Nov. 20, 1956 H. A. LINDAHL ET AL 2,771,192

GRAIN CLEANING APPARATUS

Filed June 30, 1951 4 Sheets-Sheet 1

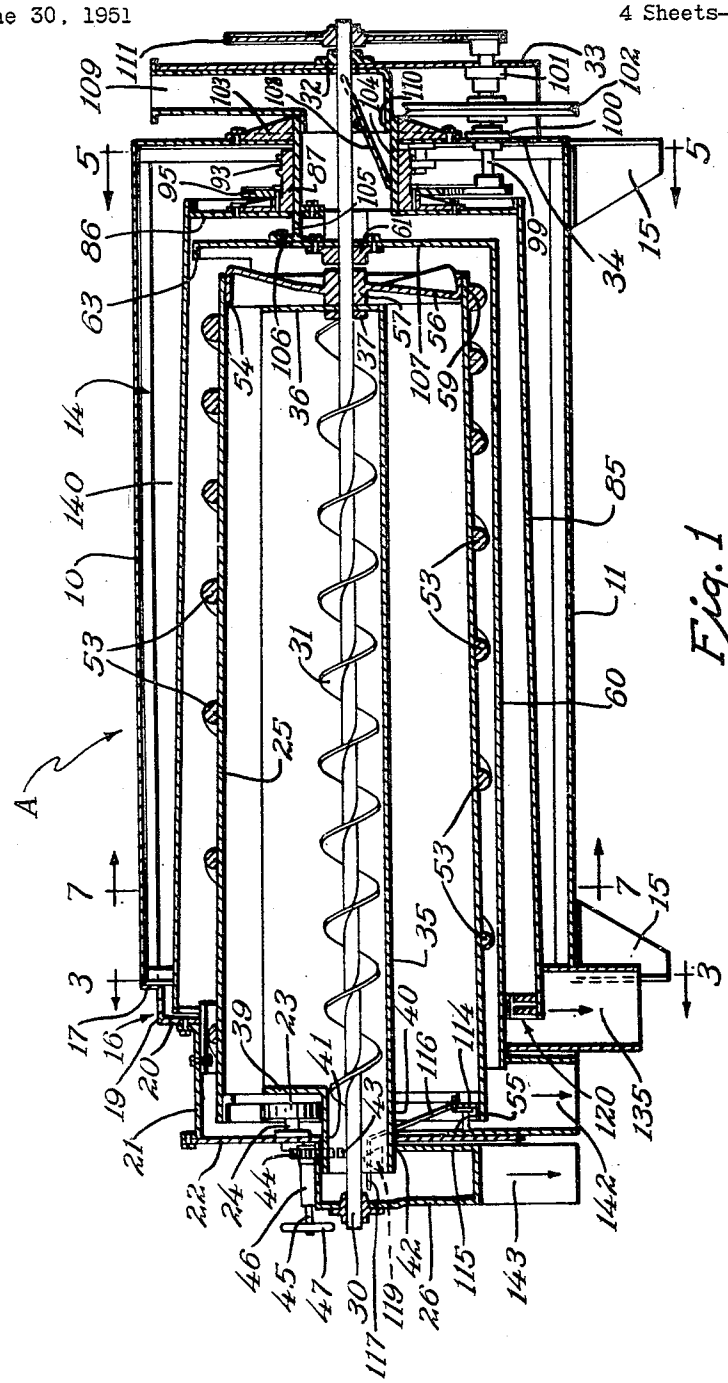


Fig. 1

Inventor
Harry A. Lindahl
Karl Gustaf Strandberg
By Robert M. Dunning Attorney

Nov. 20, 1956 H. A. LINDAHL ET AL 2,771,192

GRAIN CLEANING APPARATUS

Filed June 30, 1951 4 Sheets-Sheet 2

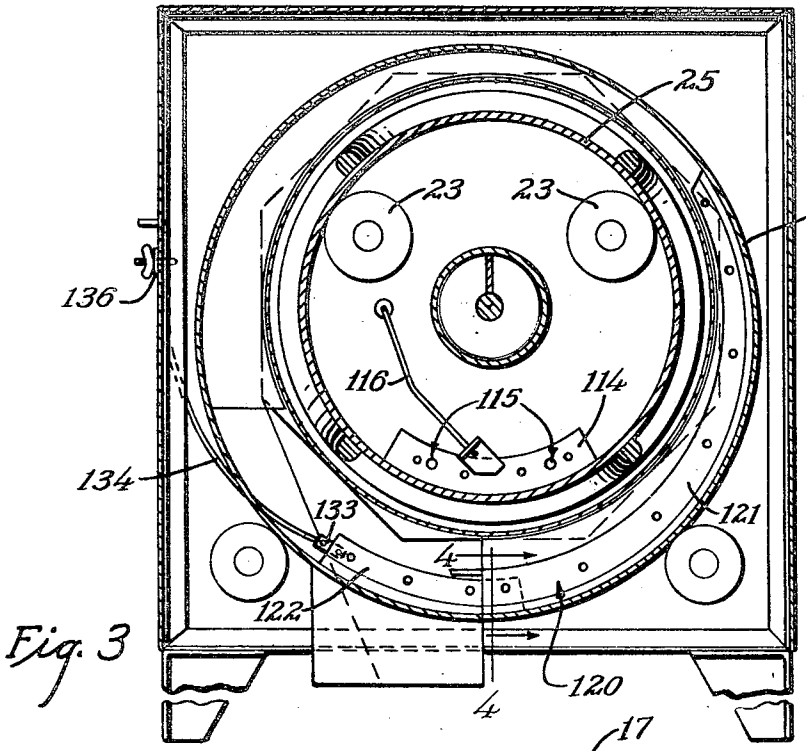


Fig. 3

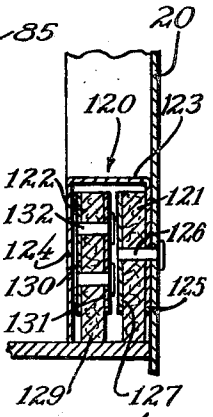


Fig. 4

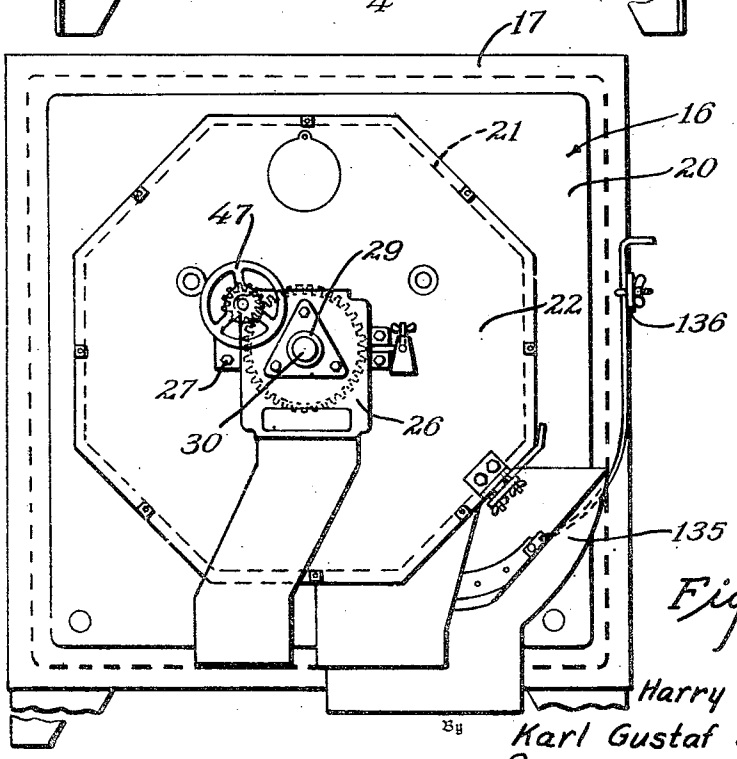


Fig. 2

Inventor
Harry A. Lindahl
Karl Gustaf Strandberg
By Robert M. Dunning Attorney

Nov. 20, 1956 H. A. LINDAHL ET AL 2,771,192

GRAIN CLEANING APPARATUS

Filed June 30, 1951 4 Sheets-Sheet 3

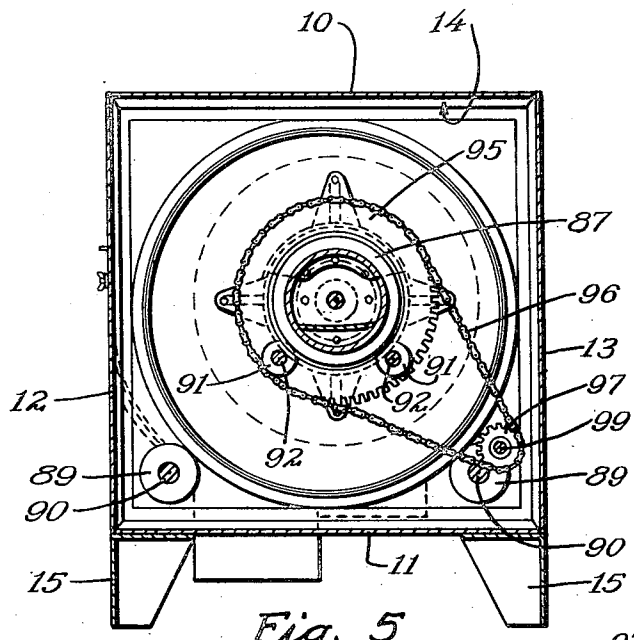


Fig. 5

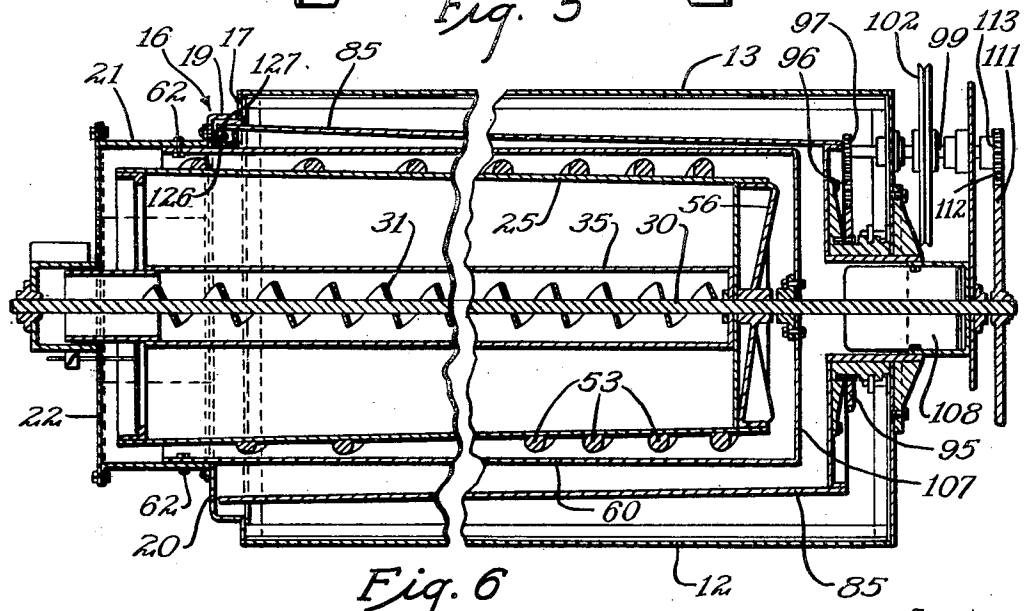


Fig. 6

Inventor
Harry A. Lindahl
Karl Gustaf Strandberg
By Robert M. Dunning
Attorney

Nov. 20, 1956 H. A. LINDAHL ET AL 2,771,192

GRAIN CLEANING APPARATUS

Filed June 30, 1951 4 Sheets-Sheet 4

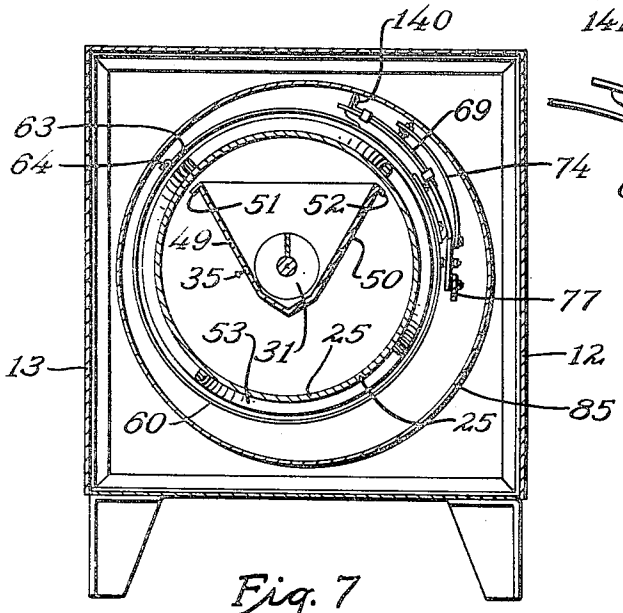


Fig. 7

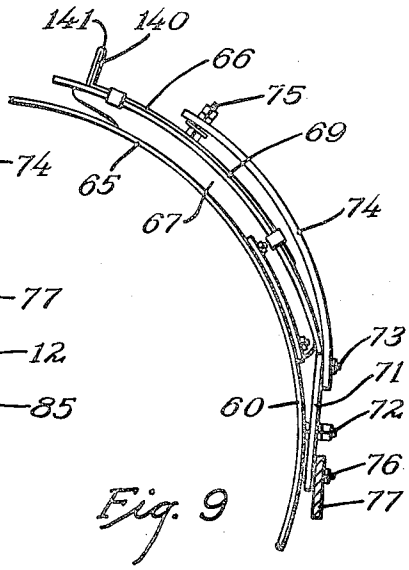


Fig. 9

