# United States Patent [19]

**Gilmore et al.**

[11] **3,833,118**

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[54] **GRAIN CLEANING DEVICE**


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[52] **U.S. Cl.** ..... **209/28,** 209/250, 209/283, 209/358

[51] **Int. Cl.** ..... **B07b 7/06,** B07b 7/086

[58] **Field of Search** ..... 209/283, 11, 474, 358, 209/28, 250



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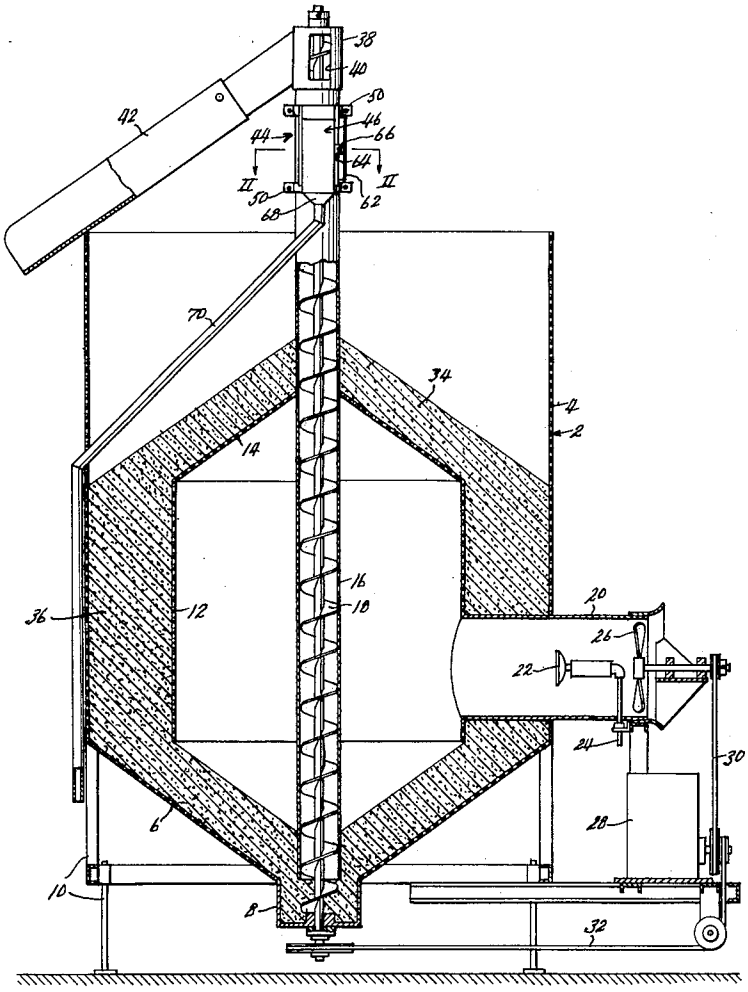
*Attorney, Agent, or Firm*—John A. Hamilton



[57] **ABSTRACT**

A grain cleaning device for removing "fines" such as broken kernels, hulls, dust and the like from grain, including a tube through which grain is moved with a whirling motion and in an elevated air pressure, the tube having an opening to the atmosphere at its periphery obstructed by a perforated screen, so that the fines are removed from grain through said opening by both centrifugal force and by air flow. The screen is interchangeable with others having different perforation sizes, for use with grains having other kernel sizes, so as to prevent passage of whole kernels but to permit passage of fines.


