Aug. 13, 1940. H. MJOLSNESS 2,211,575

GRAIN SEPARATOR AND ASPIRATOR

Filed July 17, 1936 5 Sheets-Sheet 1

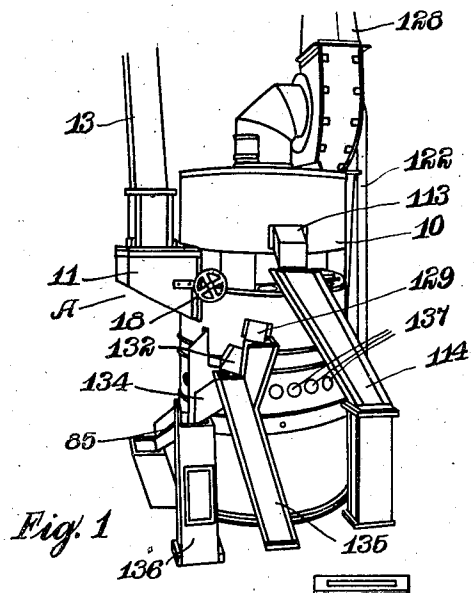


Fig. 1

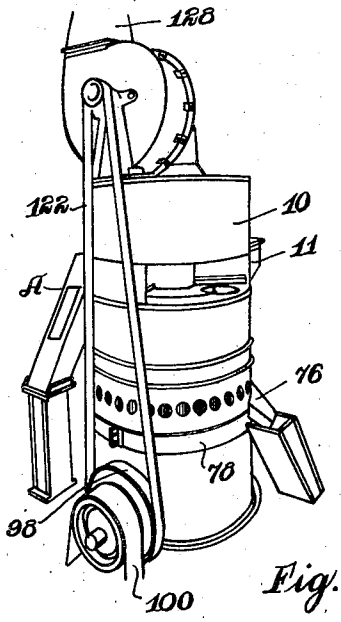


Fig. 2

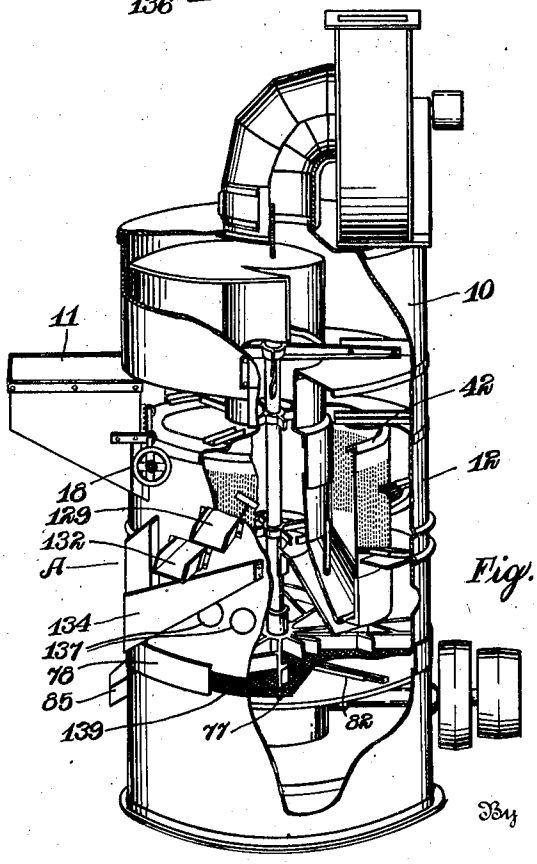


Fig. 3

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Aug. 13, 1940. H. MJOLSNESS 2,211,575

GRAIN SEPARATOR AND ASPIRATOR

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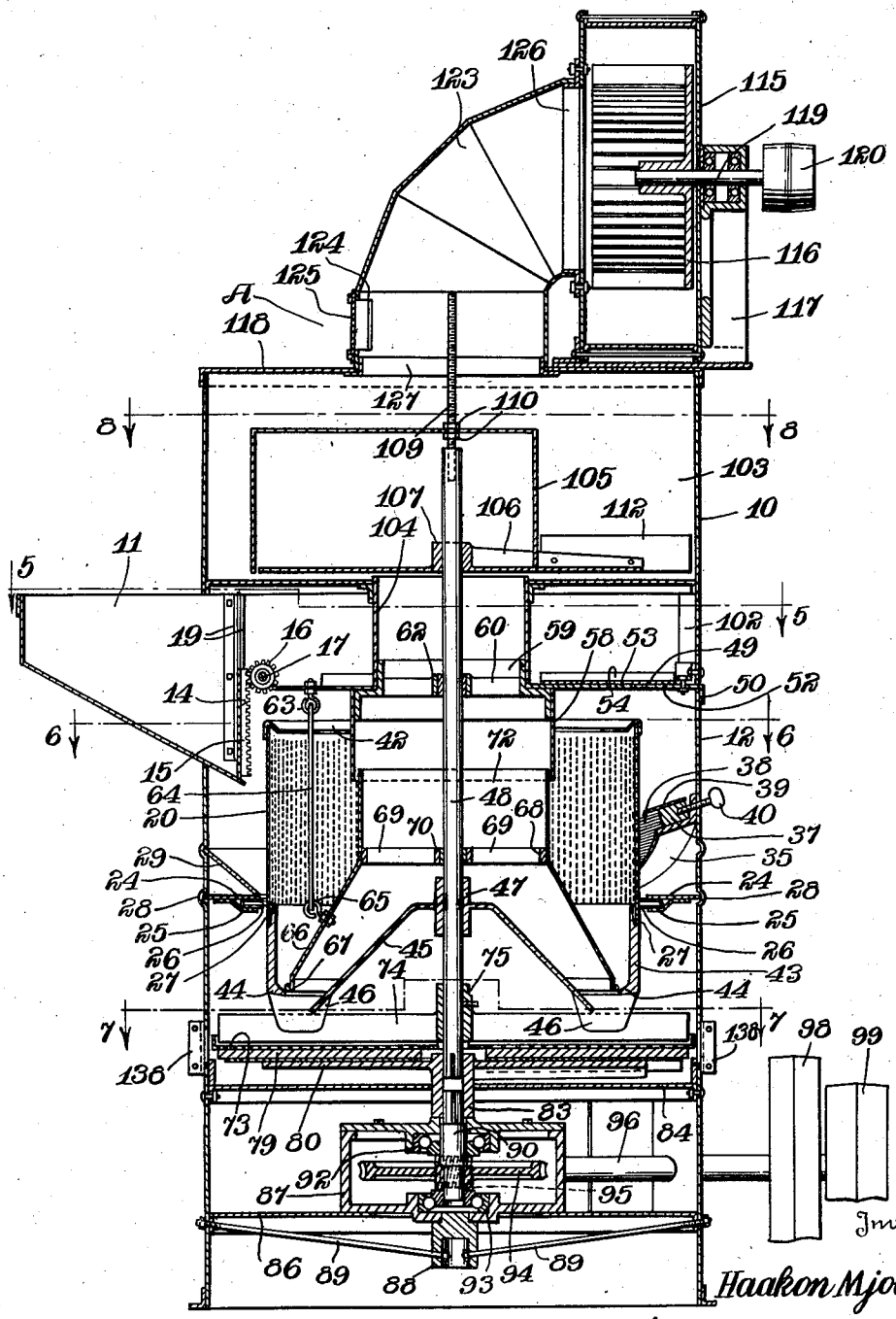


