Nov. 7, 1961 A. HANNAFORD 3,007,576

ROTATING SCREEN SEPARATOR

Filed July 24, 1957 2 Sheets-Sheet 1

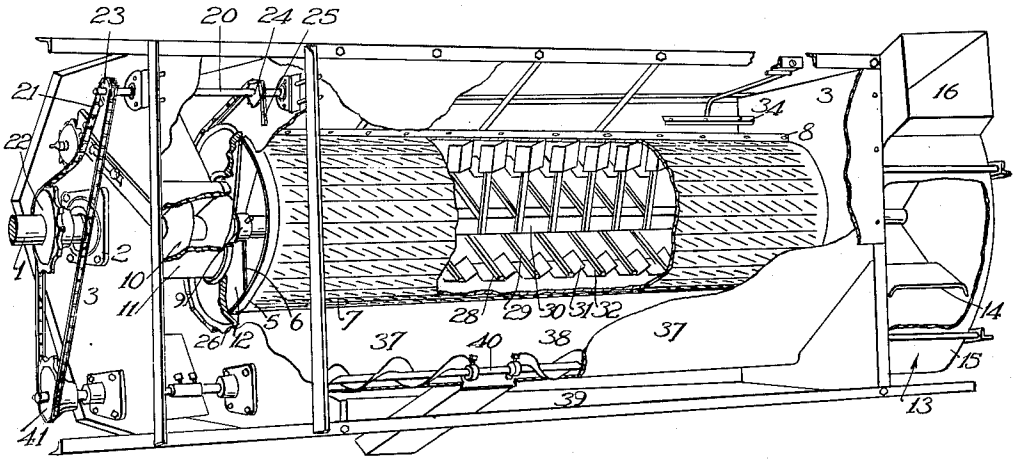

FIG 1

Nov. 7, 1961 A. HANNAFORD 3,007,576

ROTATING SCREEN SEPARATOR

Filed July 24, 1957 2 Sheets-Sheet 2

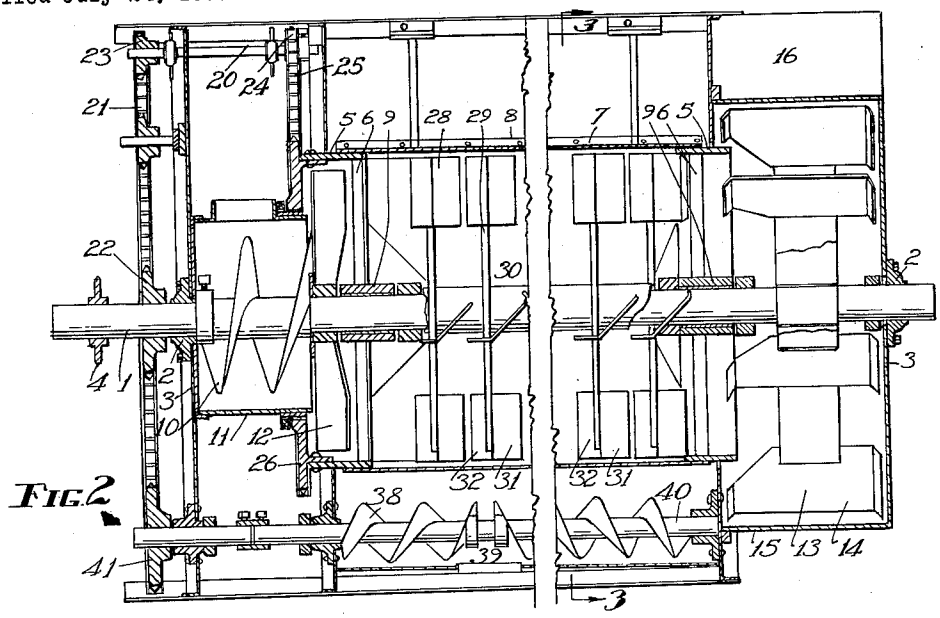

FIG. 2

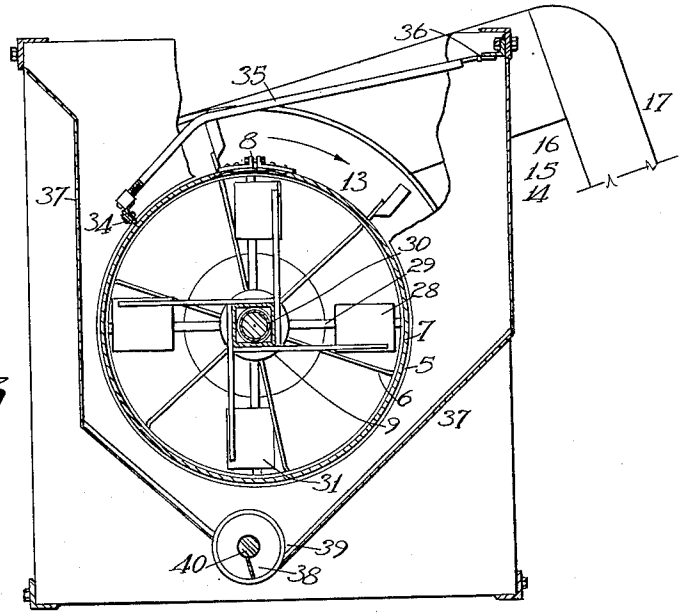

FIG. 3

United States Patent Office

3,007,576
Patented Nov. 7, 1961

3,007,576

ROTATING SCREEN SEPARATOR

Alfred Hannaford, Woodville, South Australia, Australia, assignor to Alf. Hannaford & Company Limited, Woodville, South Australia, Australia

Filed July 24, 1957, Ser. No. 673,776
Claims priority, application Australia July 30, 1956
2 Claims. (Cl. 209—296)

This invention relates to apparatus for removing small foreign matter from grain or other material.

Among the types of apparatus known for removing small seeds or foreign matter from grain are the types employing fixed screens of cylindrical type on horizontal shafts having within them rotating beaters or memebrs which serve to agitate the grain within the screens and to feed it gradually forward in such screens with a view to subjecting the whole of the grain and foreign matter to the screens to give the small particles an opportunity of passing through the apertures of the screen.

It is also known to use rotating screens with fixed helical vanes, or rotating screens with counter revolving vanes.

One of the problems with this type of apparatus is to keep the screens in an effective working condition without blockage and also to insure that the grain being treated by the cylindrical screens is subjected with maximum effect to the action of such screens.

An object of the present invention is to provide apparatus of this nature which will be more effective than that known heretofore and which will operate the subject the grain to the maximum possible cleaning without increasing the size of the apparatus beyond practical limits.