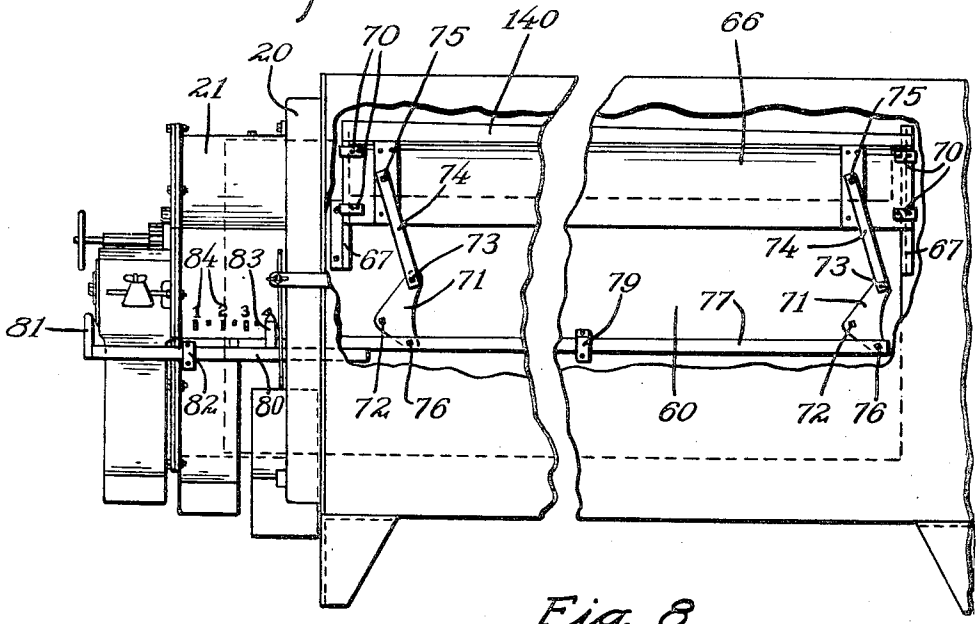


Fig. 8

INVENTOR

Harry A. Lindahl

Karl Gustaf Strandberg

BY Robert M. Dunning

ATTORNEY

United States Patent Office 2,771,192 Patented Nov. 20, 1956

2,771,192

GRAIN CLEANING APPARATUS

Harry A. Lindahl and Karl Gustaf Strandberg, St. Paul, Minn., assignors to Ideal Grain Cleaner Company, St. Paul, Minn., a corporation of Minnesota

Application June 30, 1951, Serial No. 234,512

6 Claims. (Cl. 209—95)

This invention relates to an improvement in grain cleaning apparatus wherein it is desired to provide a simple and effective apparatus for the separation of grains of different sizes and removing foreign material therefrom.

An object of the present invention resides in the provision of a mechanical apparatus capable of grading grains in such a manner as to separate grains of one kernel size from grains having a different kernel size. This device also functions to separate the grain kernels from cracked kernels, seeds, and other small particles. While the provision of grain cleaning and separating apparatus is not new in itself, the present device embodies various features which simplify the construction and make it more effective than previous forms of devices which we are familiar with.