Fig. 4

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GRAIN SEPARATOR AND ASPIRATOR

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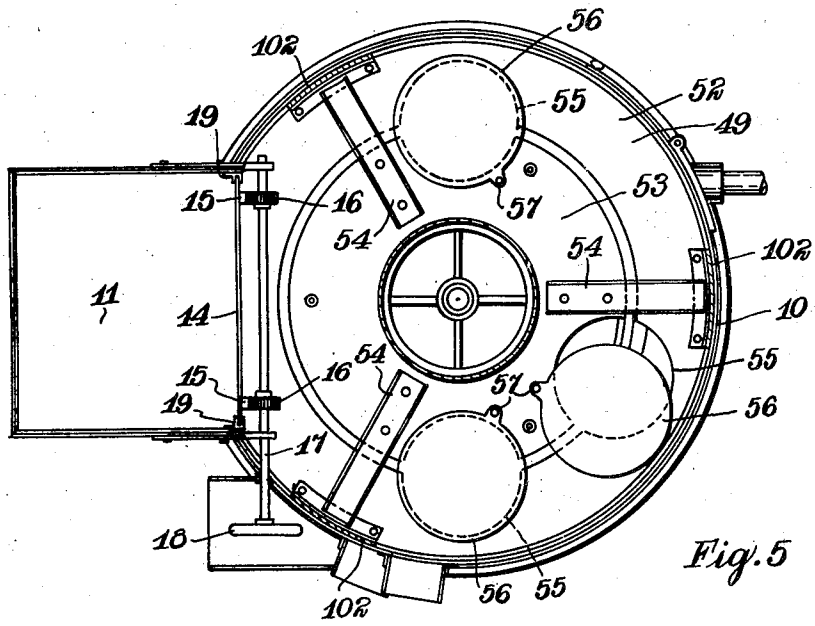


Fig. 5

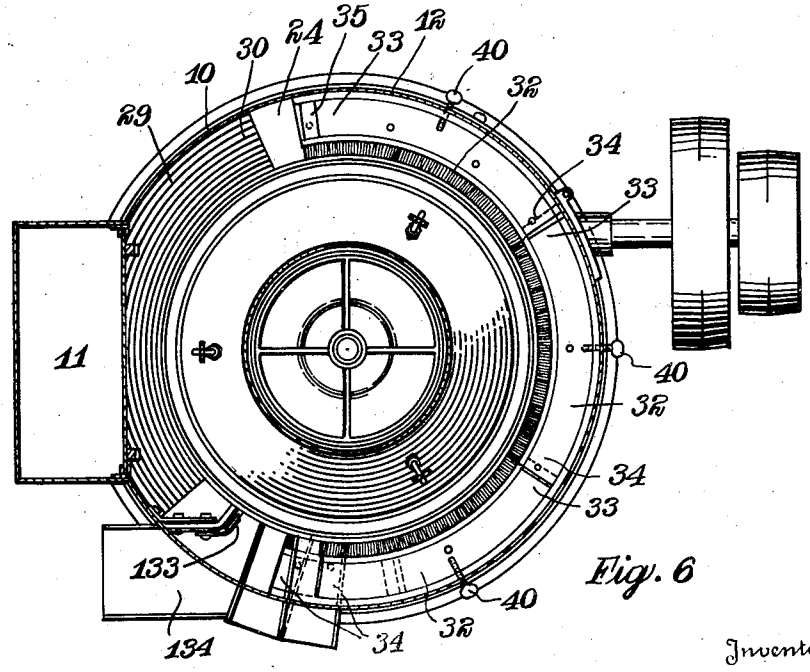


Fig. 6

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Aug. 13, 1940. H. MJOLSNESS 2,211,575

GRAIN SEPARATOR AND ASPIRATOR

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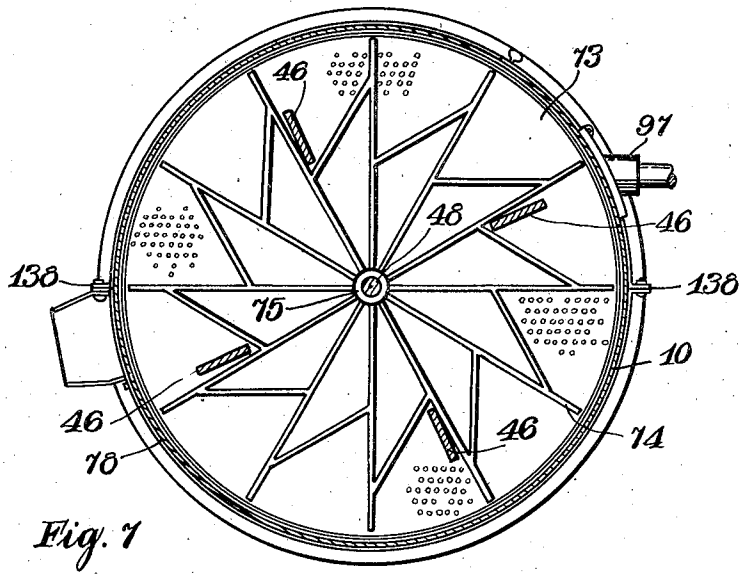


