United States Patent [19]

Richard

[11] **3,827,554**

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[54] **BEAN SIZER AND BROKEN BEAN ELIMINATOR**

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[73] Assignee: **Conveyor Line Products, Inc.,** Princeton, Fla.

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[52] **U.S. Cl.** **209/95**

[51] **Int. Cl.** **B07b 1/00**

[58] **Field of Search** 209/86, 95, 97, 98

[56] **References Cited**

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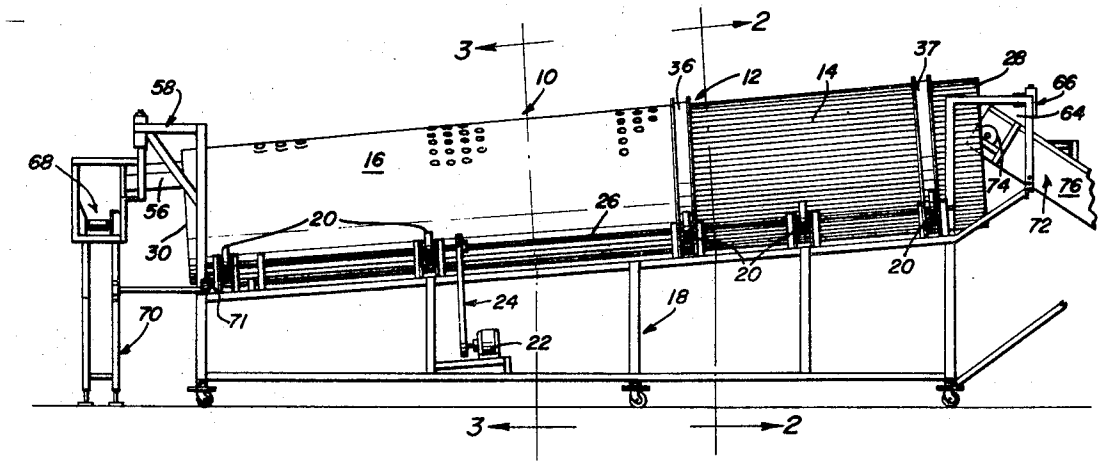
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3,061,094	10/1962	Gaddie	209/86 X
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Primary Examiner—Richard A. Schacher
Attorney, Agent, or Firm—Clarence O'Brien; Harvey B. Jacobson

[57] **ABSTRACT**

A gravity separator having a cylinder formed by a first drum arranged for forming a stream of articles fed into the separator, and a second drum arranged for receiving articles from the first drum and separating out articles having a dimension less than a predetermined value for that dimension. The first drum is constructed from a plurality of longitudinally extending and longitudinally spaced members. These members and the gaps resulting from the spacing between them form an article sorter which permits undersized articles, such as pin beans, and foreign matter, such as sand, rock pebbles, and the like, to fall out of the drum. The longitudinal members advantageously have a V-shaped cross-section, with the apex of the V arranged directed into the drum. The second drum is provided with a plurality of internally opening, circumferential recesses arranged for receiving articles from the stream below a predetermined size for separating out undersized or broken articles. Each of the recesses has a wall which converges on itself as it extends away from an opening toward a bottom portion, and rounded edges arranged between the opening and wall and between the wall and bottom portion. An eliminator conveyor is arranged in the second drum for receiving articles discharged from the recesses by force of gravity when the recesses are elevated by rotation of the cylinder.