Another feature of this invention is to provide an improved grain cleaning and separating arrangement of cencentric cylinders in tapering relationship having a feed-in at one end and adjustable relative retarder feed-outlets.

An additional feature of this invention is to provide an improved arrangement of relative rotating cylinders including a centered pivotal and angularly adjustable trough within an inner cylinder. A further feature of this invention is to provide an improved cylinder arrangement having angularly adjustable and fixed retarder elements for separation and banking of grain within the cylinder arrangement.

An additional feature of this invention is to provide an improved grain cleaning and separating arrangement having internal seals which prevent leakage and reduce wear with minimum replacement and adjustment required.

An added feature of the present invention resides in the provision of an adjustable flanged edge on the trough located within the outer separating cylinder and in the provision of a novel means for adjusting the position of this flanged edge. When the adjustable trough edge is in one extreme position less grain is deposited in the trough and with the edge in its opposite extreme position more grain is deposited into the trough. The flanged edge on the trough is tapered to fit the shape of the other separating cylinder and so that the marginal edge of the flange will be substantially equally spaced from the surface of the cylinder throughout its length.

These and other objects and novel features of our invention will be more clearly and fully set forth in the following specification and claims.

In the drawings forming a part of our specification:

Figure 1 is a vertical longitudinal section through the separator showing in general the arrangement of parts therein.

Figure 2 is a front end view of the separator showing the construction thereof.

Figure 3 is a cross-sectional view through the separator near the discharge end thereof, the position of the section being indicated by the line 3—3 of Figure 1.