In considering the present invention it should be clear that the coventional rotary screen depends on gravity, assisted by a worm or agitator, in order to get sufficient capacity to handle the flow of grain being harvested, and usually there is a considerable body of grain on the bottom of the screen which may prevent the weed seeds from finding their way out of the screen orifice.

According to our invention the screen is driven at sufficient speed to cause centrifugal force to hold the grain to the screen over its entire inner surface and small material will then find its way through the screen.

It will be obvious that when operating at such a speed, the grain would not ordinarily move on the inner surface of the screen and therefore the grain must be agitated and urged forward along the screen by an impeller travelling at a different speed than the cylindrical screen.

According to our invention the rotary screen should run at sufficient speed to cause the grain to adhere to the inner surface and usually this is approximately 300 feet of travel per minute, with a screen of 11 inches diameter, and we find that beneficial effects are obtained up to a speed of say 600 feet of travel per minute.

It will be appreciated that grain, held in a screen by centrifugal force, has a greater effective weight due to gravity, and the outward pull on the grain therefore tends to assist a flow of grain through the screen, the larger grain being, of course, prevented from passing therethrough by physical size limitation.

Without the rotor, however, the grain would not flow at all, but would simply be held to the screen, and it is therefore necessary to use a rotor travelling at a different speed, either faster or slower, to move the grain in the screen.

The combination of the rotary screen travelling at sufficient speed to hold the objects by centrifugal force on the inside of the screen, combined with an impeller to urge the material forward or backward in relation to the

screen and expelling it along the horizontal length of the screen insures efficient separation.

It is preferred to drive the impeller at a higher speed that the rotary screen when adapting it to harvesting machinery, as this gives a greater capacity than if the rotor were to be travelling at too slow a speed.

