

[54] **PORTABLE GRAIN DRYER**

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[58] Field of Search..... **34/90, 102, 174, 34/236; 214/83.26, 83.32, 520, 521, 522; 56/1, 12.2; 198/87-91**

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[57] **ABSTRACT**

An improved portable grain dryer which includes a wheel-supported frame and a conveyor-connected grain holding bin and grain drying unit carried by the frame. A conveyor is carried by the frame and is connected to the grain drying unit outlet with the discharge end of the conveyor being shiftable to enable the grain issuing from the drying unit to be deposited at a selected location spaced from the unit.

7 Claims, 6 Drawing Figures

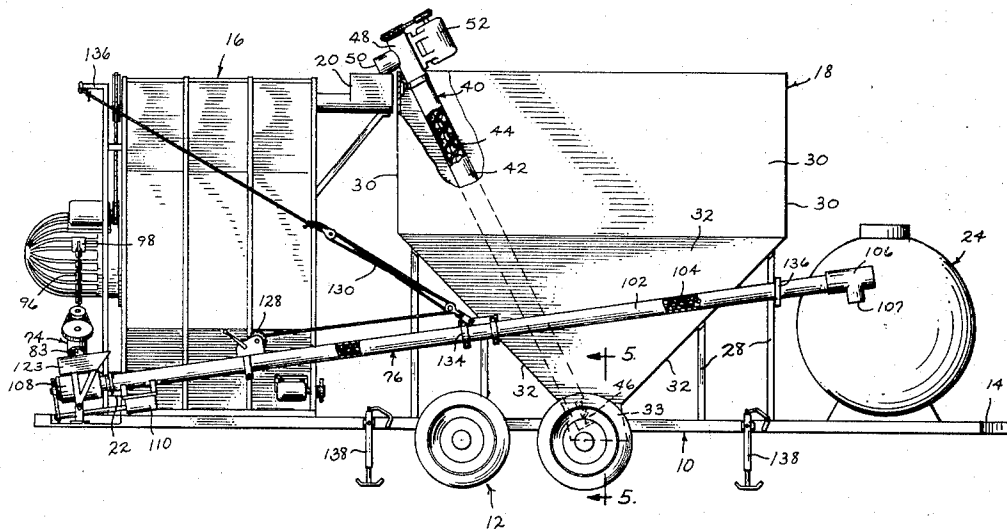
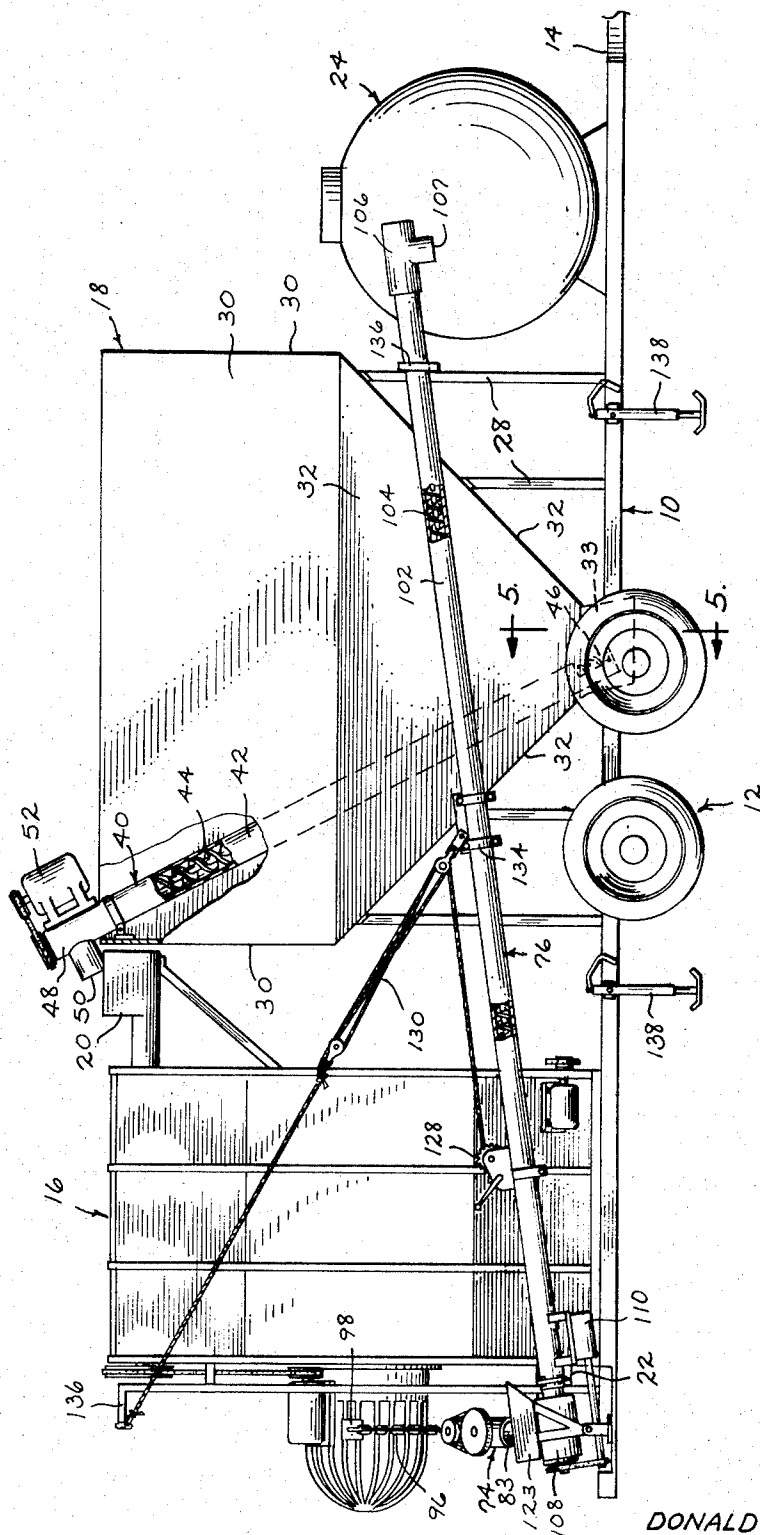