Fig. 7

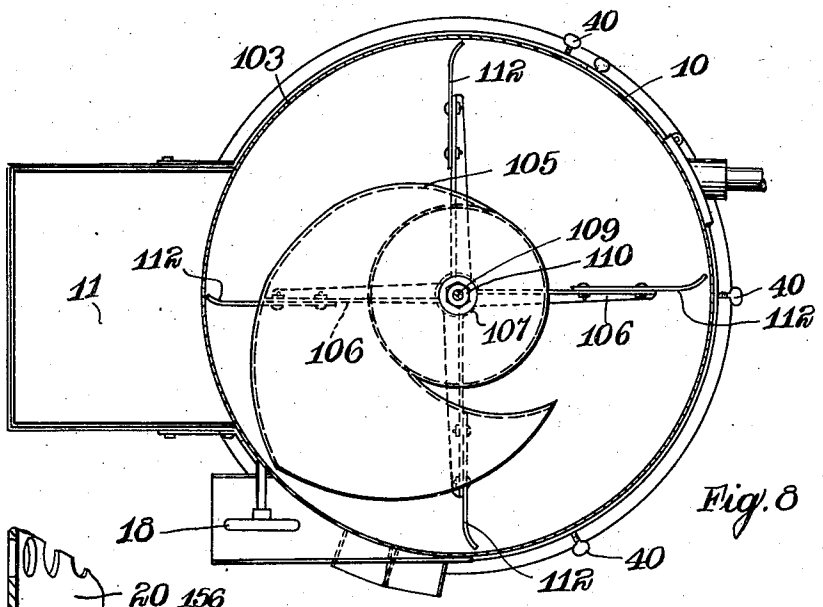


Fig. 8

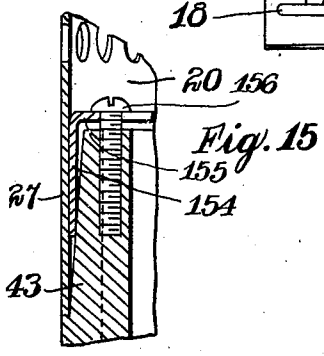


Fig. 15

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GRAIN SEPARATOR AND ASPIRATOR

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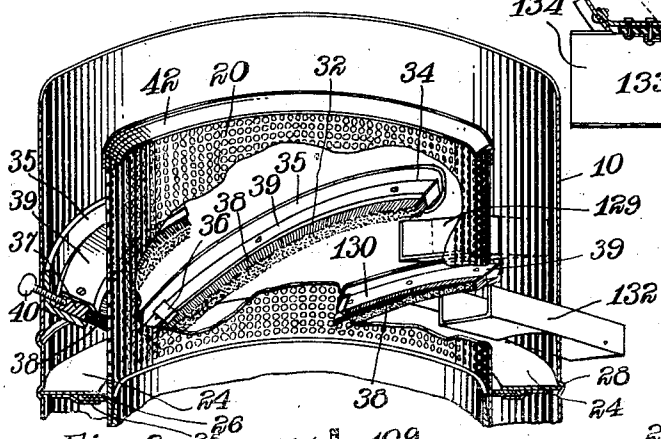


Fig. 9

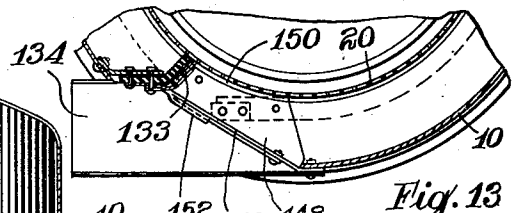


Fig. 13

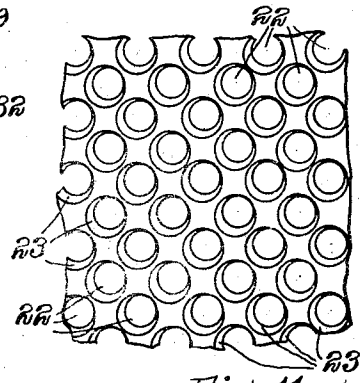


Fig. 11

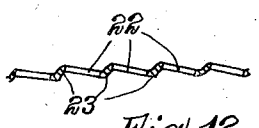


Fig. 12

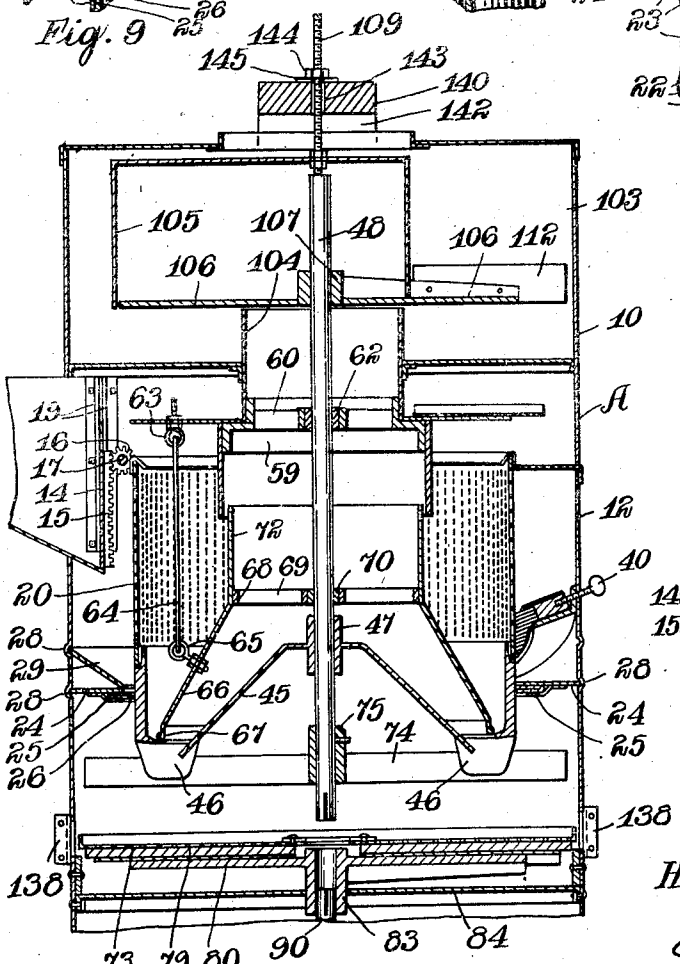


Fig. 10

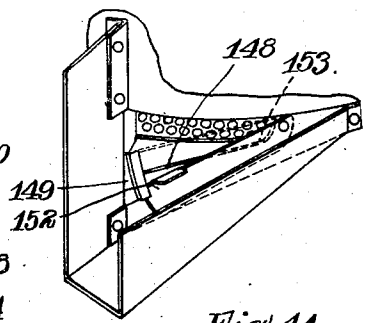


Fig. 14

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Patented Aug. 13, 1940 2,211,575

UNITED STATES PATENT OFFICE

2,211,575

GRAIN SEPARATOR AND ASPIRATOR

Haakon Mjolsness, Minneapolis, Minn., assignor to Haaky Manufacturing Company, St. Paul, Minn., a corporation of Minnesota

Application July 17, 1936, Serial No. 91,146

17 Claims. (Cl. 209—21)

My invention relates to a grain separator and more particularly to a rotary vertical separator designed to remove foreign material from grains, such as wheat or the like.

