Jan. 19, 1965 A. MAKSYMEC 3,166,386

GRAIN DRYER AND COOLER

Filed Oct. 16, 1961 3 Sheets-Sheet 1

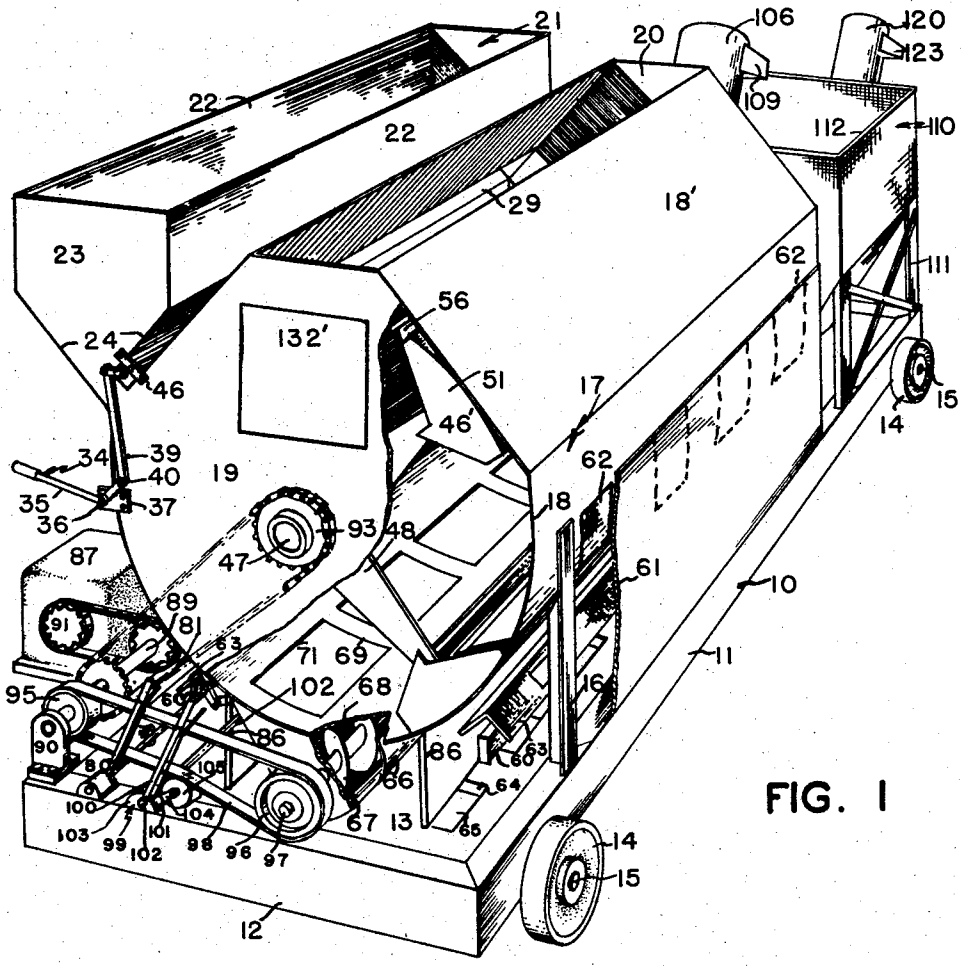

FIG. 1

INVENTOR
ANDY MAKSYMEC

BY

ATTORNEY

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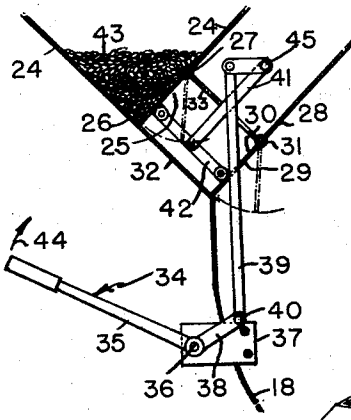

FIG. 6

FIG. 2

INVENTOR

ANDY MAKSYMEC

BY

ATTORNEY

Jan. 19, 1965 A. MAKSYMEC 3,166,386

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FIG. 3

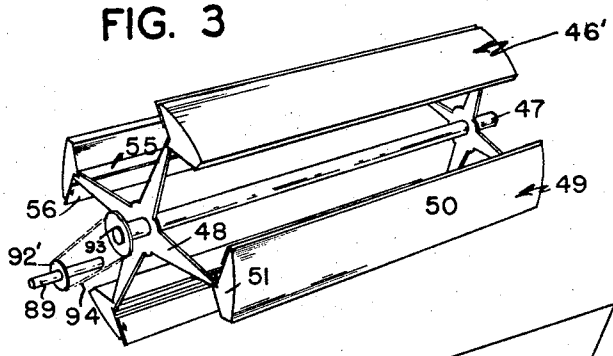
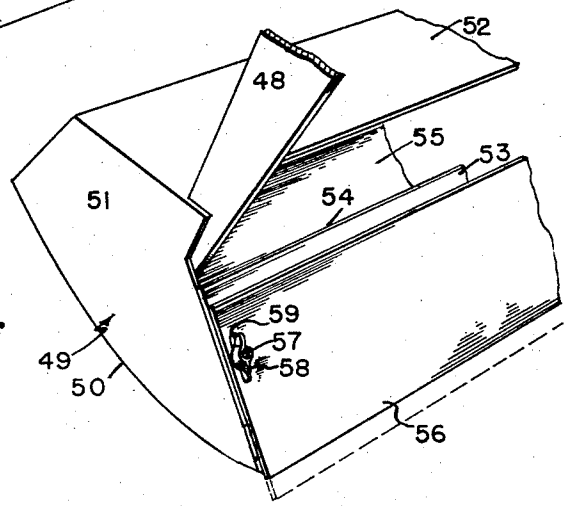