**8 Claims, 3 Drawing Figures**



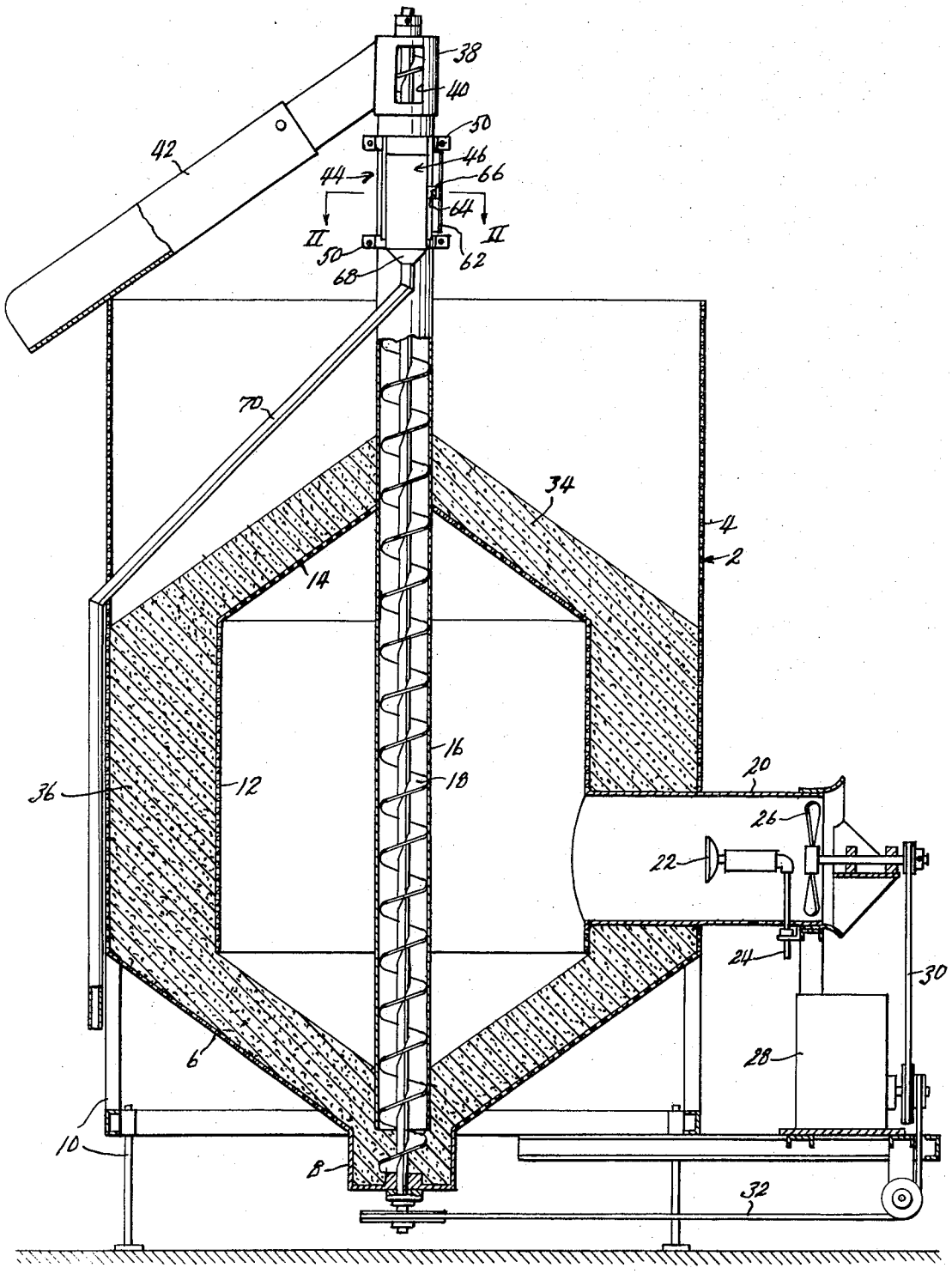

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Fig. 1

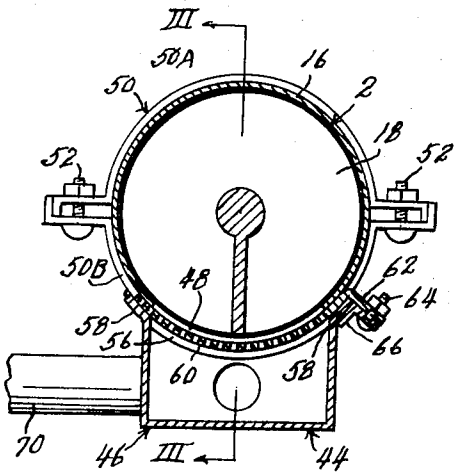

III
50A
16
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50B
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Fig. 2