With the speed of the screen, the centrifugal force aids considerably in the screen's doing efficient work, and the movement of the inner impeller gives the stock a turbulent action and the grain is constantly stirred and urged from the time it enters the free end of the screen until it is discharged.

Suitable means of keeping the screen clean are provided by flexible wipers or rollers, and a helical conveyor collects the screenings that are thrown out from the screen while a series of blades on the impeller shaft expels the grain that has passed over the length of the screen to the outlet to be caught in a bin, box or bag.

It will therefore be realized that the device according to this invention comprises a screen, means to revolve the said screen, means to feed material into one end of said screen, impellers disposed coaxially within the said screen shaped to drive material around in said screen and feed it forward, means to revolve the impellers in the same direction but at a speed different from the said screen, means to receive material at the discharge end of the said screen, and means to receive material which has passed through the apertures in said screen.

A further object of this invention is to so construct the apparatus that the screen can be fitted to a header, harvester, reaper, thresher or the like of usual construction or incorporated in other seed or grain cleaning machines.

To enable the invention to be fully understood an embodiment thereof will now be described with reference to the accompanying drawings in which:

FIG. 1 is a perspective view of such an embodiment,

FIG. 2 is a vertical section of the same partly on the center-line of the screen but showing the impeller and the mechanism on its shaft unsectioned, and

FIG. 3 is a transverse section on line 3—3 of FIG. 2.

In the drawing, a main shaft 1 is supported in suitable bearings 2 on a frame 3 and is arranged to be driven by any suitable means such as by a sprocket 4 driven by a chain from any rotating part of a harvester or header or reaper, thresher or cleaning or grading machine or the like, or from an engine, depending on the positioning of the cleaning unit.

Supported on this shaft 1 are rims 5, these being disposed on spiders 6, to be freely rotational about the shaft. The rims 5 support a screen 7 which is formed in sections joined at 8 so that the screen may be removed. The spiders 6 connect to bosses 9 which form bearing members on the shaft 1 so that the shaft 1 can rotate independently of the screen 7. However, the screen is coaxially supported on the shaft.

Fitted to this shaft 1 is a feed spiral or screw 10 which is disposed in a fixed housing 11 which has an inlet for the grain to be cleaned, the spiral 10 discharging into one end of the screen 7 through one of the aforesaid spiders 6. A fan-like feed member 12 is provided at this locality, also secured on the shaft 1, which will assist the forward feed of the grain into the screen 7.

At the other end of this shaft 1 is a thrower 13 having blades 14 shaped so that, in conjunction with a cylindrical housing 15, they serve to throw the cleaned grain which has passed through the device but has not passed through the apertures in the screen 7, through an outlet 16 in the housing 15 of this thrower 13 and thus through the chute 17 into a grain bin or the like.

The screen 7 itself is driven from the aforesaid main shaft 1 but through suitable reduction gearing which

drives the screen in the same direction as the shaft but at a different speed, the drive for the screen comprising a lay shaft 20 driven by the main shaft 1 through a chain 21 and sprockets 22 and 23, the lay shaft 20 having on it a sprocket 24 joined by a chain 25 to a toothed rim 26 on the one end of the screen 7.

The screen has within it an impeller consisting of a series of blades 28 which are spaced equidistant around the shaft 1 and are moved thereby, the blades 28 being carried on arms 29 fixed to bosses 30 secured on the shaft 1. The blades have their main surface 31 inclined at an angle relative to shaft 1 to provide the forward movement to the grain, but also have a straight portion 32 parallel to shaft 1 which serves to throw the grain in the direction of rotation of the drum.

The blades 28 of the impeller spread a thin film or layer over the entire surface so that its mixture of material comes readily over the orifices of the screen 7, the blades 28 causing the grain to move forward in the screen in the direction of rotation of the screen but also to move it gradually towards the outlet, the time the grain is in the screen 7 being determined by the position and shape of the angular surfaces 31 of the blades 28.

As the blades 28 constantly force the grain, together with the melilotus or undesirable seeds or other small impurities, to move along the screen 7, in spite of the tendency of the centrifugal force to hold same in position on the screen and as the screen 7 itself is moving in the same direction, it is obvious that the maximum opportunity is provided for the smaller material to pass through the apertures in the screen.