10 Claims, 9 Drawing Figures



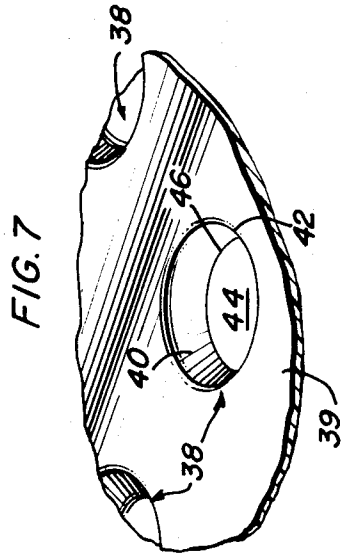


FIG. 7

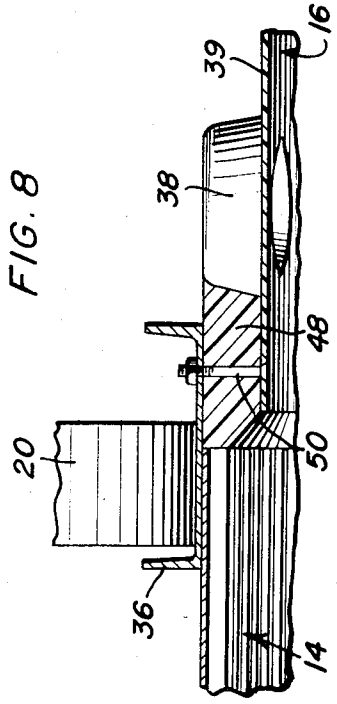


FIG. 8

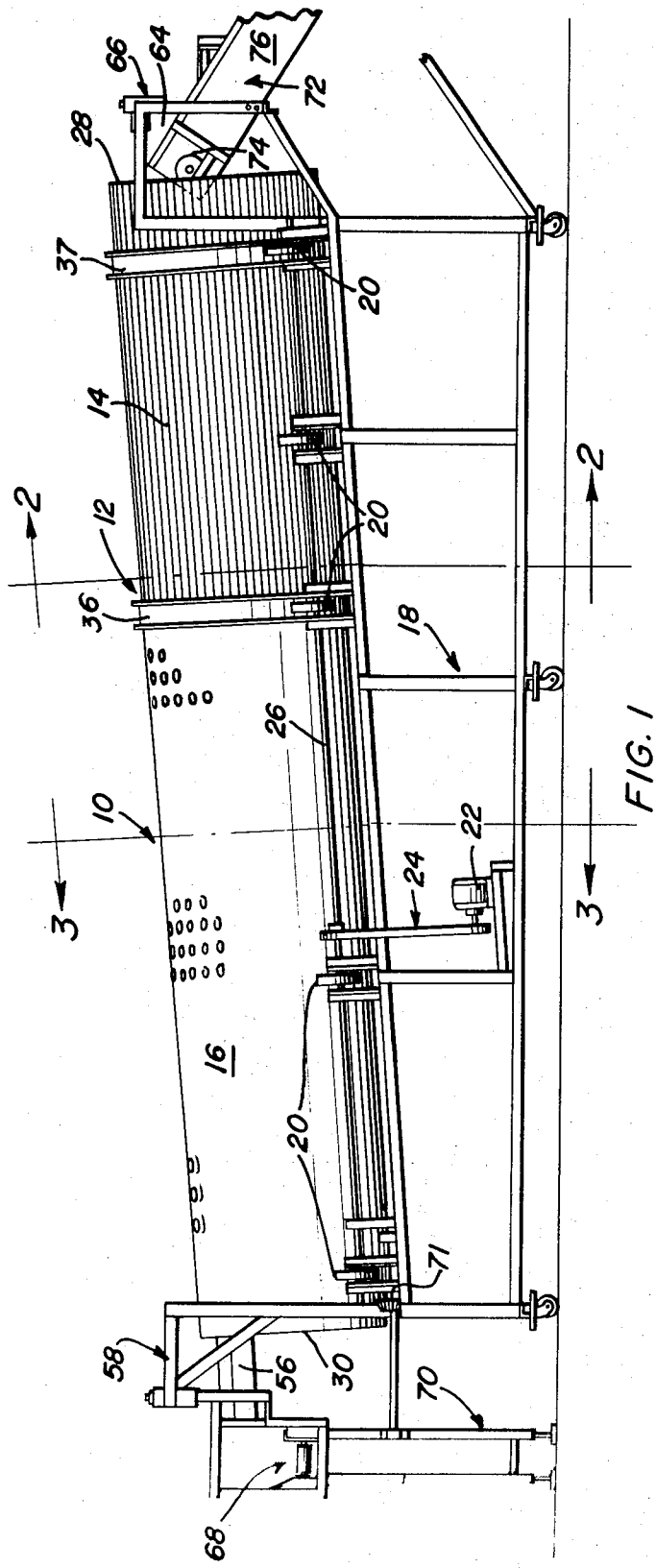