Fig. 1



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Fig. 2

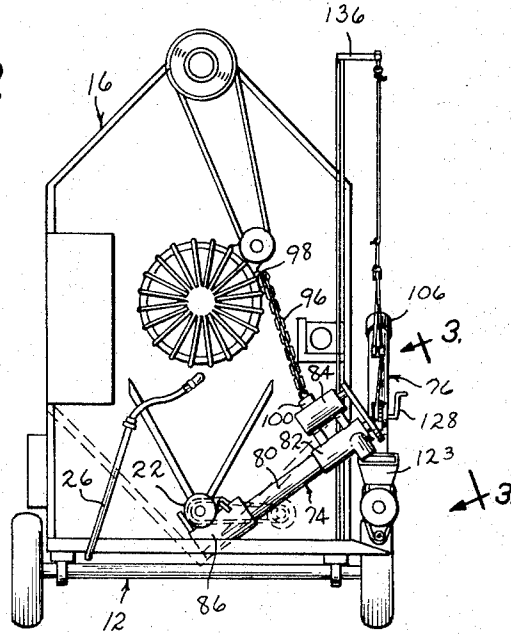
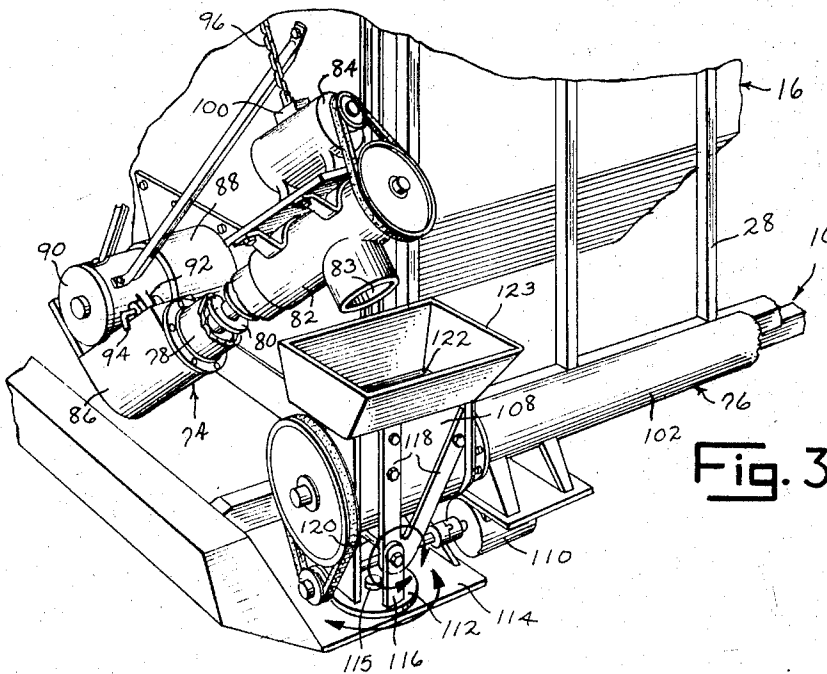