FIG. 4



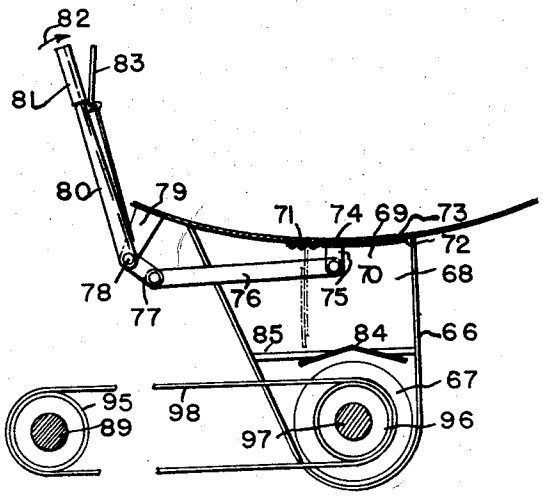


FIG. 5

INVENTOR.
ANDY MAKSYMEC
BY
ATTORNEY

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GRAIN DRYER AND COOLER

Andy Maksymec, Box 104, Egremont, Alberta, Canada

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2 Claims. (Cl. 34—62)

My invention relates to new and useful improvements in grain driers. Conventional grain driers normally use a supply of heated forced air which is passed through the grain and allowed to escape with the moisture through screened openings surrounding the drying chamber. This causes an excess of vapor around the drier which makes it difficult to see while working and, if operated during the winter months, normally freezes on the clothing of the operator. Furthermore conventional driers cannot use a high source of heat without the danger of burning grain particularly when the grain is of a type wherein the grain is moved slowly. Furthermore, the grain has to be stored in a heated condition under conventional operations, once again limiting the temperature at which the grain can be dried, unless it is first cooled in the drying chamber which is very time consuming.

Another disadvantage of conventional grain driers is that they can only operate efficiently at full capacity. Furthermore the cost is excessive and the amount of fuel area is high necessitating storage facilities for the fuel and causing difficulties when moving the device from one location to the other.

By providing a drying chamber with a discharge aperture at the upper end thereof and with an agitator therein, I am able to dry grain at a higher temperature than normal without the danger of burning the grain. By providing a cooling chamber adjacent the drying chamber, the grain is rapidly cooled ready for immediate storage and by utilizing a source of gas heat below the drying chamber I can route heated air through the drying chamber without the necessity of using forced air in order to accomplish this result.

Another advantage of my device is a preloading hopper situated adjacent one side of the drying chamber which can be filled with a measured quantity of grain and then dumped into the drying chamber thus permitting the operator to ready the next load while the first load is being dried. This facilitates the operation of the drying and, in particular, speeds up the process.

The principal object and essence of my invention is therefore to provide a grain dryer with an agitating means therein which circulates a measured quantity of grain through a source of hot air rising through the drying chamber.

Another object of my invention is to provide a device of the character herewithin described which includes a preloading hopper on one side of the drying chamber whereby a metered amount of grain can be dumped rapidly into the drying chamber when required.

Still another object of my invention is to provide a device of the character herewithin described which includes a cooling chamber adjacent one end of the drying chamber thus permitting a rapid cooling of the grain prior to storage.

Yet another object of my invention is to provide a device of the character herewithin described in which all of the operations can occur in sequence so that continuous batches of grain can be fed to the machine and discharged at the other end thereof.

A yet further object of my invention is to provide a device of the character herewithin described which is extremely simple in construction, economical in manufacture, and otherwise well suited to the purpose for which it is designed.

With the foregoing objects in view, and such other

objects and advantages as will become apparent to those skilled in the art to which this invention relates as this specification proceeds, my invention consists essentially in the arrangement and construction of parts all as hereinafter more particularly described, reference being had to the accompanying drawings in which:

FIGURE 1 is a perspective view of my machine, cut away in part to show the interior thereof.

FIGURE 2 is a perspective view similar to FIGURE 1 but shown from the other end thereof.

FIGURE 3 is a perspective view of the agitator per se.

FIGURE 4 is an enlarged fragmentary perspective view of one end of one of the scoops of the agitator.