FIG. 1

FIG. 4

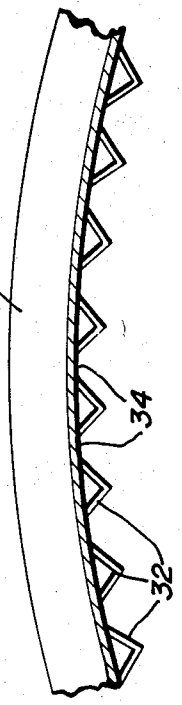


FIG. 5

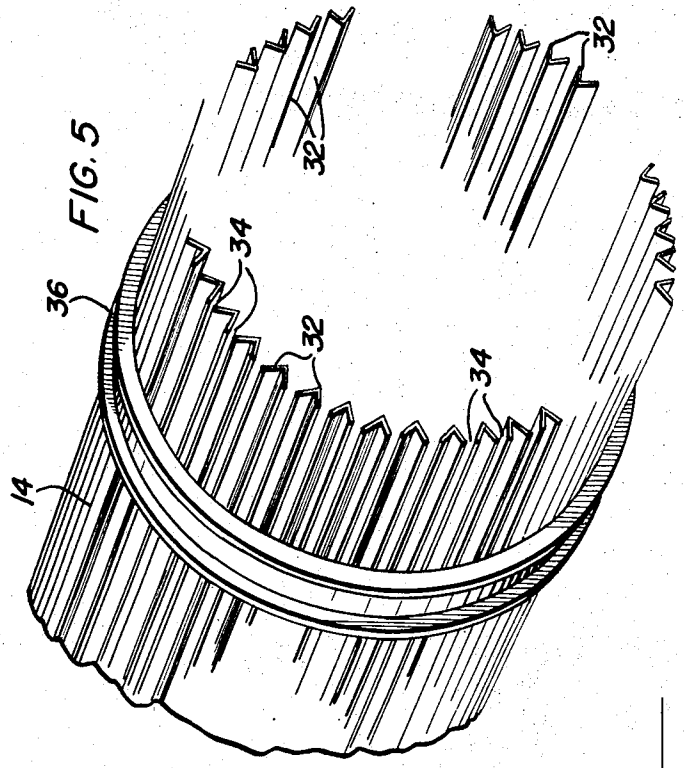


FIG. 2

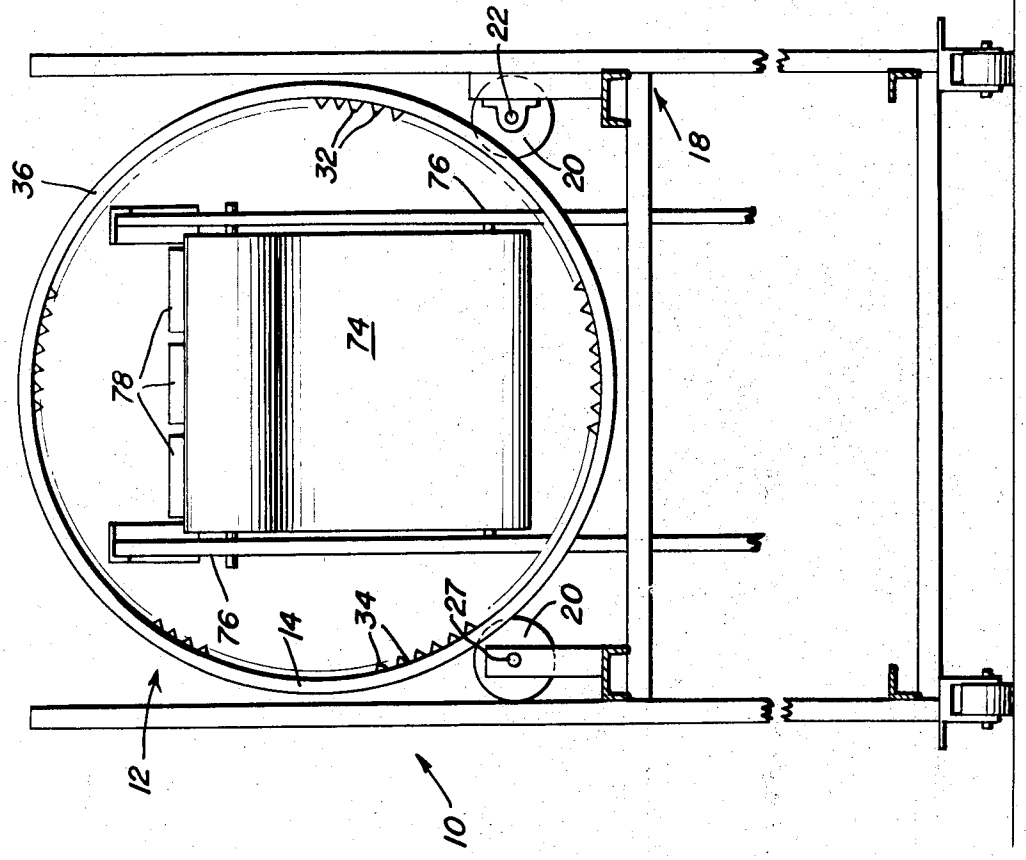


FIG. 9

