Feb. 23, 1960 M. W. GILMORE ET AL 2,925,910

GRAIN CLEANER

Filed Sept. 29, 1958 3 Sheets-Sheet 1

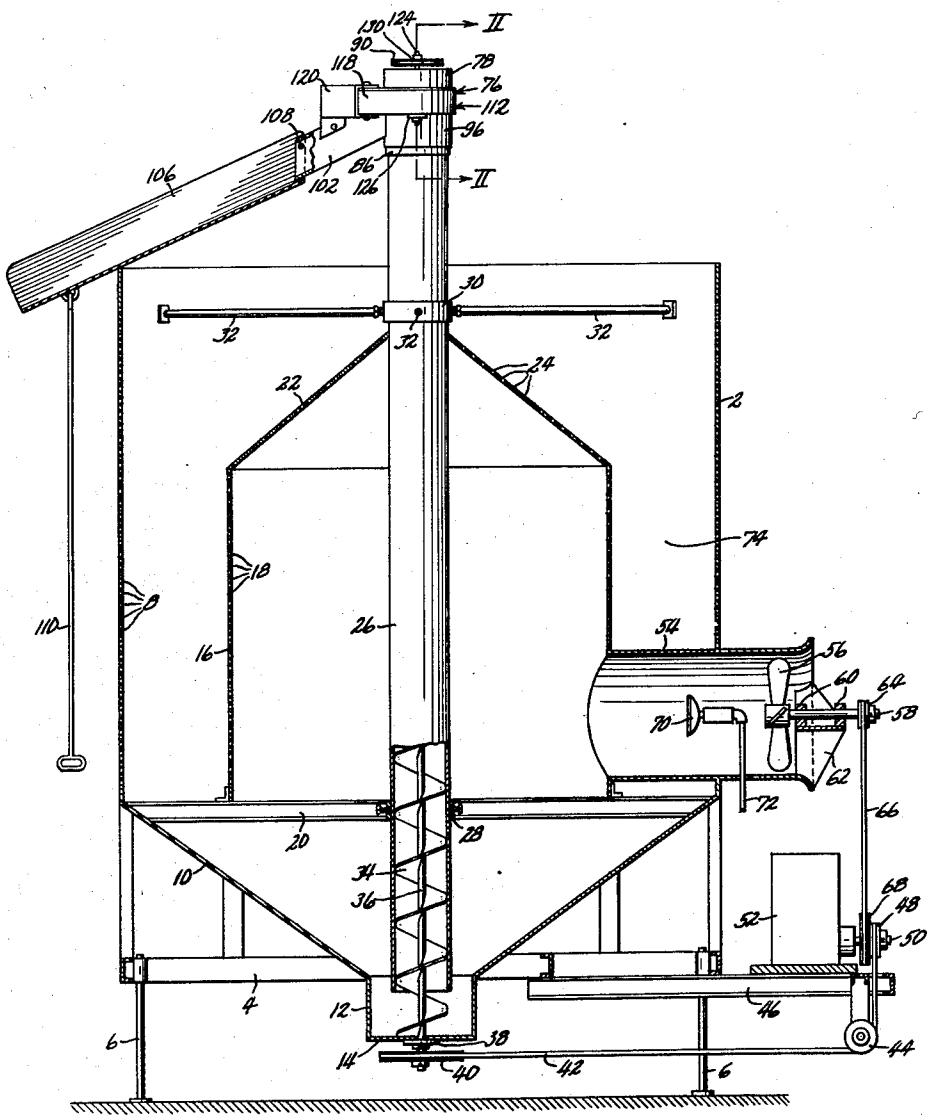


Fig. 1

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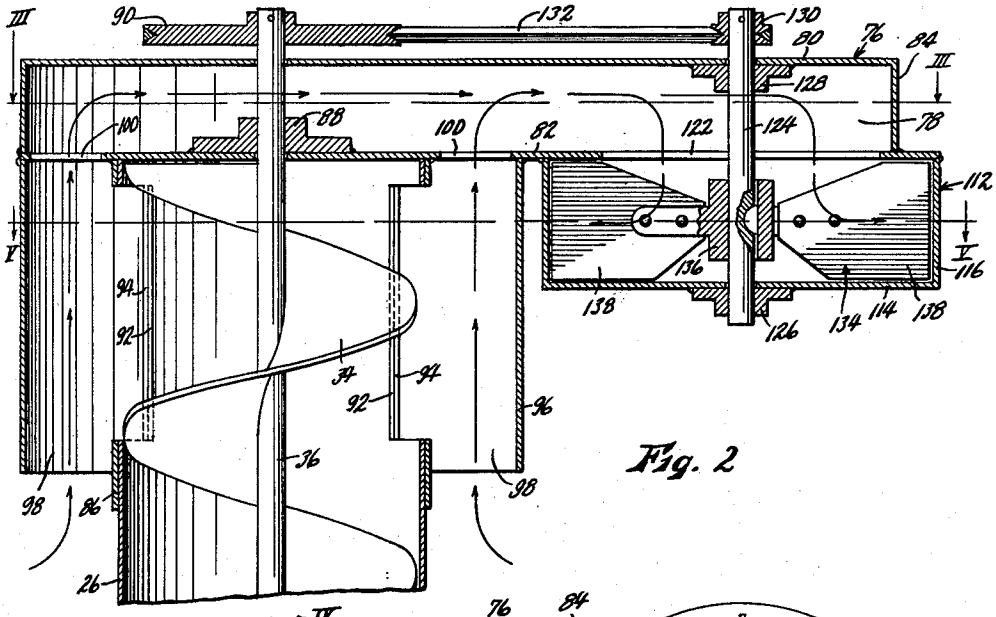