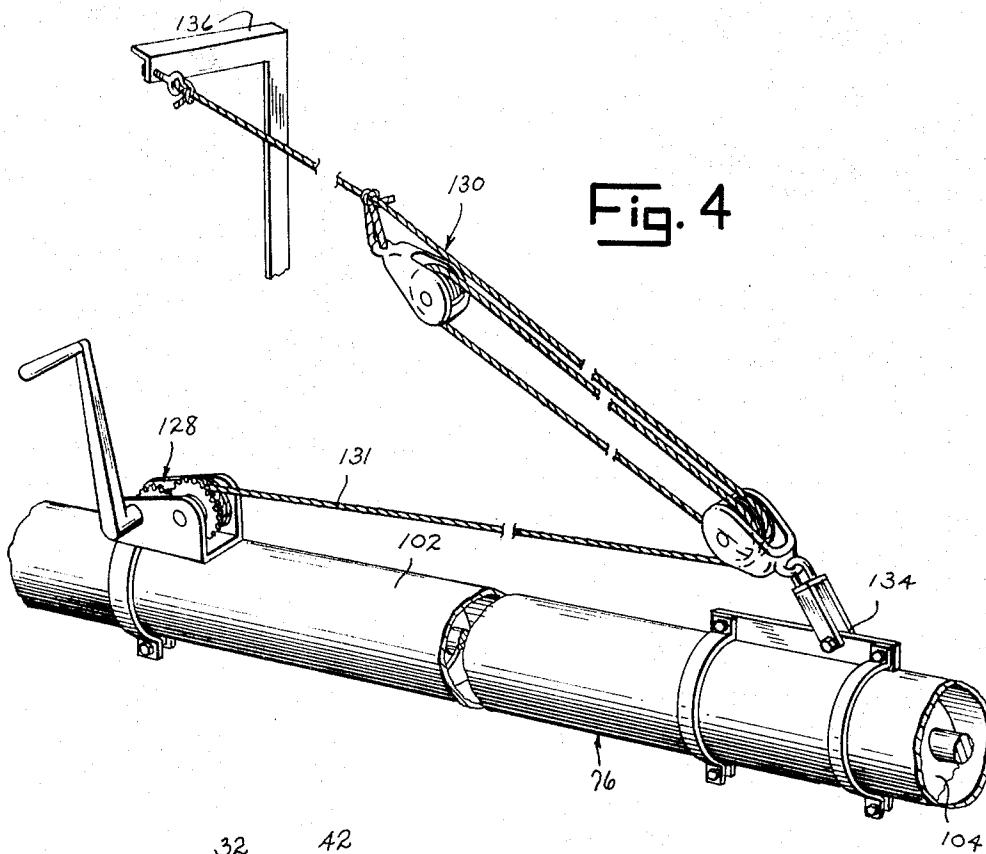
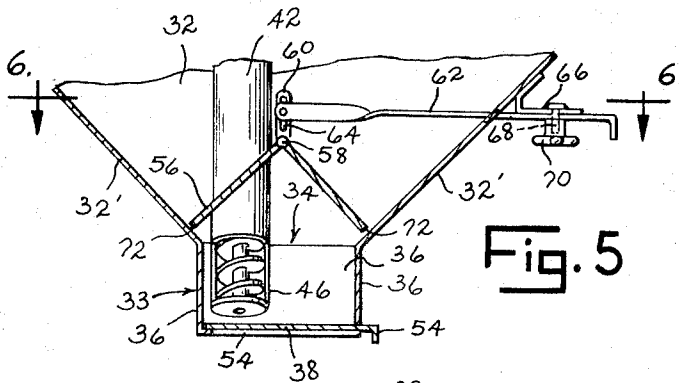
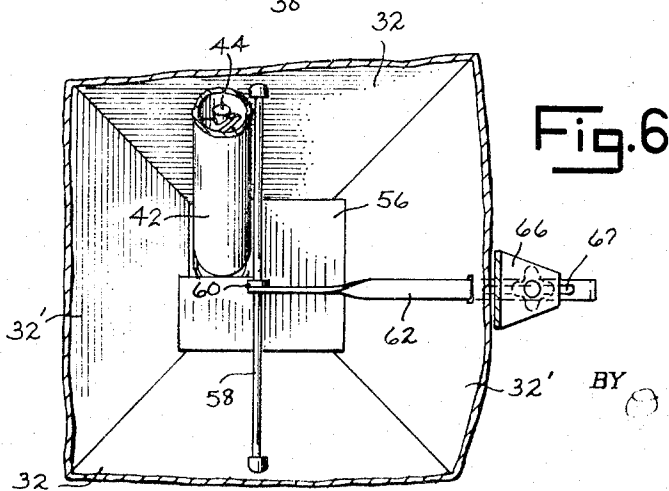