Figure 4 is a sectional view through the adjustable retarder, the position of the section being indicated by the line 4—4 of Figure 3.

Figure 5 is a sectional view through the separator near the inlet end thereof, this view showing the drive mechanism for driving the cylinders, the position of the section being indicated by the line 5—5 of Figure 1.

Figure 6 is a horizontal longitudinal section through the separator, the section being taken through the axes of the separating cylinders.

Figure 7 is a sectional view through the separator, the position of the section being indicated by the line 7—7 of Figure 1.

Figure 8 is a side elevational view of the separator, a portion of the casing being broken away to indicate a portion of the structure.

Figure 9 is a detail sectional view showing the manner in which the adjustable trough edge is supported and adjusted.

The separator is indicated in general by the letter A. It is shown as having a generally rectangular casing including a top panel **10**, a bottom panel **11**, and side panels **12** and **13**. The panels are supported upon a similarly shaped rectangular frame of angle iron or similar material indicated in general by the numeral **14**. Legs **15** are provided at opposite ends of the frame in order to support the housing above the floor.

An end closure member **16** is bolted or otherwise attached to the forward end of the frame **14** and projects forwardly therefrom. This closure member **16** includes an outer rim or marginal portion **17** which is connected by a forwardly extending off-set **19** at a closure panel **20**. The closure panel **20** is apertured to accommodate the outer trough and is provided with a forwardly extending octagonal sleeve **21** bolted thereto about the aperture. A front closed plate **22** is bolted or otherwise affixed to the octagonal sleeve **21** and forms the front closure for the housing.

A pair of angularly spaced idle rollers **23** are pivotally mounted upon stub shafts **24** supported by the closure panel **22**. These idle rollers **23** act to rotatably support the inner separating cylinder **25**. The cylinder **25** is provided with spaced pockets or indentations on its inner surface capable of receiving kernels of grain. The size of the pockets or indentations depends upon the size of particles which it is designed to elevate. Usually the pockets of the inner cylinder **25** are relatively small so as to receive cracked kernels of grain as well as seeds and other particles which are smaller than the kernels of grain. As a result the pockets will carry the seeds and small particles of cracked grain kernels upwardly to a point substantially higher than it can carry whole kernels of grain, the whole kernels falling from the pockets at a relatively low elevation.

A chute housing **26** is bolted or secured at **27** to the closure plate **22** and extends forwardly therefrom. A bearing **29** is secured to this chute housing **26** to support the forward end of a conveyor shaft **30**. The conveyor shaft **30** is provided with a spiral conveyor **31** thereupon. The opposite end of the shaft **30** is supported by a bearing **32** mounted upon a panel **33** supported in spaced relation to the closure panel **34** secured to the rear end of the frame **14**. The manner in which the shaft is driven will be later described in detail.

A trough **35** is provided with an end **36** supporting a bearing **37** encircling the conveyor shaft **30**. The bearing **37** merely rides upon the shaft **30** and acts to support the rear end of the trough **35**. The forward end of the trough is provided with an end plate **39** having a tubular sleeve like extension **40**. The tubular extension **40** is concentric with the conveyor shaft **30** and en-

circles the forward end of the conveyor 31. This tubular extension 40 extends through an aperture 41 in the closure plate 22 and through a registering aperture 42 in the chute housing 26. The projecting end of the tubular extension 40 is provided with rectangular apertures 43 in angularly spaced relation. These apertures are spaced to provide teeth engageable with the teeth of a cooperating pinion 44. The pinion 44 is mounted upon a shaft 45 supported by a bearing 46 attached to the outer surface of the chute housing 26. A manually operable adjustment seal 47 is provided upon the shaft 45 and serves as a means of rotating the pinion 44. Rotation of the pinion 44 acts to rotate the tubular extension 40 of the chute and consequently causes rotation or oscillation of the chute 35 about the axis of the shaft 30.

The trough 35 is provided with upwardly and outwardly diverging walls 49 and 50 which terminate in out-turned reinforcing flanges 51 and 52. The chute 35 is tapered throughout its length and the rear end of the chute being narrower than the forward end thereof. Consequently the marginal edge of the flange 52 is spaced from the surface of the cylinder 25 a substantially equal distance throughout the length of the flange. This feature is of importance as otherwise the grain particles elevated by the cylinder 25 at one end thereof might be deposited into the chute while at the opposite end of the cylinder, grain particles elevated an equal amount might well be rejected.