Fig. 2

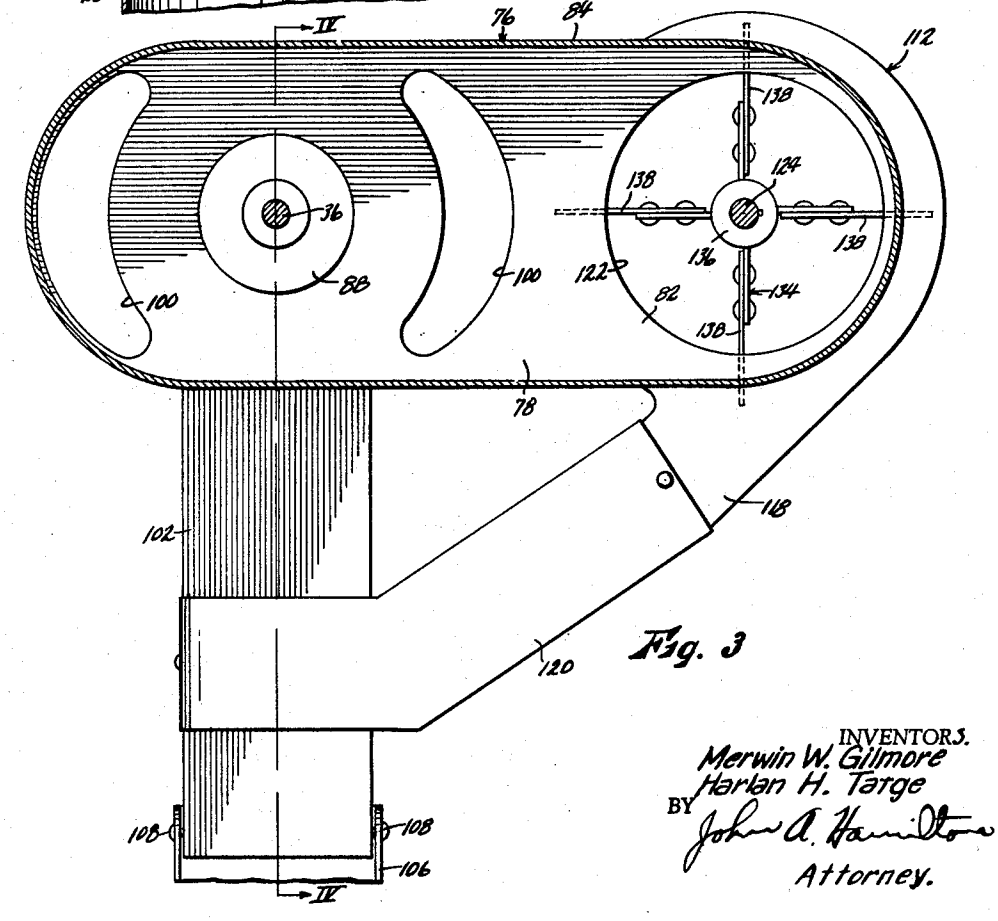


Fig. 3

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GRAIN CLEANER

Filed Sept. 29, 1958 3 Sheets-Sheet 3

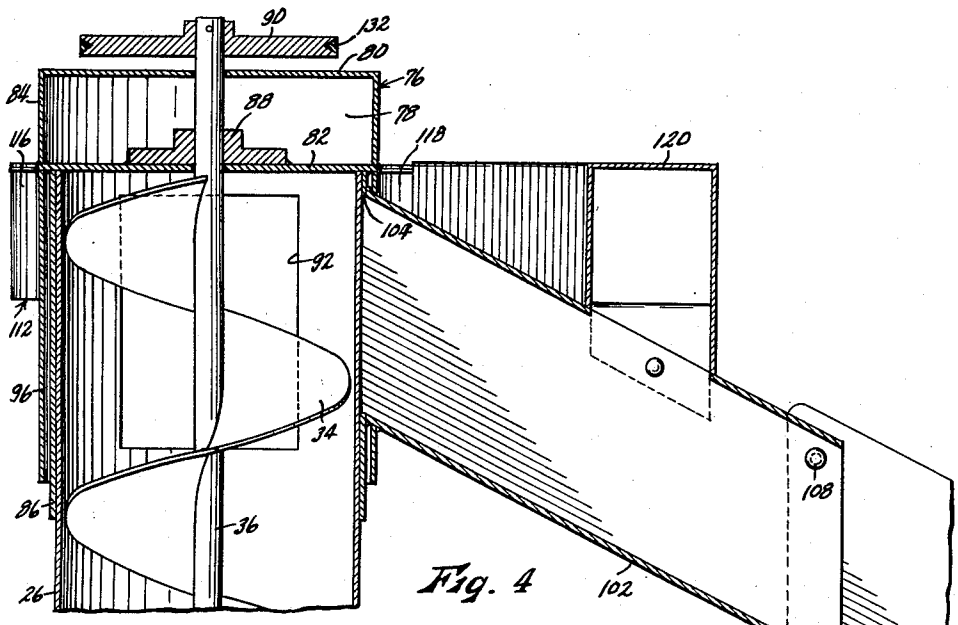


Fig. 4

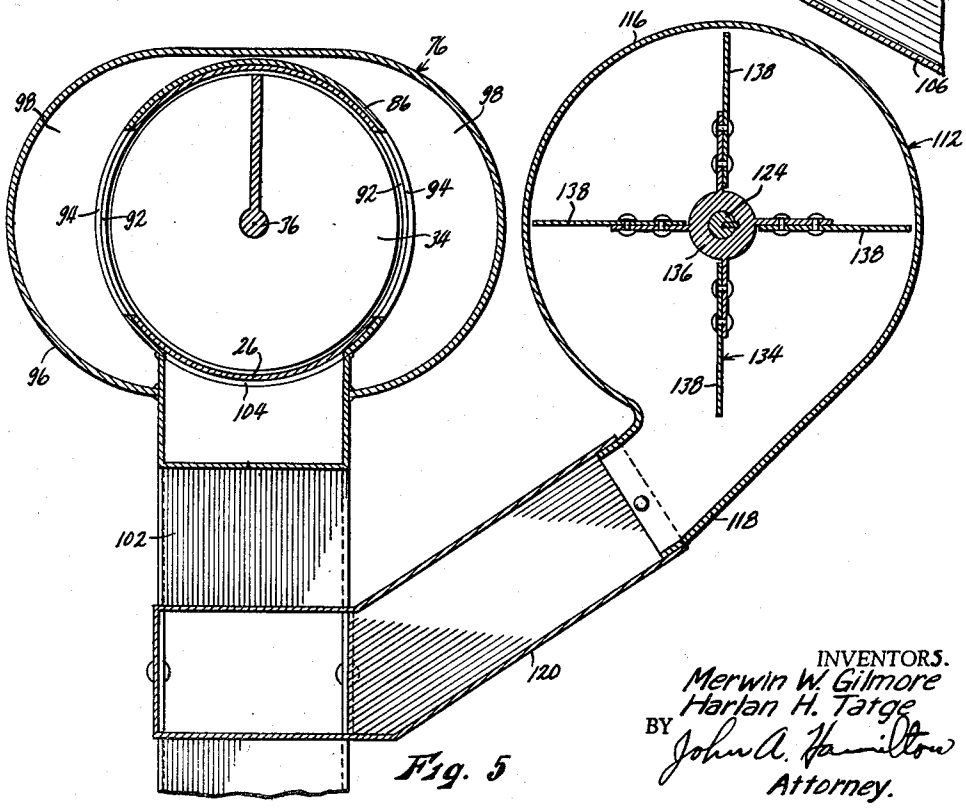


Fig. 5

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2,925,910

GRAIN CLEANER

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Application September 29, 1958, Serial No. 764,191

4 Claims. (Cl. 209—11)

This invention relates to new and useful improvements in grain cleaners, and has particular reference to an apparatus operable to remove straw, grass, grain husks, dirt and dust, and other lighter-than-grain foreign matter from the grain, all such foreign matter commonly being designated as "trash," and its presence of course being highly undesirable.

The principal object of the present invention is therefore the provision of an apparatus which will perform this cleaning operation efficiently, rapidly and economically. Generally, this object is accomplished by a conveyor operable to discharge or "spray" the grain into a suitable chamber so that the separate kernels are separated to permit free