It is the purpose of my invention to provide a separator which will take the place of standard milling separators. It is designed to separate oats, straw-joints, sticks, stones, corn and other foreign material from grains such as wheat. When the wheat leaves the separator virtually all of the foreign materials have been removed.

It is a purpose of my invention to combine a rotary screening system with a scalping device and an aspirating system whereby the large and small foreign particles may be removed from the wheat. The grain may accordingly be received as it comes from the field or from the railway cars and may remove virtually all of the foreign material as a first step before the cleaning of the grain.

It is a feature of my invention to provide a separator which is inexpensive to operate and which requires little power to drive. The rotary principle involved permits the screening action to take place with a minimum of required power. Accordingly, the separator not only is inexpensive to manufacture, but also costs a fraction of the usual amount to operate.

It is also a feature of my invention to provide a separator which requires little space in a mill. Milling separators which have been previously used have usually been large and bulky and therefore required a large amount of valuable floor space. The vertical rotary operation of the present separator permits a small diameter separator to be used which saves a greater portion of the floor space usually required.

It is a further purpose of my invention to provide a separator in which few parts are subject to wear. It is also my purpose to so mount the wearing parts that they may be readily removed in a minimum of time for repair or replacement when necessary.

An object of my invention is to combine a rotary vertical cylindrical screen with a horizontally extending screen so that the seeds and grains passing through the cylindrical screen may again be screened upon the horizontal screen. This permits a double screening action with a minimum of operating parts.

It is further an object of my invention to provide a separating means positioned substantially centrally in a vertical casing and to provide an aspirating means which draws the lighter materials through the center thereof into a centrifugal settling chamber where the largest of the lighter materials are separated from the fine particles of dust. The lower portion of the chamber provides the means for separating the desired grain from smaller materials, such as seeds.

While I am describing my separator as particularly adapted for use in cleaning wheat, it should be understood that other grains may also be separated from undesirable impurities by my machine and in a similar manner. For the sake of convenience, the operation of the machine will be described as separating foreign materials from wheat.

My grain separator and aspirator is constructed to operate with a rotary vertical screen having a cylindrical shape against which the grain is introduced as it enters the separator and which is provided with guarded openings, the guard being formed integral with the screen adjacent the opening so as to act as an impelling means to draw the grain around the screen or to rake it as the vertical screen rotates. The guided portion adjacent the openings of this screen are positioned in a particular manner so as to act as projecting portions on the surface of the screen to draw the oats and longer grains, together with sticks, straw-joints and other elements that may have become mingled with the grain to be drawn around as the vertical screen rotates. In the rotation of the vertical screen the grain is carried around the same and by means of a series of wire brushes which are diagonally disposed and which overlap with each other, the foreign matter together with other larger grains like corn, oats, barley, longer grains, and sticks, straw, stones, and straw joints, will follow along up over the brushes and will be disposed out of separate openings, so as to make the proper separation during the operation of the vertical screen. The separator is designed to rotate the vertical screen at a comparatively slow speed such as from thirty to thirty-five revolutions, or approximately that speed, so that the separator may operate continuously as is necessary in a flour mill or other mill where separation is desired to be carried on through the continuous flow of grain through the machine.

It is a feature to provide a rotary vertical separator wherein in the first separation the grain desired to be cleaned is passed around the vertical separator or is drawn around the same by the rotary movement of the separator, and the grain with the small seeds will roll through this screen and fall through a current of air to thoroughly aspirate the grain from dust, dirt or light

chaff which may pass through the screen with the seeds and the grains, thus thoroughly aspirating the grain as it falls to the lower horizontal seed screen. As the grain is carried through the separator, it is scoured and polished to a certain extent so that when it is discharged from the separator it is thoroughly cleaned and separated from foreign matter.

As the grain falls aspirated upon the lower horizontal seed screen, it is carried around by paddle members on the horizontal seed screen, further scouring and polishing the same and finally discharging the clean grain out of the machine. The rotary action of my vertical separator provides a machine of a character which, even though it is small in size, may handle a large amount of grain in a given time at a reasonable cost owing to the small amount of power necessary to operate my vertical rotary separator. The wearing parts, primarily such as the vertical screen and the horizontal floating seed screen, are hardened so as to give a long wearing screen for my vertical rotary separator which even though operated continuously, may require little or no attention after it has been adjusted to run in a manner to take care of the stream of grain which it is desired to pass through the same. The rotary vertical separator is built so that the screens may be readily replaced when desired.

It is also a feature to provide a separator wherein means is provided for supporting a driving transmission or unit within the base of the machine, adjustably held by a series of brace members which hold the transmission firmly within the base and adjusted into position to operate the vertical axially extending shaft means which rotates the vertical separating screen and supports the conical spreader over which the grain rolls as it passes through the first screen in the separator, which is the vertical rotary screen extending above and about the conical spreader. Further, the separator is provided with adjustable means for holding the conical spreader floating so as to be self-adjusting in accordance with the flow of the grain over the same. The grain falls through the rotary vertical screen onto the floating cone, which spreads the same, causing it to drop in a cylinder-like sheet down to the seed screen.

The separator includes a floating seed screen which rides upon a series of non-metallic paddles which keep the screens clean and permit a certain amount of vibration to the screen, shaking it just a sufficient amount to cause the screen to be kept thoroughly clean. These paddles upon which the floating screen rests are removable providing a very practical means of supporting the screen and keeping it clean.

An important feature of my separator resides in the wire brushes which contact the surface adjustably and are positioned diagonally or spirally with the wire bristles, and the brush shaped to provide an arcuated bristle engaging surface or means against the arcuated or cylindrical surface of the vertical separator. These brushes act to retard the foreign material and cause the same to ride up over the brushes or of the incline of the brushes, that is the top surface of the same, and as this material such as the sticks, stones, corn, and other foreign material rides up over the first brush, it falls down to the second brush and is carried up over the second brush, and so on to the third brush and on till the material is passed over the series of brushes, and thus the grain is thoroughly cleaned of any foreign material and is permitted to pass through the vertical rotating screen. As the ends of the bristles wear down bearing slightly against the perforated surface of the rotating vertical screen, the brushes may be readily adjusted into proper position to slightly contact the surface of the perforated screen.