The cylinder 25 is provided with inclined guide vanes 53 on its exterior surface, these vanes being spaced a relatively long axial distance apart near the outlet end of the cylinder and spaced closer together near the inlet end of the cylinder 25. The cylinder 25 is of smaller diameter at its inlet end 54 than at its outlet end 55 so that grain within this cylinder will have a tendency to move toward the outlet end upon rotation of the cylinder. A series of paddles 56 are provided at the inlet end of the cylinder, these paddles being supported by a hub 57 and being secured at their outer extremity to a rim 59 attached to the inlet end of the cylinder. These paddles 56 are so shaped as to draw grain banked adjacent the end of the cylinder by the guide vanes 53 inwardly into the interior of the cylinder. In other words, the grain builds up in depth against the end of the rotating cylinder and the paddles scoop the grain into the cylinder.

Encircling the cylinder 25 is provided a trough 60. This trough 60 supports grain for movement toward the inlet end of the cylinder. The trough 60 is supported at one end by a bearing 61 encircling the conveyor shaft 30. At the opposite end this trough is bolted or otherwise secured as indicated at 62 in Figure 6 to the octagonal sleeve 21. The trough 60 is open along its upper extremity as indicated at 63, one edge of the trough being provided with an outwardly turned reinforcing flange 64 as indicated in Figure 7. The other edge 65 of the trough supports an adjustable wing 66 which may be moved angularly to widen or narrow the trough opening. The manner in which the wing 66 is supported is best indicated in Figures 7, 8 and 9 of the drawings.

A pair of supporting tracks 67 are secured to the trough 60 near opposite ends thereof. These tracks 67 include arcuate guides 69 which are concentric with the trough. The wing 66 includes spaced clips 70 which hook over the arcuate guides 69 and support the wing for angular movement on the tracks 67. Thus the wing 66 may be moved angularly between two extreme positions.

A pair of bell crank levers 71 are pivotally anchored at 72 to the trough 60 at a point below the level of the wing. One end of each lever 71 is pivotally connected at 73 to a curved link 74 which is hingedly connected at 75 to the wing 66. The other end of each bell crank lever 71 is pivotally connected at 76 to an arm 77 extending longitudinally of the trough. The arm 77 is slidably supported by clips 79 attached to the trough 60, these clips fitting the arm 77 loosely enough to permit the necessary vertical movement of the arm as the bell crank levers 71 pivot about their fixed pivots. The arm 77 is provided with an extension 80 which extends through the front closure panel 20 and is provided on its outer extremity with a handle 81. A guide clip 82 loosely guides the arm extension 80 in its movement. A pointer 83 on the arm extension 80 is cooperable with indicia 84 on the rectangular sleeve 21 to indicate the position of the wing 66.

A cylinder 85 encircles the trough 60 and elevates grain particles to be deposited into this trough. One end of the cylinder 85 is supported by an end closure disc 86 anchored to a hub 87. As indicated in Figure 5 of the drawings, rollers 89 are supported upon stub shafts 90 which in turn are supported by the closure panel 34 of the housing. Rollers 91 supported upon stub shafts 92 engage in a track or groove 93 in the hub 87 to assist in supporting this element. A sprocket 95 is secured to the hub 87 for rotation in unison therewith. A chain 96 connects this sprocket 95 with a cooperable sprocket 97 mounted on a counter-shaft 99. The counter-shaft 99 is supported by bearings 100 and 101 on the end closure plate 34 and the parallel panel 33 and support a belt pulley 102. The belt pulley 102 is driven by a belt from any suitable source of power supply such as an electric motor secured adjacent to the housing or actually attached thereto.

The end panel 34 of the housing is provided with a reinforcing casting 103 secured to a sleeve 104 extending through the hub 87. A flange 105 on the sleeve 104 is bolted or otherwise affixed to a bracket 106, which in turn is connected to the end 107 of the chute 60 to assist in supporting this chute. The sleeve 104 serves as an inlet passage leading to the interior of the outer cylinder 85. A baffle 108 is provided within the sleeve 104 to deflect grain and other material into the outer cylinder. An inlet chute 109 extends downwardly between the end panel 34 and the parallel panel 33 and terminates in an angularly extending sleeve 110 which telescopes into the sleeve 104. The mixture of grains and seeds enters through the inlet chute 109 and is deflected by the baffle 108 through the sleeve 104 and into the interior of the outer cylinder 85. Thus all of the incoming material passes into this outer cylinder.

A sprocket 111 is mounted upon the conveyor shaft 30 and this sprocket is connected by a chain 112 to a drive sprocket 113 on the counter-shaft 99. Thus rotation of this counter-shaft acts to rotate the conveyor shaft and the inner cylinder 25 secured thereto for rotation in unison therewith. Simultaneously the rotation is transferred through the belt 96 to the sprocket 95 connected to the end of the outer cylinder 85 so that both cylinders are rotated in unison.

