor.

9. A sorting machine comprising a rotatable conveyor having an annular series of suction orifices, a feed hopper disposed so that a portion of the conveyor sweeps upwardly therethrough, an agitator for said hopper, means supporting said agitator for swinging movement toward and away from said conveyor, the axis of the agitator being substantially parallel to the axis of the conveyor. a stripper disposed above the material level of the hopper for removing excess articles from said conveyor, a discharge means for removing selected articles from said conveyor, and means for actuating said discharge means including a color-sensitive element positioned so that it is successively focused upon the articles carried by the conveyor.

10. A sorting machine comprising a rotatable conveyor having an annular series of suction orifices, a feed hopper disposed so that a portion of the conveyor sweeps upwardly therethrough, an agitator for said hopper, said agitator comprising a substantially rigid arm hinged at its upper end for swinging movement toward and away from said conveyor, a discharge means for removing selected articles from said conveyor, and means for actuating said discharge means including a color-sensitive element positioned so that it is successively focused upon the articles carried by the conveyor.

11. A sorting machine comprising a rotatable conveyor having an annular series of suction orifices, a feed hopper disposed so that a portion of the conveyor sweeps upwardly through the material within the hopper, a discharge means for removing selected articles from said conveyor, means for electrically actuating said discharge means including a color-sensitive element positioned so that it is successively focused upon the articles carried by the conveyor, an amplifying means, and a commutator, said commutator being driven in synchronism with said conveyor.

12. A sorting machine comprising a conveyor having a series of suction orifices, a discharge means for removing selected articles from said conveyor, means for electrically actuating said discharge including a color sensitive element positioned so that it is successively focused upon the articles carried by the conveyor, an amplifying means, and a commutator, said commutator being driven in synchronism with said conveyor.

13. In a sorting machine, the combination of a conveyor having a series of suction orifices, a hopper through which a portion of said conveyor passes so that it sweeps upwardly through the material within the hopper whereby the articles to be sorted are picked up by the conveyor, means for removing selected articles from said conveyor comprising a tappet, an actuating solenoid therefor, a color-sensitive element positioned so that

it is focused successively upon the articles carried by said conveyor, and operating connections for said color-sensitive element to said solenoid including a relay and a circuit breaker driven in synchronism with said conveyor and interposed in the circuit of said relay and said solenoid.

14. In a sorting machine, the combination of a conveyor having a series of suction orifices, a hopper through which a portion of said conveyor passes so that it sweeps upwardly through the material within the hopper, whereby the articles to be sorted are picked up by the conveyor, means for removing selected articles from said conveyor comprising a tappet located at the selecting station, an actuating solenoid for said tappet, a color-sensitive element positioned so that it is focused successively upon the articles carried by said conveyor, and operating connections for said color-sensitive element to said solenoid including an ionizing tube, and de-ionizing means for periodically restoring said tube to its de-ionized condition between the arrival and departure of articles at said selecting station, the suction being maintained on the articles carried by the conveyor until they are removed therefrom by said tappet or carried past the tappet.

15. In a sorting machine, the combination of a conveyor having a series of suction orifices, means for removing selected articles from said conveyor comprising a tappet, an actuating solenoid therefor, a color-sensitive element positioned so that it is focused successively upon the articles carried by said conveyor, and operating connections for said color-sensitive element to said solenoid including a relay and a circuit breaker driven in synchronism with said conveyor and interposed in the circuit of said relay and said solenoid.

16. In a sorting machine, the combination of a conveyor having a series of suction orifices, electrically actuated means for removing selected articles from said conveyor comprising a color-sensitive element positioned so that it is focused successively upon the articles carried by said conveyor, and operating connections for said color-sensitive element to said selecting means including a relay and a circuit breaker driven in synchronism with said conveyor.

17. In a sorting machine, the combination with a conveyor provided with a plurality of suction orifices, a lamp housing disposed so that a portion of said conveyor travels therethrough, lamps disposed within said housing on opposite sides of said conveyor, a color-sensitive element disposed to focus successively on the articles carried by said conveyor while within said lamp housing, a discharge member for removing selected articles from said conveyor, a relay operatively associated with said element and said discharge member, and a circuit breaker in the circuit of said relay and said discharge member and driven in synchronism with said conveyor.

18. In a sorting machine, the combination with a conveyor provided with a plurality of suction orifices, a color-sensitive element disposed to focus successively on the articles carried by said conveyor, a discharge member for removing selected articles from said conveyor, a relay operatively associated with said element and said discharge member, and a commutator interposed in the circuit of said relay and said discharge member and driven in synchronism with said conveyor.

19. In a sorting machine, the combination with a conveyor provided with a plurality of suction orifices, a lamp housing disposed to receive the articles carried by said conveyor, lamps disposed within said housing, a color-sensitive means disposed to focus successively on the articles carried by said conveyor while within said lamp housing, a discharge means for discharging selected articles from said conveyor, a relay operatively associated with said color-sensitive means and said discharge member, and a circuit breaker in the circuit of said relay and said discharge means and driven in synchronism with said conveyor.

20. In a sorting machine, the combination with a pair of spaced rotatable drum-like conveyors having an annular series of suction orifices, a hopper interposed between said conveyors and having openings in the opposed ends thereof to receive portions of the peripheries of said conveyors, the conveyors constituting walls for the hopper, a centrally disposed feed spout depending into said hopper, and agitators disposed on opposite sides of said spout and having driving connections to said conveyors.