The settling chamber at the top of the separator just below the aspirating fan is important as it permits the heavier materials to settle into the settling chamber. By means of a rotary deflector, the foreign material, chaff, and light particles of grain, which may have been drawn into this chamber, are separated from the air stream. This material is rotated to a discharge opening by rotary paddles. This discharge opening is provided with an automatic door which is closed normally by the suction of the air from the aspirating fan, and which opens periodically when sufficient amount of chaff and foreign material is directed against the door from the settling chamber at the top.

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

In the drawings forming a part of my specification:

Figure 1 is a perspective view of one side of my separator in operation.

Figure 2 is a perspective view of the other side of my separator in operation.

Figure 3 is a perspective view of my separator having portions thereof cut away to disclose the construction thereof.

Figure 4 is a vertical section centrally through my separator.

Figure 5 is a cross sectional view on the line 5—5 of Figure 4.

Figure 6 is a cross sectional view on the line 6—6 of Figure 4.

Figure 7 is a cross sectional view on the line 7—7 of Figure 4.

Figure 8 is a cross section on the line 8—8 of Figure 4.

Figure 9 is a diagrammatic perspective view illustrating the manner in which the inclined brushes are mounted with respect to the screen.

Figure 10 is a vertical sectional view, illustrating the elements in raised position for removal of the seed screen.

Figure 11 is an enlarged detail view of a portion of the rotary screen.

Figure 12 is a cross section of a small portion of the screen shown in Figure 11.

Figure 13 is a detail section showing a recleaning arrangement.

Figure 14 is a perspective view of my recleaning attachment.

Figure 15 is a section showing the screen securing means.

The separator A is provided with a cylindrical casing 10 formed of several parts. A hopper 11 is mounted upon the casing 10 and provides an entrance into the wheat separating chamber 12 forming a portion of the casing 10. The hopper 11 is adapted to receive grain from a suitable inlet chute 13 illustrated in Figure 1, and is provided with a gate 14 having a pair of spaced racks 15 thereon engaged with a pair of pinions 16 on a shaft 17 upon which is mounted a control wheel 18. The gate 14 is vertically slidable in tracks 19 in such a manner that by rotation of the operating wheel 18, the shaft 17 is rotated, turning the pinion 16 engaged with the racks 15 and

raising the gate 14 in the tracks 19. The flow of grain into the wheat separating chamber 12 may in this way be regulated.

Within the wheat separating chamber 12, I provide a cylindrical screen 20 which will permit wheat, seeds, and smaller or rounder grains to fall therethrough, but which will not permit the longer grains such as oats or foreign material such as sticks, stones and corn, to pass therethrough. The type of screen used may be seen in Figures 11 and 12 of the drawings. The openings 22 in the screen are formed in one side of arcuated indentations, providing a lip 23 partially surrounding each hole 22. This lip 23 is on the lower edge of the openings 22 and on one side edge of each opening. The holes accordingly provide pockets for scooping in the wheat and smaller or rounder grains, but act to carry larger grains such as oats, along on the outer periphery of the screen without passing through the screen. The openings or perforations in the screen 20 are such that the rounder grains, such as wheat will roll readily therethrough, but longer grains, such as oats, while sufficiently small in width to pass through the openings, will be carried along the outside of the cylinder.

Extending inwardly from the casing 10 forming the wheat separating chamber 12, I provide a ring-like shelf 24 having a bifurcated inner edge 25 to receive a sealing wick 26. This wick extends into engagement with the lower unperforated portion 27 of the cylindrical screen 20 and prevents grain from passing between the shelf 24 and the screen 20. In order to hold the shelf 24 in place, an outwardly bulged ring 28 is provided in the casing 10.

Beneath the hopper 11 I provide an inclined arcuated shelf 29 extending for a small portion of the periphery of the chamber 12 as may be seen in Figure 6 of the drawings. Adjacent the end 30 of the shelf 29 I provide the first of a series of inclined steel brushes 32. Each of the brushes 32 is mounted with one end 33 thereof closely adjacent the shelf 24 and with the other end 34 thereof near the top of the wheat screen 20. The manner in which the brushes 32 are mounted may perhaps be best seen in Figure 9 of the drawings.

Each brush 32 is slidably mounted upon an angular arcuated supporting bracket 35 which is curved to conform with the shape of the casing 10 and which is curved to provide the incline for the brushes which is desired. The brush is supported slidably in position adjacent its lower end 33 by a finger 36 extending over the top of the brush to slidably support the same. Each brush is formed with an arcuated base 37 of wood or the like, in which are set steel bristles 38 or some other stiff long-wearing bristle, capable of accomplishing the present purpose. An arcuated plate 39 attached to the upper edge of each brush 32 provides a sliding surface for the larger materials which are carried over the brushes 32 and provide a support for the bristles 38. Each brush 32 is adjustably mounted by means of a thumb screw 40 as may be seen in Figure 4, for example, and by tightening or loosening the nut 40 which is threadably engaged in the bracket 35 and loosely mounted in the backing 37 of the brush, the brush may be urged with greater or less tension against the screen 20.

The cylindrical screen 20 is reinforced by an angle band member 42 at the top thereof and along its lower edge it fits tightly about the cylindrical frame 43. The frame 43 has an inwardly extending flange 44 at its lower extremity and is connected at peripherally spaced points to a cone 45 by connecting fins 46. The cone 45 is provided with a hub 47 mounted for rotation upon a central vertical shaft 48. Thus when the shaft 48 is rotated by a means which will be hereinafter described, the cone 45 is rotated carrying the cylindrical member 43 upon which is mounted the screen 20, acting to rotate the screen.

The compartment 12 is provided with a cover 49 having a circumferential flange 50 engaging about the outside of the shell 10 of which the compartment 12 is a part. The cover 49 comprises, as may be seen in Figure 5 of the drawings, an outer ring 52 and an inner ring 53 which are not definitely secured together. To hold the parts 52 and 53 of the cover 49 in proper relationship, a series of channels 54 are mounted radially upon the inner ring 53 of the cover and project over the portion 52 of the cover to prevent the portion 53 from dropping below the portion 52. In this way, the portion 53 is supported by the portion 52. Openings 55 are provided in the cover 49, approximately one-half of each opening being in the outer ring 52, and the other half being formed in the inner ring 53. These openings 55 provide access to the brushes 32 so that these brushes may be removed when desired without removing the cover 49. Cover plates 56 hinged at 57 to the inner ring 53 normally close the openings 55.