As best indicated in Figures 1 and 3 of the drawings, a retarder 114 is supported loosely upon spaced parallel pins 115 extending inwardly into the outlet end 55 of the cylinder 25. This retarder 114 comprises an arcuate body of material preferably having a wearing surface of fiber or other long wearing material. An arm 116 is connected to the retarder 114 and extends upwardly and forwardly therefrom. This arm 116 is provided with a forwardly extending extremity 117 which extends through the closure plate 22 and is provided with a counterweight 119. This counter-weight tends to urge the retarder 114 inwardly of the cylinder 25 against the pressure of the grain which banks against the retarder and tends to move this member outwardly toward the outlet of the cylinder. The position of the weight 119 regulates the force with which the retarder is urged against the grain. Since Figure 1 is the only side elevational view and since this view

is a sectional one, the counterweight is actually toward the reader from the vertical plane on which the section is taken. Accordingly the dotted or phantom outline of the counter-weight in this figure represents only a shadow or projected view of the weight.

The outlet end of the outer cylinder **85** is also provided with a retarder indicated in general by the numeral **120**. The retarder **120** includes a fixed section **121** which is secured in fixed relation to the closure panel **20** of the end closure member **16** and which engages against the inner surface of the cylinder **85** with a sliding fit. The retarder **120** also includes a relatively movable section **122** which is arranged in telescoping relation with the fixed retarder section **121** and which is angularly adjustable to vary the effective angular length of the retarder. As indicated in Figure 4 of the drawings, a channel **123** having outwardly turned parallel sides **124** and **125** provided with arcuate outer edges accommodates both the fixed retarder member **121** and the movable retarder member **122**. The fixed retarder member **121** comprises an arcuate segment of fabric or similar material which is riveted or otherwise secured as indicated at **126** to the wall **125** of the channel **123** and to the closure panel **20**. An arcuate reinforcing strip **127** overlies the opposite edge of the retarder segment **121** to further reinforce the same.

The movable retarder member **122** comprises an arcuate segment of fabric or similar material having reinforcing plates **130** and **131** on opposite sides thereof. The reinforcing plates are riveted or otherwise affixed to the reinforcing plates as indicated at **132**. The retarder **122** slides between the retarder **121** and the slide **124** of the channel **123**. A clip **133** is provided on the free end of the movable retarder **122** to connect this retarder to an adjustment arm **134**. The adjustment arm **134** extends through the wall of the outlet chute **135** and is held in adjusted position by a clamp **136** attached to the exterior surface of the housing.

The description of the operation of the apparatus is as follows:

The mixed grain combined with seeds and other impurities enters through the inlet chute **109** and is deflected by the deflector **107** through the sleeve **104** and into the interior of the outer grain cylinder **85**. This cylinder **85** is provided with indentations or pockets in its inner surface, these pockets being of a selected size, depending upon the grain with which the separator is to operate. The pockets of the cylinder **85** are of proper size to accommodate grain of a desired size as well as the seeds, broken kernels and other small particles of foreign material. The larger kernels of grain slip from the pockets as the cylinder rotates, these larger kernels falling toward the bottom of the cylinder and building up a bank of grain against one side of the cylinder. The smaller grain kernels which are to be separated from the larger kernels are carried upwardly a distance sufficient to drop into the trough **60** within the outer cylinder **85**. By adjusting the position of the wing **66**, the apparatus may be regulated to reject kernels of one size and to separate kernels of a slightly smaller size together with the smaller particles of grain, broken kernels, seeds and the like.

In adjusting the position of the wing **66** it is only necessary to loosen the guide **82** which acts in the capacity of a clamp to hold the arm extension **80** in a desired position and to move this arm extension and the arm connected thereto longitudinally of the trough in one direction or the other. As the arm **77** moves to the right, the bell crank levers **71** are pivoted in a counter-clockwise direction as viewed in Figure 8, pushing the wing **66** upwardly. As the handle **81** is pulled in the opposite direction to move the arm **77** to the left the bell crank levers **71** are pivoted in a clockwise direction, lowering the wing **86**. The flanged edge **140** is tapered so that the marginal edge **141** thereof is always at a constant distance from the outer cylinder **85**. The grain or seed separation between the carrying pockets of cylinder **85** and wing **66** is facilitated by the flange **140** carrying marginal edge **141** in relatively constant relationship over the surfaces of the pockets. In addition the flange **140** prevents marginal spill-over of material which may be forced against the flange by the rotation of cylinder **85**, as herein described.

The grain remaining in the outer cylinder **85** gradually moves to the larger diameter outlet end of this cylinder against the retarder **120**. This retarder acts to build up a bank of grain within the cylinder to insure proper action of the separating cylinder. The amount to which the bank of grain will build up is determined by adjustment of the adjustable portion **122** of this retarder.