Fig. 3

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PORTABLE GRAIN DRYER

SUMMARY OF THE INVENTION

This invention relates to a grain dryer and has specific application to a portable grain dryer which can be moved from location to location at the discretion of the farmer.

The grain dryer of this invention includes a wheel-supported frame which carries a grain holding bin and a grain drying unit which are flow-connected by a first conveyor means. A second conveyor means is carried by the frame with its loading end positioned adjacent the drying unit outlet so as to receive the dried grain issuing from the drying unit. Means are provided which permits movement of the discharge end of the second conveyor relative to the drying unit so that the dried grain may be deposited by the second conveyor at a selected location spaced from the drying unit. Support means carried by the frame of the dryer is provided for storing the second conveyor means when the dryer is moved from one location to another or parked when not in use. The holding bin which constitutes a part of this invention is designed with a grain collection pocket which receives the loading end of the first conveyor means so as to permit the conveyor means in transferring the grain to the drying unit to constantly withdraw a specified quantity of grain from the holding bin during conveyor operation. Grain deflector means is positioned within the holding bin and is located over the loading end of the first conveyor means so as to regulate the flow of grain into the collection pocket of the bin. Such a grain deflector serves to keep the bulk of the weight of the grain within the holding bin off the loading end of the first conveyor means and thus prevents clogging and malfunction of the conveyor means.

To add stability to the dryer and to ease the grain load upon the dryer wheels, jacks are provided and carried by the frame. Such jacks are extendible so as to engage the ground and thus take all or a substantial portion of the weight of the grain from the dryer wheels. The drying unit of this invention is preferably heated by a fuel which is stored in a tank carried by the frame and spaced from the drying unit.

In the portable grain dryer sold by McCrabb Bros. Mfg. Co. of West Liberty, Iowa, the drying unit and grain holding bin are interconnected by a conveyor and are carried upon a wheel-supported frame. In the McCrabb grain dryer, unlike the dryer of the subject invention, no provision is made for regulating the flow of grain from the holding bin into the conveyor. Additionally, the McCrabb dryer includes no provision for discharging the dried grain at a specific location spaced from the drying unit.

The grain dryer of this invention is a complete and operable unit in which the grain as it is harvested can be loaded into the grain holding bin where it is transferred by a first conveyor means into the drying unit. There the grain is dried and then transferred by a second conveyor means to a selected location spaced from the drying unit. The entire dryer, including fuel for the drying unit and second conveyor means for transporting the dried grain to a specific discharge location, can be easily transported from location to location and conveniently stored when the dryer is not in use. The dryer of this invention can be positioned next

to a grain storage facility, the harvested grain brought from the fields in trucks and unloaded into the holding bin of the dryer, and the grain subsequently dried and transported by conveyor means to the storage facility. Alternatively, the dryer can be brought to the harvest site, loaded while at the harvest site, and then transported to the storage facility where the grain is then dried and stored. If on occasion it is desired to distribute the dried grain by a grain movement device other than the second conveyor means connected to the drying unit outlet, means are provided in the dryer for disconnecting the second conveyor means from the drying unit while the conveyor means is positioned in its stored location on the dryer frame.