Depending from the cover 49 I provide a tube or hollow cylindrical shell 58. The shell 58 is connected to the cover 49 by means of a cylindrical bracket 59 having spider arms 60 therein to accommodate a central bearing 62 for the shaft 48. Also depending from the cover 49 are a series of angularly spaced eye-bolts 63 which are adjustably secured to the inner portion 53 of the cover 49. Arms 64 hang downwardly from the eye-bolts 63 and are secured in eye-bolts 65 secured in a cone 66. The cone 66 is provided with an outer rim 67 which extends into close proximity with the inturned flange 44 of the cylindrical member 43. The cone 66 is supported by a rim 68 having spokes 69 connected with a hub 70 encircling the shaft 48. Connected to the cone 66, I provide a cylindrical shell 72 which extends upwardly from the cone 66 and fits within the shell 58 providing a slip joint which is adjustable vertically and which is substantially tight. The cone 66 directs the grains passing through the cylindrical screen 20 through a narrow cylindrical aperture between the rim 67 thereof and the flange 44 of the cylindrical member 43, thus spreading the grain in a cylindrical sheet as it drops below these members spaced below the cones 45 and 66.

I provide a seed screen 73 horizontally disposed upon which grain dropping between the flange 44 and the rim 67 will fall. The seed screen 73 is spaced substantially below the flange 44 to provide a space between the flange 44 and the seed screen to provide aspiration in a manner which will be later more fully described. A spider 74 mounted on a hub 75 on the vertical shaft 48 agitates grain upon the seed screen to ascertain that all of the grain on the seed screen has an opportunity to pass therethrough to provide a thorough separation of grain such as wheat from smaller materials such as seeds and cracked kernels of wheat. The spider 74 is spaced slightly above the surface of the seed

screen so as not to crack or grind the grains and urges the wheat remaining on the top of the screen to a wheat outlet 76 which may be seen in Figure 2 of the drawings. The screen 73 is provided with a pin 77 illustrated in Figure 3, which extends through a band 78 forming a part of the casing 10 to prevent rotation of the screen 73 with respect to the casing.

The seed screen 73 is supported upon fibre bearing blocks 79 slidably mounted upon arms 80 of a spider. The fibre arms 79 are longitudinally slidable in channels 82 on the arms 80 and may be removed and replaced when necessary. The spider arms 80 are supported upon a hub 83 keyed to the lower extremity of the vertical shaft 48. Within the casing 10 just below the spider 83 I provide a bottom partition 84 upon which the seeds and small grains may fall. The spider arms 80 urge these seeds and small cracked grains toward an outlet 85 mounted integral with the band 78.

A base 86 is secured to the casing 10 at a point spaced below the bottom member 84 and upon this base I mount a transmission casing 87. A cap 88 extends below the transmission and a series of angularly spaced supporting rods 89 connect the end of this cap 88 to spaced points in the periphery of the base 86 to reinforce the base. Within the casing 87 I provide a vertically extending shaft 90 mounted in ball bearings 92 and 93 upon which is supported a gear 94. The gear 94 meshes with a worm 95 upon a transversely extending shaft 96 extending through a bearing 97 which may be seen in Figure 7, for example, and upon which are mounted pulleys 98 and 99. A belt 100, illustrated in Figure 2, from a suitable source of supply of power engages the pulley 99 to rotate the shaft 96 acting through the worm 95 and gear 94 to rotate the vertical shaft 90. This shaft 90 extends above the casing 87 and is keyed to fit into the spider hub 83. This hub 83 thus acts as a connector between the shaft 90 and the shaft 48 so that the shaft 48 may be raised in a manner which will be later described.

Upon the top 49 of the compartment 12 I provide a series of circumferentially spaced vertical supports 102 upon which is mounted the settling chamber or compartment 103. As may be seen in Figure 5, the channels 54 extend into contact with these supports 102 so that the inner portion 53 of the top 49 is held concentric with respect to the casing 10.

A vertical cylindrical shell 104 extends upwardly from the circular bracket 59 into the settling chamber 103. Within the settling chamber 103 and in communication with the vertical shell 104, I provide a rotating deflector 105 which may be seen in Figures 3, 4 and 8 of the drawings. The deflector 105 is supported upon a spider 106 having a hub 107 on the shaft 48. The deflector 105 is further supported by a stud 109 extending into the upper extremity of the shaft 48 and threaded. Nuts 110 on the stud 109 lock the deflector 105 in adjusted position. Paddles 112 on the spider arms 106 act to push any settlings toward an outlet 113 shown in Figure 1, where such settlings may be dropped into a suitable chute 114.

A blower 115 having a rotatable blade member 116 and mounted upon a bracket 117 is situated upon the top 118 of the settling compartment 103. The shaft 119 of the rotatable blade member 116 is provided with a pulley 120 which is driven by a belt 122 from the pulley 98 as seen in Figures 1 and 2. An elbow 123 having an opening 124 with a slidable closure 125 thereon connects the opening 126 of the fan 115 with an opening 127 in the top of the settling chamber 103. The fan 115 provides a suction in the elbow 123 which aspirates the grain and which forces fine particles of dust not settled out in the settling chamber 103 through a duct 128.

In operation a grain containing various impurities is admitted from a chute 13 into the inlet hopper 11. The grain passes the gate 16 and drops upon the shelf 24, being directed by the inclined baffle 29 against the surface of the screen 20. In the separation of wheat, the wheat, small grains, and seeds, fall through the screen 20, whereas all larger particles are carried by the rotation of the screen toward the brushes 32. The longer grains, such as oats, are carried past the brushes 32 by the pocket perforations 22 in the screen 20, but do not pass through the screen. The larger impurities, such as corn, sticks, rocks and the like, cannot pass the brushes 32 and accordingly are urged along the upper surface of these inclined brushes. These impurities drop from one brush to the next and are gradually carried to the uppermost outlet 129 illustrated in Figures 1 and 3, and in Figure 6. Some of the smaller impurities such as corn, gradually drop past the brushes 32 and fall upon a shorter brush 130 and are directed to an outlet 132 closely adjacent the outlet 129. The larger grains, such as oats, which are carried past the brushes by the screen 20, are prevented by a sealing wick 133 illustrated in Figure 6, from continuing subsequent revolutions with the screen and are ejected through the spout 134. The impurities passing from the machine through the spouts 129 and 132 are directed to a chute 135, while the oats ejected through the spout 134 are directed to a chute 136.