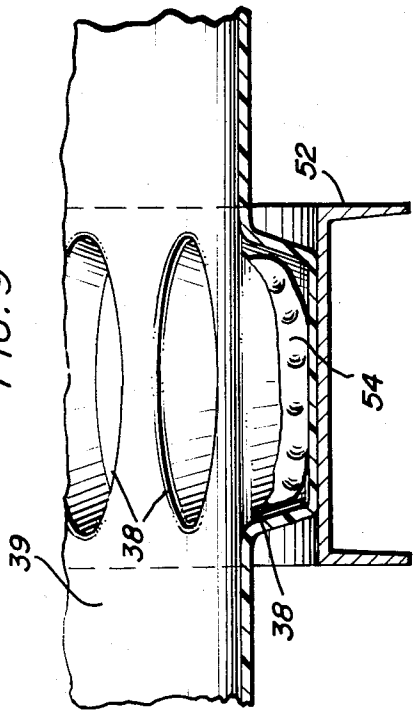


FIG. 6

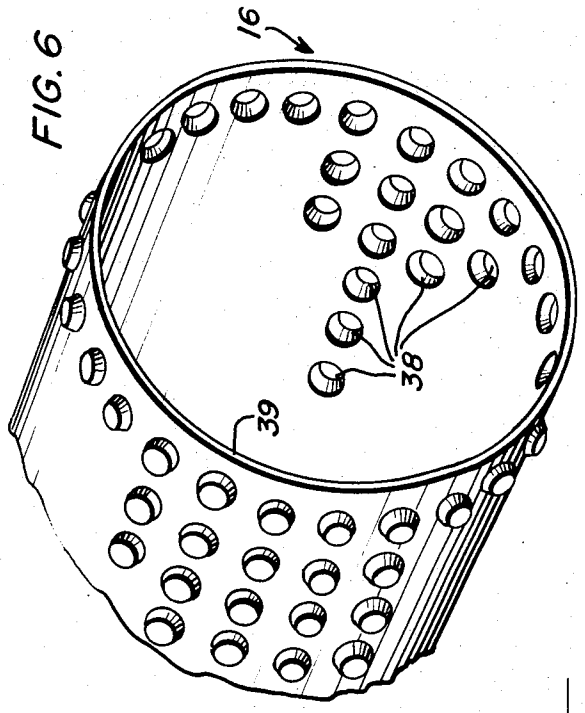
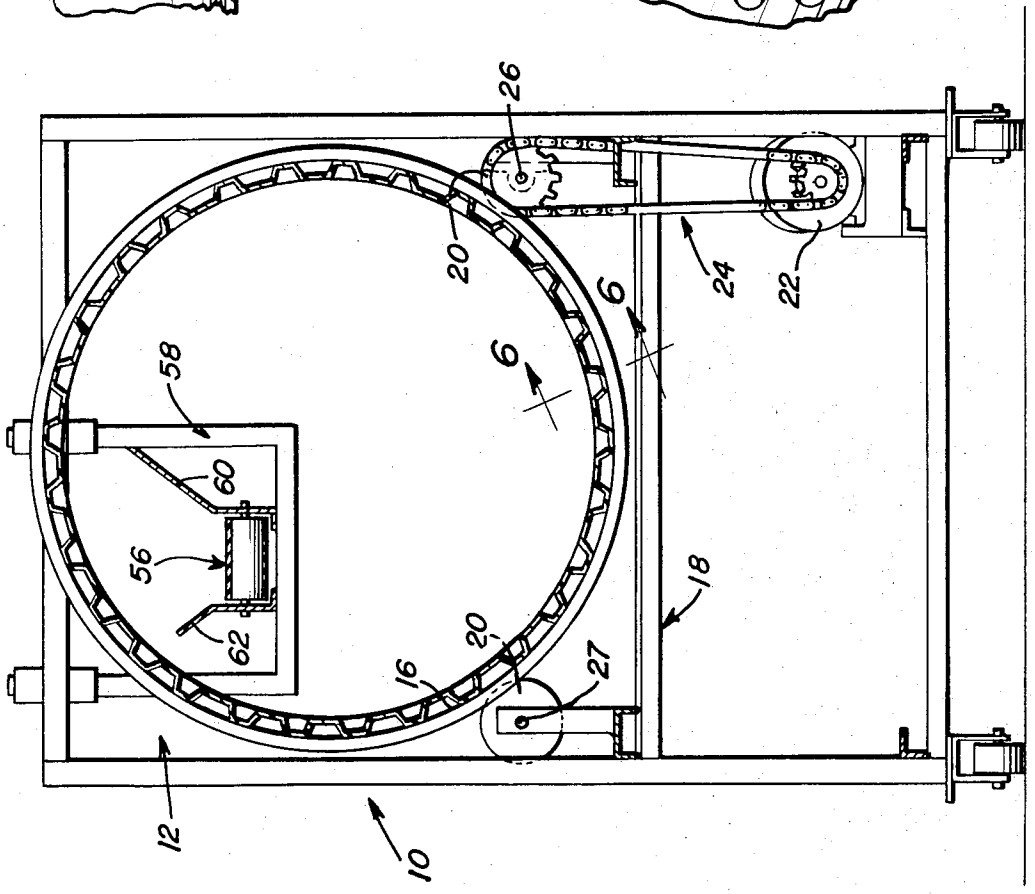


FIG. 3



BEAN SIZER AND BROKEN BEAN ELIMINATOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to a separator, and particularly to a gravity separator especially suited for handling fragile articles, such as snap beans, and the like.