The grain eventually passes over or beyond the retarder and drops into the outlet chute **135**. As the outlet end of the cylinder **85** extends well over the outlet chute **135**, the grain is guided into the chute with no difficulty. Furthermore, as the fixed section **127** of the retarder **120** is secured directly to the casing closure panel **20**, no grain can escape through the cylinder end without passing into the chute **135**. The grain elevated by the cylinder **85** drops into the chute **60** and is gradually urged against the closed end **107** of this chute by the guide vanes **53**. When a sufficient depth of grain is reached at the inlet end of the cylinder **25**, the paddles **56** draw this grain into the cylinder through the inlet end **54** thereof.

The grains within the cylinder **25** are again subjected to a separating action due to the pocketed inner surface of this cylinder. The small grains, seeds, and broken kernels may be elevated by the inner cylinder **25** to an extent where they will drop into the trough **35**. The separation between the particles of different sizes is regulated by adjusting the angular position of the trough **35**. This is accomplished as previously described by the hand seal **47** which rotates the pinion **44** to rotate the tubular extension **40** of the trough.

The seeds and other small particles are therefore dropped into the trough **35** while the larger grains fall back into the cylinder **25**. These grains gradually move toward the outlet end of the cylinder **25** due to the taper in the cylinder. The escape of these seeds is retarded by the retarder **114** which tends to build up a bank of grain in the inner cylinder and to insure contact of all of the grain with the cylinder surface. When the grain passes over or around the retarder **114** it falls from the outlet end of the cylinder **25** and into the discharge chute **142**. The cylinder extends well over the chute **142** so that no seal is required between these elements.

The seeds and other particles deposited in the trough **35** are conveyed through the tubular extension **40** by the conveyor **41** and fall into the chute housing **26** which communicates with an outlet chute **143**. Thus a large size of grain, as for example oats will be discharged through the chute **135** while smaller whole grain particles such as wheat may be discharged through the discharge chute **142**. The seeds, broken kernels and small particles may be discharged through the chute **143**.

In accordance with the patent statutes, we have described the principles of construction and operation of my grain cleaning apparatus, and while we have endeavored to set forth the best embodiment thereof, we desire to have it understood that obvious changes may be made within the scope of the following claims without departing from the spirit of my invention.

We claim:

1. A grain separator including a separating cylinder, means rotatably supporting said cylinder, a retarder at one end of said cylinder, said retarder comprising an arcuate shoe arranged in surface contact with the inner surface of said cylinder at one end thereof, means supporting said shoe for movement longitudinally of said cylinder, an arm connected at one end to said shoe and hinged intermediate its ends, said arm supporting said shoe for radial movement, and a counter-weight on the

end of said arm opposite the end connected to said shoe.

2. A grain separator including a separating cylinder having indentations in its inner surface, a trough within said cylinder, an adjustable wing on said trough designed to more or less close the upper end of said trough, and means for adjusting said wing including a pair of bell crank levers connected to said wing, fixed pivot means supporting said levers, a longitudinally extending operating rod pivotally connected to said levers, said rod extending longitudinally of said trough, the longitudinal movement of said rod pivoting said levers to adjust the position of said wing, and respective curved links articulatively connected to said levers and to said wing.

3. The structure described in claim 2 and in which the cylinder is tapered and including a marginal upper edge on said wing substantially equi-distant from the inner surface of said cylinder throughout its length.

4. A grain separator including a separating cylinder having selecting indentations distributed over its inner wall, means rotatably supporting said cylinder on a substantially horizontal axis, a trough within said cylinder, a generally arcuate retarder at the discharge end of said cylinder, said retarder being adjacent the inner wall of the cylinder and angularly extensible and contractable in length.

5. The structure described in claim 4 and in which the retarder includes a fixed section and an angularly adjustable section arranged in overlapping relation, each said section including an arcuate shoe frictionally engageable with the inner surface of the cylinder.

6. The structure described in claim 4 and in which the retarder includes a relatively fixed section and a relatively movable section arranged in telescoping relation with said fixed section, both said sections including arcuate shoes designed to follow the contour of the inner surface of the cylinder, and means connected to the movable section for holding the movable section in adjusted position.

References Cited in the file of this patent

UNITED STATES PATENTS

685,908	Colgrove	Nov. 5, 1901
1,705,302	Mjolsness	Mar. 12, 1929
1,728,238	Gray	Sept. 17, 1929
1,912,375	Johnson	June 6, 1933
1,931,074	Johnson	Oct. 7, 1933
2,015,400	Ingraham	Sept. 24, 1935
2,135,343	Johnson	Nov. 1, 1938