Accordingly, it is an object of this invention to provide a portable grain dryer in which the grain after being loaded into a holding bin and subsequently dried is transferred by a dryer connected conveyor means to a selected location spaced from the dryer.

Still another object of this invention is to provide a portable grain dryer which is of compact construction so as to enable the dryer to be conveniently pulled from one field location to another and which includes shiftable conveyor means for depositing the dried grain at a selected storage location as the grain issues from the grain drying unit of the dryer.

Still another object of this invention is to provide a portable grain dryer which is of simple and safe operation.

Still another object of this invention is to provide a portable grain dryer having a holding bin which is of a unique construction so as to enable the bin to be readily emptied.

Other objects of this invention will become apparent upon a reading of the invention's description.

BRIEF DESCRIPTION OF THE DRAWINGS

A preferred embodiment of this invention has been chosen for purposes of illustration and description wherein:

FIG. 1 is a side elevation of the grain dryer.

FIG. 2 is an end elevation of the grain dryer as viewed from the left of FIG. 1.

FIG. 3 is a fragmentary enlarged detail view in perspective form of the grain dryer as viewed from line 3—3 of FIG. 2.

FIG. 4 is a fragmentary enlarged view of the lifting and lowering means for the dried grain discharge conveyor of the dryer.

FIG. 5 is a fragmentary sectional view taken along line 5—5 of FIG. 1.

FIG. 6 is a sectional view taken along line 6—6 of FIG. 5.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The preferred embodiment illustrated is not intended to be exhaustive or to limit the invention to the precise form disclosed. It is chosen and described in order to best explain the principles of the invention and its application and practical use to thereby enable others skilled in the art to best utilize the invention.

The illustrated portable grain dryer includes a trailer frame 10 carrying axle and wheel assemblies 12. Frame 10 includes a hitch means (not shown) at the forward

end portion 14 thereof which enables the frame to be connected to a tractor or similar vehicle and pulled from one location to another. A grain drying unit 16 is carried by the rear end portion of frame 10. A holding bin 18 is carried by frame 10 adjacently forwardly of drying unit 16. Drying unit 16 has an upper inlet 20 by which the moist grain enters the unit and a lower outlet 22 from which the dried grain is discharged from the unit. Drying unit 16 may be bottle or natural gas-heated and may be any one of a variety of constructions of commercially available batch-type dryers. The drying unit illustrated in the drawings is of the type manufactured by American Farm Equipment Co. of Lake Zurich, Illinois and whose construction and operation are fully described in U.S. Pat. No. 3,056,214. The fuel for drying unit 16 is preferably contained in a tank 24 which is mounted to frame 10 adjacently forwardly of holding bin 18. Tank 24 is connected to the fuel combustion elements of the drying unit by means of a tube 26 which extends along frame 10. Drying unit 16 includes actuating and timing apparatus by which the moist grain is subjected to a flow of heated air and dried. The dried grain is then cooled by being subjected to a flow of non-heated air and subsequently discharged through lower outlet 22 of the drying unit.

Holding bin 18 is supported upon frame 10 by suitable stanchions 28 and includes four right-angularly joined vertical side walls 30 which are each joined at their lower edge to a tapered side wall 32. Tapered side walls 32 of the holding bin converge and define a lower bin opening 34 which opens into an enclosed box-like structure 33, defining a grain collection pocket, having side walls 36 and a bottom wall 38. It is to be understood that the holding bin may also be round or have some other number of multiple side walls. A conveyor 40 is positioned within holding bin 18 and extends from box-like structure 33 thereof to upper inlet 20 of drying unit 16. Conveyor 40 may be of the auger type which includes a cylindrical housing 42 having an auger 44 disposed therein and extending the length of the housing. The loading end portion 46 of conveyor 40 is positioned within box-like structure 33 while the discharge end portion 48 of the auger which includes a discharge orifice 50 is supported at the upper edge of one vertical side wall 30 of the holding bin and positioned over drying unit inlet 20. Discharge end portion 48 of conveyor 40 carries an electric motor 52 which is drive connected to auger 44 and which causes rotation of the auger so as to draw grain from the holding bin upwardly through conveyor housing 42 where it is discharged into inlet 20 of the drying unit 16 through conveyor orifice 50. By providing holding bin 18 with a box-like structure 33, an ample supply of grain within the holding bin is supplied to loading end portion 46 of conveyor 40.