2. Description of the Prior Art

Cylindrical separators are known in which the cylinder is provided with one or more recesses dimensioned for receiving articles to be separated out of a group of articles because of their size being less than a predetermined size. Rotation of the cylinder elevates the articles in the recess until they fall under the influence of gravity onto a conveyor belt, and the like, and are removed from the cylinder. An example of such a separator may be found in U.S. Pat. No. 3,612,273. This type of separator is especially suited for use in handling fragile articles, such as, snap beans, and the like. The known device previously referred to, however, has been found unsatisfactory for handling beans, and the like, in that it is unable to sort out immature or pin beans, and the like, and in that the particular construction of the drum and recesses frequently damages the broken beans, and the like, which are to be separated out.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a gravity separator for snap beans, and the like, which will sort out the immature or pin beans.

It is another object of the present invention to provide a gravity separator for snap beans, and the like, which has a recess provided drum for separating out broken beans, and the like, of improved construction for reducing the possibility of damage to the articles being separated out.

It is yet another object of the present invention to provide a cylindrical gravity separator having increased flexibility and improved article handling properties when compared to known separators of the same kind.

These and other objects are achieved according to the present invention by providing a cylindrical gravity separator having a cylinder formed from a drum arranged for forming a stream of articles and for sorting out undersized articles, such as, immature or pin beans, and the like, and a second drum arranged for receiving articles from the first drum and separating out of the stream articles below a predetermined minimum article dimension.

The second drum is provided with a plurality of internally opening, circumferential recesses. Each of these recesses has a wall which converges on itself as it expands away from an opening of the recess toward the bottom portion thereof, and rounded edges arranged between the opening and wall and between the wall and bottom portion. Advantageously, this drum is molded from a suitable synthetic resin, such as fiber glass.

The first drum is preferably constructed from a plurality of longitudinally extending and longitudinally spaced members. These members and the gaps resulting from the spacing therebetween form an article sorter by permitting undersized articles and foreign matter, such as, sand, rock pebbles, and the like, to fall out of the drum. Desirably, these longitudinal members have a V-shaped cross-section with the apex of the V arranged directed into the interior of the drum.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a fragmentary, side elevational view showing a cylindrical gravity separator according to the present invention.

FIG. **2** is a fragmentary, sectional view, taken generally along the line **2—2** of FIG. **1.**

FIG. **3** is a sectional view, taken generally along the line **3—3** of FIG. **1,** and with some parts removed.

FIG. **4** is a fragmentary, sectional view showing a detail of the drum shown in FIG. **2.**

FIG. **5** is a fragmentary, perspective view showing the drum of FIGS. **2** and **4.**

FIG. **6** is a fragmentary, perspective view showing the drum of FIG. **3.**

FIG. **7** is a fragmentary, perspective view showing a detail of the drum of FIG. **6.**

FIG. **8** is a fragmentary, sectional view showing the connection between the two drums.

FIG. **9** is a fragmentary, sectional, perspective view showing a guide ring arranged about the drum of FIGS. **3** and **6.**

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGS. **1** to **3** of the drawings show a gravity separator **10** according to the present invention. The separator **10** is of the cylindrical type having a cylinder **12** formed from a pair of coaxial drums **14** and **16.** Cylinder **12** is supported by a frame **18** provided with a plurality of wheels **20** mounted thereon in a suitable manner. A conventional motor **22,** which may be, for example, a suitable electric motor, drives selected ones of wheels **20** through a chain and sprocket drive train **24** and a shaft **26.** Those wheels **20** not rotated by motor **22** are mounted on a shaft **27** for uniform rotation therewith. As can best be seen from FIG. **1** of the drawings, cylinder **12** is cradled on wheels **20** such that it slopes downwardly from an input end **28** to an output end **30.** Further, frame **18** may be constructed in a conventional manner so as to be adjustable for varying the slope of cylinder **12.**