circulation of air thereabout, and a fan or blower operable to force a current of air through said chamber in a direction opposite to the direction of travel of grain therethrough, said air current not being sufficiently strong to entrain the grain itself, but strong enough to blow the lighter trash to a point of disposal.

Another object is the provision of a grain cleaning apparatus of the character described including means for recirculating grain continuously and repeatedly through said cleaning chamber.

A further object is the provision of a grain cleaning apparatus of the character described having a single discharge spout through which either the cleaned grain or the trash removed therefrom may be selectively exhausted, and wherein said spout is movable to discharge its contents either to a grain storage area or a trash disposal area, and is operable by said movement to operate suitable valves to connect either the cleaned grain or the trash thereto.

Still another object is the provision of a grain cleaning apparatus of the character described which is adapted to be used in conjunction with and to be driven by any other grain processing apparatus requiring circulation of grain, such as a grain dryer, so as to utilize the circulation of said other apparatus in the operation of the cleaning apparatus.

Other objects are simplicity and economy of construction, efficiency and dependability of operation, and adaptability for use in cleaning materials other than grain.

With these objects in view, as well as other objects which will appear in the course of the specification, reference will be had to the drawing, wherein:

Fig. 1 is a side elevational view of a grain dryer embodying the present invention, shown in conjunction with a grain drying apparatus of the general type shown in our joint application for patent Serial No. 712,844, filed February 3, 1958, now Patent No. 2,865,111, and entitled Grain Dryer, said grain dryer being shown in a vertical sectional view with portions left in elevation,

Fig. 2 is a view of the cleaning apparatus proper, being an enlarged fragmentary sectional view taken on line II—II of Fig. 1,

Fig. 3 is a fragmentary sectional view taken on line III—III of Fig. 2,

Fig. 4 is a sectional view taken on line IV—IV of Fig. 3, and

Fig. 5 is a sectional view taken on line V—V of Fig. 2.