Bottom wall 38 of box-like structure 33 is preferably of the sliding type, being supported by inturned flanges 54 at the lower edges of opposed side walls 36, and includes a handle 54 which enables the wall to be pulled outwardly so as to open structure 33 and permit any grain remaining therein after use of the dryer to drain from the bin. A grain deflector 56 is carried within holding bin 18 and is positioned adjacently above its lower opening 34. Deflector 56, which is shown in FIGS. 5 and 6 of the drawings, is of an inverted V-

shaped configuration. A rod 58 extends along and is affixed to the apex of the deflector. The ends of rod 58 are journaled in opposite side walls 32 of the bin with the deflector being pivoted about its apex. An upwardly projecting bracket part 60 is secured to deflector 56 at its apex. A control rod 62 extends through an aperture in one of the other side walls 32' of the bin. Rod 62 has its inner end portion pivotally connected to bracket part 60 at slot 64 therein and has its outer end portion supported by an external bracket 66 which is secured to the rod supporting wall. The outer end portion of rod 62 is slotted at 67 so as to receive a threaded pin 68 of bracket 66. An internally threaded tightening member 70 is turned onto the exposed end of bracket pin 68 and is tightened against the outer end portion of control rod 62 so as to fixedly position the control rod relative to bracket 66. As best envisioned by viewing FIG. 5, when tightening member 70 is loosened and control rod 62 is shifted inwardly and outwardly, deflector 56 is caused to pivot or tilt about its apex with a variation in spacing occurring between the ends 72 of the deflector and the adjacent pair of bin side walls 32'. The amount of space between deflector ends 72 and the adjacent bin side walls determines the rate of grain flow from the upper part of the bin into box-like structure 33. Once the deflector has been tilted to allow a selected rate of grain to flow into structure 33, tightening member 70 is tightened against rod 62 to lock the deflector in position.

A conveyor, preferably constituting two flow-connected conveyor units 74 and 76, serves to carry the dried grain from drying unit 16 to a selected spaced location from the unit. Conveyor unit 74 is of similar construction to conveyor 40 in holding bin 18 and includes a cylindrical housing 78, an auger 80 positioned within housing 78, and a discharge end portion 82 which includes a discharge orifice 83 and which carries an electric drive motor 84 and power transmission means for rotating auger 80. The loading end portion 86 of conveyor unit 74 includes an upper inlet orifice (not shown) which is positioned directly under the outlet orifice (not shown) in the grain discharge duct 88 which forms a part of drying unit outlet 22. Discharge duct 88 of the drying unit includes an end cap 90 which directs the grain down through the outlet orifice in the duct into loading end portion 86 of conveyor unit 74. Discharge duct 88 and loading end portion 86 carry cooperating hinge parts 92 which are interconnected by a removable pin 94 and which pivotally connect the loading end portion of conveyor unit 74 to lower outlet 22 of the drying unit. Conveyor unit 74 is shiftable in a vertical plane and is supported by an adjustable chain 96 releasably connected at one end to a bracket 98 carried by drying unit 16 and at its opposite end to a bracket 100 carried by conveyor unit motor 84.

Conveyor unit 76, which is flow-connected to conveyor unit 74 and preferably of a separate construction therefrom, is positioned at one side of trailer frame 10. Conveyor unit 76 is also of a similar construction to conveyor 40 and conveyor unit 74 in that it includes a cylindrical housing 102, an auger 104 disposed within housing 102, and a discharge end portion 106 which includes a discharge orifice 107. An electric drive motor 110 and drive transmitting means for rotating auger 104 are carried by the loading end portion 108 and