Pressing on the outside of the screen are blades 34 of rubber or the like which are held on arms 35 hinged at 36 to the frame 3 so arranged that they tend to force any materials which are stuck in the openings in the screen 7 back into the screen to thus keep the screen clear, the action thus insuring that once during each revolution of the screen all parts of the screen must move beneath these blades 34 and the screen 7 will thus have its apertures maintained in open condition whereby best cleaning must result.

A casing 37 around the outside of the screen 7 directs any material which passes through the apertures in the screen to a conveyor 38 in a trough 39 at the base of the unit, this conveyor having its shaft 40 driven by the chain 21 which engages a sprocket 41 on the shaft 40.

The revolving screen can readily be changed for one having different sized orifices to treat varying samples of material.

From the foregoing it will be realized that the operation of the device for separating grain utilizes a screen through which either the grain or the matter to be separated is passed according to which is the larger, the smaller grain or matter to be separated passing through the screen, while the larger objects pass out of the end of the screen.

Under normal conditions the impellers may be driven forwardly at a speed approximately twice that of the screen so that the differential speed between the impellers and the screen is not excessive.

The diameter of the screen may be varied but a drive giving 300 feet per minute is suitable for a screen of say 11 inches diameter, while the impeller could rotate at twice that speed to insure that the material which is held on the screen by centrifugal force is constantly being driven by the impeller at a greater speed to maintain movement of the material in relation to the screen at all times, this insuring a high separation efficiency. As two speeds are involved, that of the screen and that of the impeller, and as the grain is under influence of both, the grain will constantly be accelerated and decelerated within the screen and thus effective separation will result.

It is obvious that the impeller can operate at a slower speed than the screen in that it can then decelerate the material carried by the screen while the screen will again accelerate it on contact, this effect being similar to when the screen moves the faster as the effect is purely relative. Obviously the angle of the impeller will be reversed in the latter case to still give the over-all axial movement towards the outlet end.

The relative speed between the impeller and screen should however never be sufficiently high to prevent easy passage of the smaller material through the screen. Too high a speed would cause the smaller material to pass over the apertures in the screen because of their inability to change their direction quickly enough.

It will be realized that an essential in this invention is the driving of the screen at a speed which will hold the grain to its entire surface by centrifugal force, whereby to present the maximum surface for separation, and at the same time increasing separation efficiency by increasing the effective weight of the grain and impurities against the screen. Movement of the grain and impurities over the screen is effected by the impeller which causes the particles to follow a generally helical path around the said screen towards the outlet. Obviously as the grain is at times in contact with the screen and at times with the impeller, its speed must vary and the grain is therefore shuffled along a helical path towards the outlet.

What is claimed is:

1. The method of separating smaller granular particles from larger granular particles comprising the steps of applying the granular particles to the inside of a cylindrical screen having apertures of a size to pass the smaller granular particles therethrough, rotating the said screen at an angular velocity sufficient to cause the said particles to adhere to the inside of the said screen by centrifugal force over the entire screen area, and moving the said particles over the said screen in a generally helical path towards the said outlet by means of an impeller comprising a plurality of separate impeller blades facing substantially in the direction of movement of the screen and driven at an angular velocity different from that of the said screen whereby the said particles are shuffled over the surface of the said screen alternately under predominating influence of the said screen and the said impeller to cause all the particles to be subjected to the said screen and the smaller particles to pass therethrough by centrifugal action.

2. The method according to claim 1 wherein the impeller is driven faster than the said screen in the same direction.

References Cited in the file of this patent

UNITED STATES PATENTS

190,202	Feistel	May 1, 1877
329,423	Wommer et al.	Oct. 27, 1885
341,134	Dunlap	May 4, 1886
424,100	Dobson	Mar. 25, 1890
889,433	Brewster	June 2, 1908
1,839,941	Zelezniak	Jan. 5, 1932
2,048,345	Lott	July 21, 1936

FOREIGN PATENTS

2,266	Great Britain	Feb. 7, 1891
4,906	Great Britain	Oct. 15, 1883
11,066	Great Britain	May 21, 1908
472,979	Canada	Apr. 17, 1951
669,247	Germany	Dec. 20, 1938