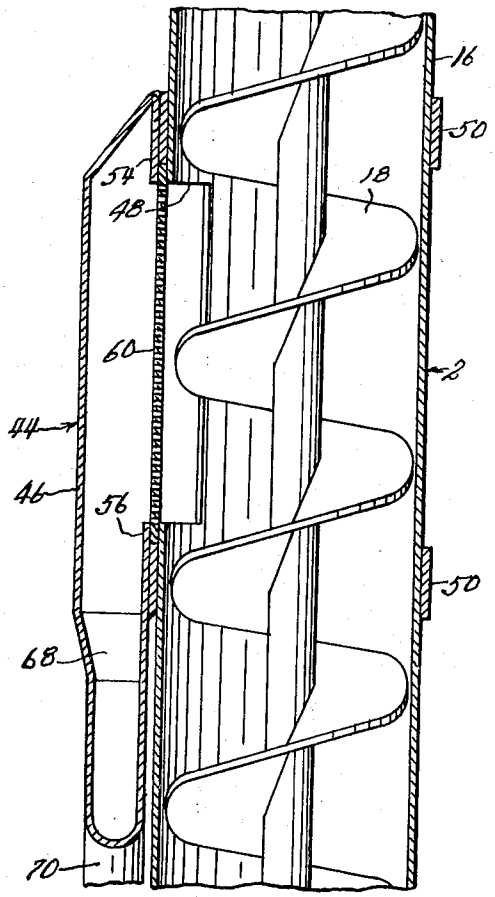

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Fig. 3

# GRAIN CLEANING DEVICE

This invention relates to new and useful improvements in grain cleaning devices of the type operable to remove fines from the grain, said fines consisting of broken kernels, hulls, dust and dirt and the like, usually light in weight. The presence of these fines is of course objectionable, representing impurities in many cases, so that removal thereof is required. The presence of such fines in grain also downgrades the grain at the time of sale thereof, so that it commands a lower price.

The primary object of the present invention is the provision of a grain cleaning device including a tube having a side opening to the atmosphere covered by a perforated screen, and through which grain to be cleaned is moved continuously with a whirling motion around the tube axis, and in an atmosphere of elevated air pressure, whereby the fines are forced outwardly through said screen both by air currents and also by centrifugal force. Either the air currents or the centrifugal force, acting alone, would of course provide a cleaning action, but acting in concert they provide a more rapid and efficient cleaning action.

Another object is the provision of a grain cleaning device of the character described adapted to serve as a simple adjunct or accessory for a grain drying machine of the hot air type, the air and grain circulating elements of the drying machine supplying the grain and air movement necessary to the functioning of the cleaning device, so that the cleaning device, in itself, requires no additional operating parts.

A further object is the provision of a grain cleaning device of the character described having a novel structure whereby the screen may be readily interchanged for others having different perforation sizes, whereby the device may be readily adapted for use with grains having different kernal sizes.

A still further object is the provision of a grain cleaning device of the character described having means for collecting the fines removed from the grain for other uses.

Other objects are simplicity and economy of construction, and efficiency and dependability of operation.

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 accompanying drawing, wherein:

FIG. **1** is a vertical sectional view, with parts omitted, of a grain drying machine of the hot air type, with a grain cleaning device embodying the present invention mounted operatively thereon,

FIG. **2** is an enlarged, fragmentary sectional view taken on line II—II of FIG. **1**, and

FIG. **3** is a fragmentary sectional view taken on line III—III of FIG. **2**.

Like reference numerals apply to similar parts throughout the several views, and the numeral **2** applies generally to a grain drying machine including a vertical open-topped cylindrical bin **4** having a conical hopper bottom **6** terminating in a cylindrical well **8** of reduced diameter and supported by a base structure **10**, a cylindrical inner chamber **12** supported coaxially in the bin by any suitable means, not shown, and having a conical top **14** and an open bottom, bin **4** and its conical bottom **6**, as well as inner chamber **12** and its conical top **14** being perforated over substantially their entire areas, an auger tube **16** supported vertically and axially in the bin by any suitable means, not shown, and extending from well **8** upwardly through the top wall **14** of the inner chamber to a point above bin **4**, an auger **18** disposed operably in tube **16**, a horizontal blast tube **20** extending inwardly through bin **4** to interconnect with inner chamber **12** and being open at its outer end, a burner **22** disposed within said blast tube and supplied with fuel from any suitable source by a fuel pipe **24**, a blower fan **26** mounted operably in the outer end of the blast tube, and an engine **28** or other prime mover mounted on base **10**, said engine being operable by belt **30** to drive fan **26**, and by belt **32** to rotate auger **18**.