housing 102 of the conveyor unit. Conveyor unit 76 is swivel connected at its end portion 108 to frame 10. The swivel connection of conveyor unit 76 to frame 10 may include a flat bearing disk 112 which rests upon a plate 114 secured to frame 10 at one rear corner of the frame and which is journaled at its center about a suitable pivot pin 115 which connects the bearing disk 112 to frame plate 114. Disk 112 carries upwardly projecting trunnion cradle members 116. Suitable brace members 118 are secured to opposite sides of end portion 108 of the conveyor unit. Brace members 118 are journaled to trunnion cradle members 116 by means of a pivot pin 120. In utilizing the swivel connection described, the free or discharge end portion 106 of conveyor unit 76 can be swung in both a substantially horizontal plane through the relative movement between unit disk 112 and frame plate 114 and a vertical plane by means of pivotal movement of brace members 118 relative to trunnion cradle members 116. Loading end portion 108 of conveyor unit 76 includes an inlet orifice 122 which is defined by a rectangularly shaped funneling member 123 located under the discharge orifice 83 of conveyor unit 74.

The swivel movement of conveyor unit 76 and the positioning of the discharge end portion 106 thereof may be controlled by means of a winch 128 and block and tackle 130 combination, which is best shown in FIG. 4. Winch 128 is secured to housing 102 of conveyor unit 76 near the loading end portion of the unit and within comfortable reach of the user of the dryer. Winch 128 carries a cable 131 which constitutes a part of block and tackle 130. The block and tackle is connected between a suitable bracket 134 secured to housing 102 of conveyor unit 76 and an angle iron 136 secured to the rear end edge of drying unit 16 and is of standard operating form which enables the user of the dryer when turning winch 128 to raise or lower the discharge end portion 106 of conveyor unit 76. Simultaneously with the raising or lowering of discharge end portion 106, the winch operator may manually shift the end portion in a generally horizontal plane so as to position discharge orifice 107 of conveyor unit 76 over a selected bin or other type of storage facility for the dried grain. Funneling member 123 of conveyor unit 76 is of sufficient size so as to have parts positioned at all times under discharge orifice 83 of conveyor unit 74. To accommodate movement of funneling member 123 during the swivel movement of conveyor unit 76 and to position the discharge orifice 83 of conveyor unit 74 as close as possible to the funneling member during operation of the dryer, the height of discharge end portion 82 of conveyor unit 74 may be adjusted by increasing or reducing the effective length of chain 96 which supports the conveyor unit 74. At least one selected stanchion 28 of trailer frame 10 carries a U-shaped support 136 in which housing 102 of conveyor unit 76 is cradled and supported, as illustrated in FIG. 1, when the dryer is being moved from one location to another or stored.

To operate the dryer of this invention, the user thereof need only tow the dryer to a location adjacent the storage bin or other facility in which the dried grain is to be placed. The electrical motors for operating the conveyors and drying unit are connected to an electrical power source. The newly harvested grain is brought

from the field and is placed in holding bin 18 which may be sized so as to hold between eight and nine tons of moist grain. Holding bin conveyor 40 is then activated by a suitable switch so as to carry the grain from structure 33 in the holding bin upwardly to inlet 20 of the drying unit 16 where it falls into the drying unit. Once the drying unit is filled, conveyor 40 may be deactivated by a pressure switch located in the drying unit and the drying process automatically begun (filling of the unit may continue as the grain shrinks). After a specified duration of time the dried grain is discharged by the drying unit through outlet 22 of the unit. A suitable pressure actuated cut-off switch may be electrically connected to motor 52 of conveyor 40 and positioned in the lower end of bin 18 so as to deactivate conveyor 40 when the grain within the bin reaches a specified lower level. Either during the operation of drying unit 16 or, preferably, after the trailer frame 10 is first positioned adjacent the dried grain storage facility, the user of the dryer actuates winch 128 so as to lift conveyor unit 76 from its frame support 136 and swings the conveyor unit outwardly from the trailer frame and holding bin into a selected position over the grain storage facility. As the dried grain is discharged from dryer unit 16, motors 84 and 110 of conveyor units 74 and 76 are activated by suitable switch means. The grain as it issues from drying unit 16 passes first through conveyor unit 74 and then through conveyor unit 76 into the storage facility. Once the drying operation is completed and all grain is removed from the unit, conveyor units 74 and 76 are deactivated and conveyor unit 76 is repositioned against bin 18 and cradled within its trailer frame support 136. Any grain remaining in bin 18 is removed by opening bottom wall 38 of the bin. Should the storage facility be filled prior to removal of all grain from drying unit 16, conveyor unit 76 can be positioned with its discharge end portion 106 located over bin 18 so as to place the grain from the drying unit in the bin where the grain may remain until it can be run again through the drying unit and deposited in another storage facility.