Referring now to FIGS. **2, 4,** and **5** of the drawings, drum **14** is constructed from a plurality of longitudinally extending and longitudinally spaced members **32** of V-shaped cross-section. These members **32** and the gaps **34** resulting from the spacing therebetween form an article sorter which permits undersized articles, such as, pin beans, and foreign matter, such as, sand, rock pebbles, and the like, to fall out of drum **14.** Further, when used to sort and separate longitudinally extending articles, such as beans, members **32** and gaps **34** will orient the articles along their longitudinal axis. A pair of rings **36** and **37** formed from, for example, 4-inch flanged channels, and the like, are connected to members **32** in a conventional manner, for forming members **32** into drum **14.** This connection of members **32** to rings **36, 37** may be achieved as by, for example,

welding the ends of the legs of members 32 to rings 36, 37. This will cause the apex of the V-shaped cross-section to be arranged directed into the interior of hollow drum 14. In this manner, drum 14 will form a stream of articles fed thereinto, as well as sort out undersized articles, such as pin beans.

As can best be seen from FIGS. 3, 6, and 7 of the drawings, rotating hollow drum 16 is provided with a plurality of internally opening, cup-like recesses 38 arranged about circumferential wall 39 defining hollow drum 16. Each recess 38 is frusto-conical and has a wall 40 which converges on itself as it extends away from an opening 42 toward a bottom wall portion 44, a rounded edge arranged between the opening 42 and wall 40 and an also rounded edge, designated 46, arranged between wall 40 and bottom portion 44. Recesses 38 are arranged for receiving articles to be separated out of a stream of articles formed in drum 14. Those articles separated will have a predetermined dimension, such as longitudinal length, less than a predetermined minimum value for that article.

FIG. 8 of the drawings shows the connection of drum 14 to drum 16. An adaptor block 48, which may be constructed from, for example, fiber glass, and the like, is attached to wall 39 and ring 36 as by a fastener 50. This fastener 50 may be a bolt and nut, as illustrated, a rivet, or any other suitable, known fastener. As mentioned previously, members 32 may be attached to ring 36 in any suitable, known manner. Block 48 is advantageously ground off to form a taper adjacent members 32 which provides a transitional area between drum 14 and drum 16.

Referring now to FIG. 9 of the drawings, a ring 52, similar to rings 36 and 37, may be arranged about recesses 38 so as to provide a guide rail for those wheels 20 engaging drum 16. A broken bean 54 is shown arranged in the broken-away recess 38 to illustrate the manner in which such an article is received in the recesses 38.

Referring again to FIGS. 1 and 3 of the drawings, an eliminator conveyor 56 is mounted on frame 18, and is arranged in drum 16 for receiving articles discharged from recesses 38 by the force of gravity when recesses 38 are elevated by the rotation of cylinder 12. This conveyor 56 which is mounted at one end by a dual, adjustable convertible support 58, conveys the articles separated out of the main stream along a conveying path. A pair of trough portions 60 and 62 form a trough which cooperates with conveyor 56 to guide the articles along the aforementioned conveying path. A length of tubing 64 is connected in a known manner to the other end of conveyor 56 and to a support 66, the purpose of which will be discussed below, to cooperate with support 58 in supporting conveyor 56. A run-out conveyor 68, which may be a conventional belt conveyor, is arranged adjacent the discharge end of drum 16, which is output end 30 of conveyor 56, for receiving the separated articles from conveyor 56 and transporting these articles along a conveying path transverse to the conveying path of conveyor 56. An adjustable stand 70 cooperates with support 58 for adjustably supporting conveyor 68. A drive train 71 (FIG. 1) of conventional construction transmit power from shaft 26 to conveyor 68. A hopper 72 (FIGS. 1 and 2) having an upwardly inclined moving bottom formed by a belt 74 is advantageously arranged for discharging articles into the input end 28 of cylinder 12. A pair of parallel, spaced side walls 76 mount the pulleys that guide belt 74 and act as side-guides for the articles.