Thus, grain **34** poured into the top of bin **4** moves downwardly through the annular plenum chamber **36** between the bin and inner chamber to well **8**, where it is picked up by auger **18** and elevated through auger tube **16** to the upper end thereof. Said auger tube is provided at its upper end with a valve cap **38** which is operable, by rotation thereof on the auger tube, to deliver grain selectively either through side opening **40** thereof, whereby it returns to the bin for recirculation, or to a trough **42**, whereby it is conveyed to a truck or the like, after it has circulated enough to be dried to the desired degree. As the grain passes downwardly through the bin, air delivered by fan **26** and heated by burner **22** enters inner chamber **12** through blast tube **20** at an elevated pressure, and is forced by its pressure to travel outwardly through the perforations of the inner chamber, through the grain, and through the perforations of the bin, whereby moisture is removed from the grain. The time the grain must be circulated before it can be diverted to trough **42** of course depends on such factors as its original degree of wetness, the degree to which it must be dried, and the temperature and volume of the air delivered by fan **26**.

The above description of the structure and operation of grain drying machine **2** is believed ample for the purpose of supporting the operation of the grain cleaning device forming the subject matter of the present invention, its only importance, as relates to the grain cleaning device, being that it provides a circular whirling motion of the grain, and an elevated air pressure, within auger tube **16**. However, further details of structure and operation of the grain drying machine may be had by reference to U.S. Pat. No. 2,925,666, issued Feb. 23, 1960.

The grain cleaning device forming the subject matter of the present invention is indicated generally by the numeral **44**, and is mounted on auger tube **16** above bin **4**, but below valve cap **38** of said auger tube. Said device includes a housing **46** formed of sheet metal and being generally rectilinear in form, except that its inner side is cylindrically curved to fit over the exterior of the auger tube, so as to cover an opening **48** formed therefor in the wall of said auger tube. Said housing is welded or otherwise rigidly affixed to a pair of vertically spaced apart clamp rings **50** adapted to encircle the auger tube respectively above and below opening **48** to secure the housing in place. As best shown in FIG. **2**, each clamp ring is divided into two semicircular sections **50A** and **50B**, detachably joined together by bolts **52**, to provide for application and tightening of said rings. As shown, housing **46** is affixed to ring sections **50B**.

As shown in FIG. 3, housing 46 is open at its inner side in an area coinciding with auger tube opening 48, having no inner wall itself except for a top lip 54 affixed to top ring 50 and extending therebelow to coincide with the top edge of opening 48, and a bottom lip 56 affixed to lower ring 50 and extending thereabove to coincide with the lower edge of opening 48. As best shown in FIG. 2, each side wall of housing 46 is provided with an out-turned lip 58, said lips being concentric with the auger tube. However, the housing is affixed to the outer surfaces of clamp rings 50, so that all of its lips 54, 56 and 58 are spaced outwardly from the auger tube by a distance equal to the radial thickness of the clamp rings.

Inserted between the auger tube and housing 46 is a screen member 60. Said screen member may consist of sheet metal perforated once substantially its full area, or other foraminous sheet material, and is cylindrically curved to the contour of the exterior surface of the auger tube. It is inserted between housing 46 and the auger tube from one side of said housing, entering slidably between the auger tube and one of housing lips 58, with its upper and lower edges slidably engaging the confronting edges of clamp rings 50. It is inserted until it completely covers opening 48 of the auger tube, and overlaps said tube adjacent said opening. The side edge portions of the screen member are then confined between side lips 58 of the housing and the auger tube, and its upper and lower edge portions are confined between the auger tube and lips 54 and 56 respectively of the housing. When the screen is positioned as just described, a portion thereof extends to the right of the right lip 58 of housing 46, as viewed in FIG. 2, and this portion is bent radially outwardly to form a lip 62 which limits the insertion of the screen, and which may be detachably affixed, as by bolt 64, to a bracket 66 affixed to the housing. The housing is provided with a hopper bottom 68, to the lower end of which is attached to pipe 70. Said pipe is inclined downwardly to project through a wall of bin 4, then downwardly to a point above ground level 72, and is open at its lower end, all as shown in FIG. 1.