Like reference numerals apply to similar parts throughout the several views. The grain drying apparatus, which is partially incorporated in the grain cleaning apparatus forming the subject matter of this invention, is shown generally in Fig. 1. It includes an outer cylindrical casing 2 arranged with its axis vertical and supported by a frame 4 having ground engaging legs 6. Said outer casing has perforations 8 over substantially the entire area thereof, is open at its upper end, and is provided at its lower end with a bottom closure 10 of inverted conical shape, said closure being provided with a central reduced well 12 having a flat bottom wall 14. Arranged concentrically within casing 2 is a smaller cylindrical inner casing 16, also perforated as indicated at 18. Said inner casing is open at its lower end, being supported by an open frame 20 carried in outer casing 2 and spaced above the bottom closure 10 of said outer casing. The inner casing is provided at its upper end with a top closure 22 of conical form, also perforated as indicated at 24, and disposed below the top of outer casing 2.

Disposed axially within inner casing 16 is a vertical conveyor tube 26, said tube being supported adjacent its lower end by a clamp ring 28 mounted in frame 20, and adjacent its upper end by a clamp ring 30 supported by rods 32 extending radially therefrom and secured at their outer ends to outer casing 2. Said tube extends at its lower end into well 12, and extends upwardly through top closure 22 of inner casing 16 to a point above the top of outer casing 2. Carried rotatably within tube 26 is an auger type conveyor 34 which extends the full length of the tube. The shaft 36 of said auger is journalled at its upper end in a manner to be fully set forth below, and at its lower end extends through the bottom wall 14 of well 12, being journalled in a bearing 38 carried by said wall. A pulley 40 is affixed on said shaft below wall 14, and a belt 42 is trained about said pulley, and extends thence about pulleys 44 carried by a horizontal extension 46 of frame 4, and about a pulley 48 mounted on the drive shaft 50 of an engine 52 also supported by frame extension 46, whereby operation of said engine will cause rotation of auger 34.

An air inlet tube 54 is interconnected at its inner end into the lower portion of inner casing 16, and extends horizontally outwardly through outer casing 2. Supported in the outer end of said tube is a blower 56 carried on a shaft 58 journalled in bearings 60 carried by a spider 62 affixed in the mouth of the tube. A pulley 64 affixed on said shaft is operably connected by means of a belt 66 with a pulley 68 mounted on the drive shaft 50 of engine 52, whereby operation of said engine will drive blower 56 to direct a current of air inwardly through tube 54. A gas burner 70 or other suitable heating device is supported in tube 54 inwardly from blower 56, and is supplied with gas from any suitable source through a pipe 72. Said burner is operable to heat the air delivered by blower 56.

The apparatus thus far described, while a functional component of our grain cleaner, also constitutes a grain dryer and is capable of independent operation as such. When operated solely as a grain dryer, the grain to be dried is dumped into the open upper end of outer casing 2, from whence it passes downwardly through the annular chamber 74 between outer casing 2 and inner casing 16, into well 12, is elevated upwardly through tube 26 by auger 34, and is discharged from the upper end of said tube back into the casing, thereby setting up a continuous circulatory path. As the grain passes downwardly through the casing, hot air delivered to the in-

terior of inner casing 16 is forced outwardly through perforations 18 of said housing and perforations 24 of the top closure, through the bed of grain in chamber 74 and covering top closure 22 of the inner casing, and to the atmosphere through perforations 8 of the outer casing, or through the top thereof. The grain is thus dried, the number of circulations thereof required being determined by its degree of wetness, the speed of circulation, and other variable factors.

The principal elements of the grain cleaner are disposed in a housing 76 carried at the upper end of conveyor tube 26. Said housing includes an air chest 78 having a planar horizontal top wall 80, a planar horizontal bottom wall 82, and a vertical side wall 84 of elongated oval form. Depending from bottom wall 82, and secured fixedly thereto adjacent one end thereof, is a cylindrical tube 86 which is engaged slidably and rotatably over the upper end portion of conveyor tube 26, whereby the entire housing 76 may be rotated about tube 26. Tube 86 and wall 82 constitute a socket effectively sealing the upper end of tube 26. Shaft 36 of auger 34 extends upwardly through air chest 78 being journalled in a bearing 88 affixed to chest wall 82, and has a pulley 90 affixed thereon above top chest wall 80.