To ease the load placed upon wheel assemblies 12 of the frame by the weight of the grain, suitable jacks 138 may be connected to the trailer frame along the sides thereof. Jacks 138 are preferably pivotally connected to the frame so as to enable the jacks to be stored during movement of the dryer and then pivoted and locked into position for engagement with the ground after the dryer is parked for usage.

It is contemplated that a source of commercial electric power would be available to drive the various motors required to actuate the conveyors and drying unit of the dryer. Should such electric power be unavailable, it is contemplated that the various dryer conveyor motors would be supplied electric power by a gas or oil-powered generator. Additionally, while augers have been mentioned as the preferred conveyor means, belt or other type conveyors could also be used. Winch 128 may include a lock means by which conveyor unit 76 can be held in an elevated position.

It is to be understood that the invention is not to be limited to the details herein given, but may be modified within the scope of the appended claims.

What I claim is:

1. In a portable grain dryer which includes a wheel-supported frame adapted to be pulled from one location to another, a grain holding bin and a grain drying unit constituting parts of said frame, said drying unit having an inlet and an outlet, first conveyor means extending between said bin and said drying unit inlet for transporting grain from said bin to said drying unit, the improvement comprising second conveyor means carried by said frame, said second conveyor means constituting two conveyor units each having its own loading and discharge ends, one of said conveyor units having its loading end positioned in grain flow communication with said drying unit outlet and having its discharge end positioned in grain flow communication with the loading end of the other of said conveyor units wherein grain is received from said drying unit by said one conveyor unit and carried thereby to the other conveyor unit, means anchoring the loading end of said other conveyor unit to said frame for permitting universal pivotal movement of said other conveyor unit and the shifting of both ends thereof, means for moving said other conveyor unit so as to permit the discharge end of said other conveyor unit to be shifted into a selected location spaced from said dryer unit, means anchoring the loading end of said one conveyor unit to said frame for permitting pivotal movement of said one conveyor unit, means for moving the discharge end of said one conveyor unit into grain flow communication with the loading end of said other conveyor unit to accommodate movement of said other conveyor unit when said other conveyor unit is shifted into said selected location.

2. A dryer of claim 1 and support means carried by said frame for engagement with said second conveyor means to position said second conveyor means longitudinally of said frame when the grain dryer is stored or is being pulled from one location to another, second conveyor means connecting means positioning the loading end of said second conveyor means at said drying unit

outlet, said connecting means having releasable parts to permit the disconnection of said second conveyor means wherein the loading end thereof may be shifted from said drying unit outlet while said second conveyor means is supported longitudinally of said frame by said support means.

3. The dryer of claim 1 wherein said holding bin includes a funnel-shaped side wall having a lower open end and a grain collection pocket positioned below said open end, the loading end of said first conveyor means received within said collection pocket, the discharge end of said first conveyor means positioned in grain flow communication with the inlet of said drying unit, said collection pocket including a vertical side wall angularly positioned relative to said holding bin side wall and a horizontal bottom wall.

4. The dryer of claim 3 wherein said bottom wall is shiftably carried by said pocket side wall and constitutes a door which is normally closed during use of said grain dryer.

5. The dryer of claim 1 and including a grain deflector carried within said holding bin adjacently above the loading end of said first conveyor means, said holding bin including a side wall, said grain deflector having circumferential edges spaced from said side wall, means for shifting said grain deflector to vary the spacing between said edges and side wall whereby the flow of grain around said deflector and into the loading end of said first conveyor means may be regulated.

6. The dryer of claim 1 and including jacking devices positioned at each side of said frame, said jacking devices connected to said frame and having parts extendible into ground contact for supporting the weight of said bin and drying unit during use of said dryer.

7. The dryer of claim 1 and a fuel tank carried by said frame for supplying fuel to said drying unit, said holding bin being positioned between said drying unit and tank.

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