21. In a sorting machine, the combination with a pair of spaced rotatable drum-like conveyors having an annular series of suction orifices, a hopper interposed between said conveyors and having openings in the opposed ends thereof to receive portions of the peripheries of said conveyors, the conveyors constituting walls for the hopper, and a centrally disposed feed spout depending into said hopper.

22. In a sorting machine, the combination with a pair of spaced rotatable drum-like conveyors having an annular series of suction orifices, a hopper interposed between said conveyors and having openings in the opposed ends thereof to receive portions of the peripheries of said conveyors, the conveyors constituting walls for the hopper, and agitators disposed on opposite sides of said spout and having driving connections to said conveyors.

23. In a sorting machine, the combination with a rotatable drum-like conveyor having a series of peripheral suction orifices, a hopper disposed to receive a portion of said conveyor, the conveyor constituting a side for the hopper, a feed spout depending into said hopper, and an agitator at the lower end of said spout adapted to agitate the contents of the hopper at a point adjacent the periphery of the conveyor.

24. In a sorting machine, the combination with a rotatable drum-like conveyor having a series of peripheral suction orifices, a hopper disposed to receive a portion of said conveyor, the conveyor constituting a side for the hopper, and an agitator adapted to agitate the contents of the hopper at a point adjacent the periphery of the conveyor, said agitator comprising a member of substantially less width than the thickness of the sorted articles and movable toward and away from said conveyor in a plane normal to the axis thereof and positioned centrally of the conveyor.

25. In a sorting machine, the combination of a rotatable member having an annular series of suction orifices for individually picking up an article to be sorted from a mass thereof, and means for agitating the mass of articles to keep them near the orbit of said suction orifices, said agitating means being mounted for oscillatory movement in a plane normal to the axis of the conveyor.

26. A sorting machine comprising a rotatable conveyor having an annular series of suction orifices, a feed hopper disposed so that a portion of the conveyor sweeps upwardly therethrough, a pair of spaced stripper fingers mounted within

and disposed above the material level of the hopper and at the sides of the orbit of the orifices for removing excess articles from said conveyor and for positioning the article picked up by each orifice, a discharge means for removing selected articles from said conveyor, and means for actuating said discharge means including a color sensitive-element positioned so that it is focused upon successive articles carried by the conveyor.

27. A sorting machine comprising a conveyor, discharge means for removing selected articles from said conveyor, means for electrically actuating said discharge means including a color-sensitive element positioned so that it views successive articles carried by the conveyor, an amplifying means, an ionizing tube operatively associated with said amplifying means, and a de-ionizer for said tube, said de-ionizer being operated in synchronism with said conveyor to de-ionize the tube if ionized after the operation of said discharge means and between successive articles.

28. In a sorting machine, the combination of a conveyor adapted to convey articles to be sorted through a selecting station at uniformly timed intervals, article selecting means located at said station and adapted to be influenced by a certain characteristic of the articles, amplifying means operatively associated with said article selecting means, an ionizing relay controlled by said amplifying means and adapted to ionize when said article selecting means is influenced, article discharge means located at said station and operatively associated with said relay to operate on the ionizing thereof, means for de-ionizing said relay between the arrival and departure of articles at said selecting station, and means synchronizing the operation of said conveyor and de-ionizing means.

29. In a sorting machine, the combination of a conveyor adapted to convey articles to be sorted through a selecting station, article selecting means located at said station and adapted to be influenced by a certain characteristic of the articles, amplifying means operatively associated with said article selecting means, an ionizing relay controlled by said amplifying means and adapted to ionize when said article selecting means is influenced, article discharge means located at said station and operatively associated with said relay to operate on the ionizing thereof, and means for de-ionizing said relay between the arrival and departure of articles at said selecting station.

30. In a sorting machine, the combination of a conveyor adapted to convey articles to be sorted through a selecting station, article selecting means located at said station and adapted to be influenced by a certain characteristic of the articles, an ionizing relay controlled by said article selecting means and adapted to ionize when said article selecting means is influenced, article discharge means located at said station and operatively associated with said relay to operate on the ionizing thereof, and means for de-ionizing said relay between the arrival and departure of articles at said selecting station.

31. In a sorting machine, the combination with a feed hopper, of a rotatable drum-like conveyor disposed so that an annular portion thereof sweeps upwardly through said feed hopper, such annular portion having an annular series of suction orifices, a housing disposed so that said annular portion of the conveyor sweeps therethrough as the conveyor rotates, said housing having a discharge chute, means for illuminating the said annular portion of the conveyor as it sweeps through the housing and the articles carried by the conveyor, a light sensitive element disposed to focus on the said annular portion of the conveyor within the housing and to focus on the articles as they are successively carried by the conveyor into the housing, means operatively associated with said light, sensitive element for disengaging selected articles from the conveyor within the housing whereby they are discharged through said discharge chute thereof, and means at the rear of said housing acting to discharge from said conveyor the article carried thereby through the housing, the suction being maintained on the articles carried by said conveyor until they are disengaged or discharged therefrom by said light sensitive control means or discharging means at the rear of the housing.

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