In operation, a plurality of generally uniform articles, which are not shown but may be beans similar to bean 54 (FIG. 9) are dumped onto the lower end (not shown) of belt 74 and are conveyed by belt 74 into input end 28 of cylinder 12. This is also the input end of drum 14. Cylinder 12 is being rotated in a known manner by rotation of wheels 20 upon which cylinder 12 is cradled. Since drum 14 forms part of cylinder 12 and rotates therewith, the articles will be tumbled into the bottom of drum 14 and, assuming the articles have longitudinal extents, will become longitudinally oriented in gaps 34 formed by members 32. The configuration of members 32 facilitates the orientation. Accordingly, a stream of articles will be formed in the bottom of drum 14. Those articles having an extent transverse to the longitudinal extent less than gaps 34 will fall through the gaps 34 and be sorted from the incoming articles. The stream of articles thus formed passes from drum 14 into drum 16, where any articles having, for example, a longitudinal extent less than a predetermined extent, which is used to dimension recesses 38, will fall into recesses 38 and be carried thereby up above conveyor 56. Force of gravity will then cause the broken or otherwise undersized articles to be discharged from recesses 38 onto conveyor 56 and discharged as by conveyor 68. For snap beans, dimension for recesses 38 of 3 inches diameter at opening 42 and 2¾ inches diameter at bottom portion 44 have been found satisfactory. Cylinder 12 may be, for example, 48 inches in diameter, and conveyor 56 may be, for example, 8 inches wide. The particular construction and configuration of drum 16, including recesses 38, will assure a minimum of breakage of fragile articles, permitting larger diameter cylinders to be used, with resulting higher speed and volume range. A washer system (not shown) may be added to permit cleaning-in-place of cylinder 12. In this manner, the various kinds of articles are sorted and separated within FDA requirements, and can be packaged for separate marketing.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.

What is claimed as new is as follows:

1. A separator, comprising, in combination:

a. means for forming articles into a stream and sorting the articles by the size of a one dimension; and

b. means receiving articles from the stream forming means for separating out of the stream articles having a predetermined dimension less than a predetermined dimension for the articles different from the one dimension, the receiving means including a hollow drum provided with a circumferential recess arranged for receiving an article to be separated out, the stream forming means being a further hollow drum attached to said drum for rotation therewith, the drums cooperating for forming a hollow cylinder arranged sloping downwardly from an input end of the further drum to an output

end of said drum, the further hollow drum being constructed from a plurality of longitudinally extending and longitudinally spaced members, these members and the gaps resulting from the spacing therebetween forming the article sorting means by permitting undersized articles and foreign matter to fall out of the further drum; and

c. means for rotating the hollow cylinder.

2. The structure as defined in claim **1,** wherein the hollow cylinder rotating means includes a support frame, a plurality of wheels mounted on the frame and arranged for cradling the cylinder, and means for rotating at least one wheel and rotating the cylinder.

3. A structure as defined in claim **2,** wherein a conveyor is mounted on the frame, and is arranged in said drum for receiving an article discharged from the recess by the force of gravity when the recess is elevated by the rotation of the cylinder and for conveying the articles along a conveying path.

4. A structure as defined in claim **3,** further including means arranged adjacent a discharge end of the conveyor for receiving separated articles from the conveyor and transporting the articles along a conveying path transverse to the conveying path of said conveyor.

5. A structure as defined in claim **1,** wherein the members have a V-shaped cross section with the apex of the V arranged directed into the further drum.

6. A structure as defined in claim **5,** wherein the hollow cylinder means includes a support frame, a plurality of wheels mounted on the frame and arranged for cradling the cylinder, and means for rotating at least one wheel and rotating the cylinder.

7. A structure as defined in claim **1,** further including a hopper having an upwardly inclined, moving bottom arranged for discharging articles into the input end of the further drum.

8. A structure as defined in claim **7,** wherein the members have a V-shaped cross section with the apex of the V arranged directed into the further drum.

9. A structure as defined in claim **8,** wherein the hollow drum is provided with a plurality of circumferential recesses, each recess arranged for receiving an article to be separated out.

10. A structure as defined in claim **1,** wherein the hollow drum is provided with a plurality of circumferential recesses, each recess arranged for receiving an article to be separated out.

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