A pair of diametrically opposite windows 92 are formed in the upper end portion of conveyor tube 26, within the axial end limits of tube 86. A pair of corresponding diametrically opposite windows 94 are formed in tube 86, and are adapted to be brought into registering relation to windows 92 by turning housing 76 on tube 26. Said windows are of less than 90 degrees in angular extent. Enclosing tube 86 is an oval tubular skirt 96 which is affixed at its upper end to bottom chest wall 82, and which is open at its lower end. Said skirt defines a pair of substantially crescent-shaped chambers 98 respectively at opposite sides of tube 86, and aligned with windows 94 of said tube. At the upper end of each of said chambers, a crescent-shaped hole 100 is formed in bottom wall 82 of air chest 76, whereby to permit passage of air from said chambers to said chest. A tubular spout 102 is affixed at its inner end to tube 86, communicating with a window 104 formed in said tube in 90 degree offset relation from windows 94 thereof. Said spout extends outwardly in downwardly inclined relation, passing through skirt 96. At the outer end of said spout, a trough-like spout extension 106 is pivoted thereto as at 108. Said extension projects radially outwardly and rests by gravity on the upper edge of outer casing 2. Exteriorly of said casing, the extension is provided with a depending handle 110 which extends sufficiently close to the ground to be utilized in turning housing 76 about conveyor tube 26.

Depending from bottom wall 82 of air chest 76, at the end thereof opposite from tube 86, is a blower housing 112 defined by wall 82, a bottom wall 114, and a vertical side wall 116. Said blower housing is substantially circular, having a tangential outlet 118. A tube 120 is interconnected at one end with outlet 118, and is interconnected at its opposite end with discharge spout 102 through the top wall thereof, at a point spaced outwardly from housing 76. A circular opening 122 to the blower housing is formed through bottom wall 82 of the air chest, said opening being concentric with the blower housing, but having a smaller diameter. A vertical blower shaft 124 is disposed axially in the blower housing, being journalled at its lower end in a bearing 126 carried by bottom wall 114 of said housing, and at its upper end in a bearing 128 carried by top wall 80 of the air chest, and extending above said top wall. A pulley 130 fixed on the upper end of said shaft is operably connected by a belt 132 with pulley 90 of auger shaft 36. Mounted on shaft 124 within blower housing 112 is a blower 134 including a hub 136 keyed to said shaft and a plurality of radial vanes 138 affixed to said hub.

In the operation of the grain cleaner, the casing 2—16 is first charged with grain through the open top of outer casing 2, and engine 52 is started whereby to drive blower 56 and auger 34, as previously described, and burner 70 is lighted. The cleaner housing 76 is at this time turned about conveyor tube 26, by means of handle 110, until windows 94 in tubular portion 86 thereof are registered with windows 92 of tube 26, as shown in the drawing. Window 104 of tube 86, communicating with discharge spout 102, is closed at this time by a blank portion of the wall of tube 26, as shown. It will be understood also that with the blower housing in this position, discharge spout 102 and its extension 106 will be disposed to direct its contents into a suitable trash receptacle, not shown. Operation of auger 34 then elevates grain through tube 26 and discharges it outwardly through windows 92—94 at the upper end thereof into chambers 98, which may be termed dispersion chambers. The grain strikes skirt 96 defining said chambers and is thereby dispersed or "bounced" so that the separate grains are spaced apart to permit free circulation of air thereabout, and falls by gravity back into casing 2. At the same time, operation of auger 34 operates through pulley 90, belt 132 and pulley 130 to drive blower 134. The blower draws a strong current of air upwardly through dispersion chambers 98, through holes 100 into air chest 78, and through opening 122 into blower housing 112, as indicated by the arrows in Fig. 2, and discharges said air through outlet 118 and tube 120 into discharge spout 102. In moving upwardly through chambers 98, the air entrains any trash or foreign matter present in the grain which is lighter than the grain itself, and carries said trash therewith to be discharged into spout 102. Said trash then moves through spout extension 106 by gravity to be deposited in the trash receptacle previously referred to. The dispersion or spacing of the grain kernels caused by their impingement against skirt 96 frees the trash for easy removal from the grain, and also the shock or impact of said impingement tends to release any trash which may be adhered to the grain kernels. The agitation of the grain in the auger tube 26 also assists in the latter function.