In operation, it will be seen that as grain is elevated through auger tube 16 by auger 18, as said auger is rotated, the auger will impart to the grain a whirling motion within the tube, since the grain does not move as a solid mass, but always tends to slip or slide downwardly along the auger flight in some degree. As the grain passes opening 48 of the auger tube during its rise, centrifugal force generated by this whirling movement tends to move any particles sufficiently small through screen 60 into housing 46. The screen perforations, in every case, should be small enough not to pass whole kernels of grain, but large enough to pass broken kernels, hull fragments, grain dust, dirt and the like. Thus the desired perforation size depends in the main on the whole kernel size of the grain being cleaned. Different grains of course have different kernel sizes, and for grains having any given kernel size, a screen having perforations of the appropriate size may be inserted. The structure shown and described permits easy and convenient interchanging of screens. Simultaneously, the elevated air pressure within the auger tube provided by the operation of blower fan 26 causes an outward current of air through opening 48. This air current assists in carrying the "fines" outwardly through the screen, housing 46 of course being at atmospheric pressure by reason of open pipe 70. The combination of centrifugal force and air current has been found to provide an efficient cleaning action. As a matter of fact, either the centrifugal force or the air current, acting alone, provides a definite cleaning action capable of removing at least a portion of the fines, but the combination is still more effective.

After the fines pass through screen 60 and enter housing 46, they pass downwardly through pipe 70, both by gravity and by the force of the air current, to the lower end of said pipe, where they may be bagged, for use as animal feed or otherwise, or otherwise disposed of.

While a specific embodiment of the invention has been shown and described, it will be readily apparent that many minor changes of structure and operation could be made without departing from the spirit of the invention.

What is claimed as new and desired to be protected by Letters Patent is:

1. A device for cleaning kernel fragments, hulls and other small debris, denoted "fines", from grain, comprising:
   a. a tube having an aperture formed in the wall thereof,
   b. a perforated screen covering said opening,
   c. means operable to move grain to be cleaned through said tube, and
   d. means operable to provide an atmosphere of positively elevated air pressure within said tube, whereby as said grain passes through said tube, the resulting outward current of air through said screen will carry said fines with it, the perforations of said screen being too small to pass whole kernels of grain.

2. A device as recited in claim 1 with the addition of means operable to impart to the grain moving through said tube a whirling motion about the axis of said tube, whereby as said grain moves past said aperture, said fines are additionally driven outwardly through said screen by centrifugal force.

3. A device as recited in claim 2 wherein said tube is vertical, and wherein said means for moving grain through said tube comprises an auger mounted coaxially within said tube for rotation therein, and means operable to rotate said auger to elevate grain in said tube past the aperture thereof.

4. A device as recited in claim 1 wherein said means for providing an elevated air pressure within said tube comprises a blower fan operable to deliver air to said tube at the end thereof at which grain enters, and means operable to drive said blower fan.

5. A device as recited in claim 1 with the addition of:
   a. a housing disposed externally of said tube and having an open side covering the opening of said tube, whereby to receive said fines, said screen being disposed between said housing and said tube,
   b. means affixing said housing to said tube, and
   c. means operable to convey said fines from said housing to a point of disposal.

6. A device as recited in claim 5 wherein said screen member is detachably mounted between said tube and said housing, whereby to be interchangeable with other screens having perforations of other sizes.

7. A device as recited in claim 6 wherein said means affixing said housing to said tube disposes said housing

spaced apart from said tube by a distance generally equal to the thickness of said screen, said screen being slidably insertable between the tube and housing.

**8.** A device as recited in claim **7** wherein said tube is cylindrical, and wherein said screen is cylindrically curved for ready insertion between said tube and housing.

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