As has been described, the wheat, seeds, and other small foreign material including chaff, dust, small straw-joints, and the like, pass through the screen 20 and are directed by the cone 66 against the flange 44. The grain is spread by the rim 67 of the cone 66 and the flange 44 into a thin cylindrical sheet falling toward the seed screen 73. Openings 137 in the casing 10 admit air which is drawn through the cylindrical sheet of grain up between the cones 66 and 45. The air thus comes into intimate contact with every particle of material dropped from the flange 44 and all of the light material is drawn by the suction of the fan 115 between the cones 45 and 66 through the cylindrical shells 72 and 58, and through the shell 104 into the centrifugal deflector 105. The rotation of this deflector acts to change the direction of air carrying the lighter materials and this change of direction allows the major portion of these lighter materials to settle within the settling chamber 103 from which they are expelled by paddles 112 through the discharge opening 113 into the chute 114. The dust and fine particles remaining in the air is forced by the fan 115 through the air duct 128. The thickness of the sheet of grain falling between the flange 44 and the rim 67 may be regulated by adjustment of the eye-bolts 63 which receives or lowers the cone 66 to vary the relationship between this member and the flange 44.

As has been described, the brushes 32 may be adjusted by means of the thumb screws 40 and may be removed through the openings 55 when the thumb screws 40 are withdrawn from contact with the backing 37 of the brush. By removal of the band 78 which attaches to the casing at opposite sides along flanges 138 an opening

is provided designated at 139 in Figure 3 of the drawings, through which the seed screen 73 and the fibre bearing arms 79 may be removed or replaced.

Figure 10 of the drawings discloses the manner in which the seed screen 73 may be replaced. A bridge 140 formed of a strip of wood having a block 142 at either end thereof is provided with a central opening 143 through which the stud 109 on top of the shaft 48 is extended. As may be seen, the elbow 123 is removed from its connection between the fan 115 and the settling chamber 103 for this purpose. A nut 144 and washer 145 are placed upon the stud 109 above the bridge member 140 and this nut 144 is tightened. Tightening the nut 144 acts to raise virtually the entire rotating mechanism within the casing 10 and draws the lower end of the shaft 48 out of contact with the hub 83 of the spider 80. When the shaft 48 has been raised sufficiently it may be seen that the seed screen 73 may be readily withdrawn through the opening 139. When the screen 73 has been repaired or replaced the nut 144 may be loosened upon the stud 109, allowing the shaft 48 to drop back into engagement with the hub 83, again providing a connection between the shaft 48 and the shaft 90 of the transmission.

Various other grains may be cleaned in the manner described. By changing the sizes of the various screens, my machine may be adapted for use in cleaning virtually any type of grain desired. As there are very few adjustments which must be made, it is obvious that my machine requires virtually no attention and will operate constantly day and night until it becomes necessary to change screens or the like. When the cylindrical screen 20 is changed, which is at rare intervals, the settling chamber 103 is removed.

The manner in which the horizontal screen 73 is floatingly supported upon the paddles 79 has been described in detail. It has been found that due to the increased distance past which the outer extremities of the paddles 79 must travel, the outer ends of these paddles wear more quickly than the inner portions of the same. The screen is flexible to some extent, and in some cases the outer extremity of a screen 73 has won the replaceable wearing portion 79 down to the metal supporting arms 80 of the spider. When the metal arms 80 contact the screen 73, the screen is worn out comparatively quickly.

To avoid this difficulty, I provide a ring 147, shown in Figures 4 and 10 secured within the casing 10, and extending just slightly above the level of the arms 80. The peripheral edges of the screen 73 will rest upon this ring 147 when the paddles 79 become worn down, preventing the screen from contacting the paddles. This does not affect the floating action of the screen, as the central portion inwardly of the extreme ends of the paddles 79 still support the screen floatingly.

The material which does not pass through the rotary vertical screen 20, and which is not elevated by the brushes 32, may be recleaned if desired by permitting rotation of this material about the screen more than once. The device which permits such action may be seen in Figures 13 and 14 of the drawings. The shelf 24 which supports such material, containing oats, for example, is normally broken away adjacent the spout 134 to permit this material to drop from the shelf 24 into the spout 134. I provide, however, an auxiliary continuation 148 of this shelf which abuts the shelf 24 and is on the same level as the shelf 24. A substantially vertical wall 149 is formed along the outer edge of this shelf 148, while the inner extremity of the shelf is provided with a gasket 150 contacting the lower portion of the vertical screen 20. A gate 152 is pivotally attached to the vertical wall 149, to close a gap 153 therein extending down substantially to the level of the shelf 148.

When the gate is in the lowered position illustrated in full lines in Figure 14 of the drawings, the oats and other material of this nature may drop off the shelf 148 through the gap 153 into the chute or spout 134. When this gate 152 is in raised position illustrated in broken line, the oats remain on the shelf 148 and are carried by movement of the screen past the sealing wick 133, and are again carried around the screen 20. As the vertical wall 149 extends only a short distance above the shelf 148, a large amount of oats will fill the space between the screen 20 and the wall 149 and gate 152, and permit additional oats or the like to drop over the top of this wall and gate.

The cylindrical screen 20 is secured in position by a novel means capable of compensating for slight variations in the diameters of screens used. The upper extremity of the casting 43 supporting the screen 20 is tapered inwardly. A ring 154 is forced into position between the unperforated portion 27 of the screen 20 and the casting 43 until the screen is wedged tightly to the casting 43, screws 156 engaged on inturned flange 155 on the ring 154, holding the ring 154 in place. The screws extend into bosses in the casting 43. By removing the bolts 156, the ring 154 and consequently the screen 20, may be readily removed.

In accordance with the patent statutes I have described the principles of operation of my separator, and while I have endeavored to disclose the best embodiment thereof, I desire to have it understood that this is only illustrative of a means of carrying out my invention and that obvious changes may be made in accordance with the following claims without departing from the spirit of my invention.

I claim:

1. A grain separator including a vertical shaft, means for rotating said shaft, a cylindrical screen on said shaft, means for supporting grain adjacent said screen to separate larger from smaller grain, means for spreading said smaller grains to form substantially a cylindrical sheet, means for aspirating said grains while in said cylindrical sheet, a substantially horizontal screen for receiving the aspirated grains to separate the smaller particles of said smaller grains from the larger particles thereof, and means on said shaft spaced above said horizontal screen for agitating said grain on said screen.

2. A grain separator including a casing, a cylindrical screen in said casing, a horizontal screen in said casing below said cylindrical screen, a vertical shaft upon which said cylindrical screen is mounted, said shaft extending through said horizontal screen, means below said horizontal screen for driving said shaft and terminating below said screen, and means for vertically slidably moving said shaft out of contact with said driving means and through said horizontal screen, to permit removal of said horizontal screen.