The grain is continuously recirculated by auger 34 until it is dried by blower 56 and burner 70 to the desired extent, and until it has been thoroughly cleaned. The efficiency of the cleaning operation is greatly enhanced by this recirculation, and the operation may be performed with a smaller blower than would otherwise be necessary, since the "winnowing" action thereof is repeated many times. When the grain is sufficiently cleaned, the cleaner housing 76 is turned on tube 26 through approximately 90 degrees by means of handle 110. Turning of said housing causes a blank wall portion of tubular portion 86 thereof to close one of the windows 92 of tube 26, and moves window 104 of tubular portion 86 into registry with the other of tube windows 92. It also repositions spout extension 106 to deliver its contents into a suitable truck, bin or other grain receptacle, not shown. With the parts in this position, grain elevated by auger 34 will not be delivered into dispersion chambers 98, but will be discharged through a window 92 and window 104 into discharge spout 102, and thence through spout extension 106 into the grain receptacle previously described. It will thus be seen that tube 86, in cooperation with tube 26, constitutes a valve apparatus operable to direct grain elevated by auger 34 selectively either to dispersion chambers 98 or to discharge spout 102.

It is believed clear that the elements hereinbefore described as constituting a grain dryer, namely all the parts not contained in or directly connected to housing 76, while capable of operation as a grain dryer independently of the cleaning operation which is the prime concern of the present invention, nevertheless are functionally a part of the grain cleaner also. The casing, auger, and auger drive of course provide the grain movement and

recirculation which are essential to the cleaning function. Also, the drying action of blower **56** and burner **70** is also directly related to the cleaning function, since the drying of the trash in the grain lightens the weight of said trash so that it may be removed more easily and efficiently by the cleaning blower **134**. It is of course also highly desirable from the standpoint of economy in equipment, space requirements, and time, that the cleaning and drying operations be performed simultaneously.

While we have shown and described a specific embodiment of our invention, it will be readily apparent that numerous minor changes of structure and operation could be made without departing from the spirit of the invention as defined by the scope of the appended claims.

What we claim as new and desire to protect by Letters Patent is:

1. A grain cleaner comprising a vertically disposed conveyor tube having a window formed therein adjacent its upper end, conveyor means disposed in said tube and operable to elevate grain through said tube and to discharge said grain horizontally through said window, a housing carried at the upper end of said conveyor tube and including a tubular portion rotatably mounted on and enclosing the windowed portion of said conveyor tube, said tubular housing portion having a pair of angularly spaced apart windows formed therein, said windows being adapted to be brought selectively into registry with the window of said conveyor tube by turning said housing on said conveyor tube, a tubular discharge spout affixed to said housing and interconnected with one of the windows of the tubular portion thereof, said housing defining a dispersion chamber about the upper portion of the conveyor tube and communicating with the other window of said tubular housing portion, said dispersion chamber being open at its bottom whereby grain falls therefrom by gravity, a blower carried by said housing and operable to draw a current of air upwardly through said dispersion chamber, and means for driving said conveyor means and said blower.

2. A grain cleaner as recited in claim 1 wherein said housing provides an air inlet passage to said blower interconnected with the upper portion of said dispersion chamber, and an air outlet passage from said blower interconnected with said discharge spout at a point spaced apart from said windowed tubular housing portion.

3. A grain cleaner as recited in claim 1 with the addition of an open-topped casing disposed vertically beneath said housing whereby to receive grain falling from said dispersion chamber, and wherein said conveyor means is positioned to elevate grain from said casing, whereby said grain is continuously recirculated.

4. A grain cleaner as recited in claim 1 with the addition of an open-topped casing disposed vertically beneath said housing whereby to receive grain falling from said dispersion chamber, and wherein said conveyor means is positioned to elevate grain from said casing, whereby said grain is continuously recirculated, and with the further addition of means carried by said casing and operable to direct a current of heated air through the grain disposed therein.

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