3. A grain separator including a vertically extending shaft, drive slidably engaged to one end of said shaft, a screen loosely mounted on said shaft adjacent said drive means, grain agitating

means on said shaft above said screen, and means for slidably supporting the other end of said shaft whereby said shaft may be disengaged from said drive means and slidably moved through said screen to permit removal of said screen.

4. A grain separator including a series of arms arranged in a horizontal plane, a screen horizontally and floatingly supported by said arms, said screen bearing by gravity upon said arms, and means for rotating said arms with respect to said screen.

5. A grain separator including a horizontally extending supporting means, a series of removably mounted arms secured to said supporting means, a horizontal screen floatingly supported on said removable arms and bearing by gravity upon said arms, and means for rotating said arms with respect to said screen.

6. A grain separator and aspirator including a cylindrical body, a base portion, a transmission positioned within the base portion, and adjustably supported, a vertically disposed axial operating shaft adapted to be rotated by said transmission, a rotary screen vertically disposed and supported by said shaft, a series of wire brush means helically disposed and overlapping at the ends to provide flexible retarders against said vertically disposed screen, a centrally disposed aspirating passageway inside of said rotary screen, a floating conical end formed on said passageway over which the grain is adapted to fall from the said vertical screen, an inner conical member carried by said shaft and rotating directly below said floating conical end, a horizontal floating seed screen onto which the grain is adapted to fall when it leaves said conical end of the aspirating passageway, means for rotating the grain on said seed screen to cause the seeds to fall through the same, a non-metallic removable paddle means rotating below and supporting said seed screen to thoroughly clean and vibrate said seed screen sufficiently to shake the seeds through the same.

7. A grain scalper, aspirator and screening means including a cylindrical casing, a centrally disposed operating shaft axially positioned in said casing, a transmission in the base of said separator for operating said shaft, a floating horizontally disposed disc-like seed screen in the bottom of said separator, a cylindrical rotary screen on said shaft in the upper portion of said casing, an aspirating passageway extending axially through said separator, a settling chamber within the top of said casing into which said aspirating passageway extends, and an adjustable air passageway into which the grain is adapted to fall and be aspirated when it goes through the vertical rotary screen and is discharged upon the seed screen in the bottom of said separator.

8. A grain separating device including a vertical rotary shaft, a vertically disposed rotary screen through which the grain is passed on said shaft, an aspirating passageway through which the grain falls as it passes through the vertical screen, a horizontally disposed disc-like seed screen onto which the grain falls, rotary means rotatable with said rotary screen for scouring the grain over the seed screen, non-metallic removable paddle means for supporting said seed screen floatingly, adapted to clean the seed screen and discharge the seeds out of said separating device, means on said shaft for creating relative rotative movement between said horizontal screen and said paddles, and means for rotating said vertical rotary shaft.

9. A grain separating device, including a transmission, an axial shaft adapted to be rotated by said transmission, an aspirating fan at the top of said device, an aspirating passageway extending axially through said device, through which grain is adapted to fall, vertically disposed rotary screen operated by said axial shaft, horizontally disposed disc-like floating seed screen below said aspirating passageway, means spaced above said screen for rotating the grain over said seed screen to scour and separate the same from the seeds and rotating supporting members engaging the lower surface of said seed screen adapted to support said screen and to discharge the seeds out of said device.

10. A grain separating and cleaning device comprising an outer casing, a base portion formed in said casing, a transmission adjustably disposed in said base portion, a seed chamber horizontally disposed above said transmission, a floating seed screen above said seed chamber, rotatable paddle means in said seed chamber for supporting said seed screen, paddle means for agitating grain on said screen axially disposed operating shaft extending from said transmission to support the paddle agitating means, an axially disposed aspirating passageway extending through said device, an adjustable passageway through which the grain is adapted to pass before it falls onto said seed screen, a vertically disposed cylindrical scalping screen positioned above said passageway and about said aspirating passageway and mounted for rotation with said shaft, a settling chamber, a hollow rotatable deflector in said settling chamber through which air may flow for changing the direction of and retarding the air passing through the aspirating passageway, and an air fan connected to said settling chamber.

11. A grain separating system including a casing, an aspirating fan mounted on said casing, an aspirating passageway extending through said casing, a settling chamber below said fan having a hollow rotatable air directing vane therein through which the air may pass, an axial air passage through said casing, a scalping device including a rotatable screen with a series of helically disposed overlapping wire brushes contacting said screen, a passage having an adjusting means through which the grain is adapted to fall from the scalping screen, and a seed separating screen disposed below said passage to receive grain dropping through said last named passage and over which the grain is adapted to be scoured before it is discharged from said device to separate the seeds from the same.

12. A grain separator comprising a vertical shaft, a cylindrical screen mounted for rotation with said shaft, means for supporting grain about said cylinder, said screen permitting some of said grain to fall therethrough, a horizontal screen below said vertical screen onto which said grain passing through said cylindrical screen may fall, and means on said shaft for agitation of said grain on said horizontal screen.

13. A grain separator comprising a vertical shaft, a cylindrical screen on said shaft to rotate therewith, a horizontal screen encircling said shaft beneath said cylindrical screen to receive grain passing through said cylindrical screen, agitators arranged to stir grain on said horizontal screen, and means on said shaft causing relative

rotative movement between said horizontal screen and said agitators.

14. A grain separator comprising a vertical shaft, a cylindrical screen secured to said shaft for rotation therewith, a horizontal screen encircling said shaft below said cylinder, agitator means on said shaft to stirr the grain on said horizontal screen, and aspirator means to aspirate the grain falling through said cylindrical screen onto said horizontal screen.

15. A grain separator comprising a vertical shaft, a cylindrical screen mounted thereon, a horizontal screen below said cylindrical screen to receive grain therefrom, means on said shaft for stirring said grain on said horizontal screen, a vertical passage surrounding said shaft extending through said cylindrical screen, a baffle into which said passage extends, a settling chamber above said baffle, and a rotary deflector in said chamber having an inlet registrable with said passage and rotatable with said shaft.

16. In a grain separator, a settling chamber having an inlet in the bottom thereof, a rotary deflector having an inlet registrable with said inlet, an outlet at the outer periphery of said deflector, and paddle means rotatable with said deflector to urge grain in said settling chamber toward the periphery thereof.

17. A settling device for expelling grain impurities from air, comprising a settling chamber, a central air inlet thereto and a rotary deflector member in registry with said inlet, said deflector member comprising a vertical arcuate wall concentric with said inlet, and vertical spiral walls extending from each end of said arcuate wall, said spiral walls extending outwardly in the same direction, at least one of said spiral walls extending into proximity with the outer periphery of said settling chamber, and covering said arcuate and spiral walls.

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