FIGURE 5 is a fragmentary partially sectioned view showing the dump flaps of the drying chamber and the drive for the horizontal auger situated thereunder.

FIGURE 6 is a fragmentary sectioned view showing the communication between the preloading hopper and the drying chamber.

In the drawings like characters of reference indicate corresponding parts in the different figures.

Proceeding therefore to describe my invention in detail, reference should first be made to FIGURES 1 and 2 in which I have shown a substantially rectangular supporting framework **10** consisting of longitudinals **11** and transverse members **12** and having a floor **13** spanning these members.

Ground engaging wheels **14** are journalled upon axles **15** and permit the entire device to be moved from one location to another as desired.

Vertical supports **16** extend upwardly from the longitudinal members and support a horizontally disposed substantially cylindrical drying chamber collectively designated **17**. This drying chamber comprises a semi-cylindrical wall **18**, upwardly and inwardly diverging upper walls **18'** and end walls **19**. The walls **18'** terminate in spaced apart relationship from one another thus encompassing an air discharge opening **20** extending the full length of the drying chamber **17**.

Situated on one side of the drying chamber and supported thereby is a preloading hopper collectively designated **21** and it will be observed that this hopper extends the entire length of the drying chamber **17**. This hopper **21**, which is open at the upper side thereof, includes side walls **22** and end walls **23** and inwardly converging lower walls **24**.

Reference to FIGURE 6 will show the means for communication between the preloading hopper **21** and the drying chamber **17**.

Within one of the walls **24** is an elongated discharge aperture **25** selectively opened and closed by a hinged flap **26** hinged upon pin **27**. Within the lower side **28** of the upper side wall **18'** of the drying chamber adjacent the preloading hopper is an entrance aperture **29** selectively opened and closed by a further flap **30** hinged upon pin **31**.

An elongated duct bounded by walls **32** and **33** communicates between the apertures **25** and **29** and linkage and lever means collectively designated **34** are connected to the flaps **26** and **30** in order to actuate same.

This linkage and leverage **34** comprises a lever **35** pivoted upon a pin **36** supported upon bracket **37** secured to one end **19** of the drying chamber. This lever **35** is part of a bell crank including a short lever **38** to which is secured a vertical link **39** by means of pin **40**. Further linkage **41** is pivotally connected adjacent the upper end of the link **39** and in turn is pivotally connected to a connecting link **42** extending between the two flaps **26** and **30** as clearly shown in FIGURE 6.

In the drawing, these flaps are shown in the closed position which permits grain **43** to be loaded within the preloading chamber level with the top thereof thus measur-

ing the amount of grain to be transferred to the drying chamber.

Movement of the lever 34 in the direction of arrow 44 causes the linkage to actuate the flaps due to the pivotal connection of the linkage to cross pin 45 mounted within bracket 46. This causes the flaps to take up the position shown in phantom in FIGURE 6 thus permitting the grain 43 to flow, by gravity, from the preloading hopper 21, through the duct bounded by walls 32 and 33, through the opening 29 and thus into the drying chamber 17.

When the grain has emptied from the preloading hopper, the lever 35 is moved in the opposite direction thus closing the flaps so that preloading of the hopper 21 can continue while the grain just transferred therefrom is being dried.

Grain agitator means collectively designated 46' are journalled within the drying chamber and adapted to maintain the grain therein in a constantly turbulent condition, said agitating means taking the form of a spindle 47 journalled for rotation centrally within the end walls 19 of the drying chamber and extending horizontally therethrough.

Arms 48 extend radially from adjacent each end of the spindle 47 and within the drying chamber 17, said arms carrying a plurality of grain pick-up-and-dumping scoops collectively designated 49, said scoops extending horizontally and parallel with the longitudinal axis of the drying chamber.

FIGURES 3 and 4 show details of the construction of these scoops, each of which consists of an arcuately curved outer wall 50, end walls 51, and inner walls 52 and 53, the edges 54 of which terminate in spaced apart relationship thus providing the scooped openings 55. These scoops are attached to the arms 48 as by welding adjacent the end walls 51 thereof as clearly shown in the drawings. Grain pick-up flanges 56 extend the full length of the inner walls 53 of the scoops and are secured thereto by means of bolts 57 and wing nuts 58 extending through elongated slots 59 within the flanges. These flanges are adjustable as shown in phantom in FIGURE 4 so that they can be positioned in wiping contact with the inner wall of the grain drying chamber thus ensuring that all of the grain is picked up by the flanges, dumped into the scoops and carried upwardly and then discharged in a curtain downwardly through the drying chamber so that the grain is always in constant movement through the heated air passing upwardly through the drying chamber. This not only facilitates the drying action but prevents burning of the grain.

A source of heat is provided below the drying chamber and takes the form, preferably of elongated propane gas burners 60 supported upon brackets (not illustrated) and extending upwardly from the floor or base 13. It will also be appreciated that these burners 60 are connected to a source of propane gas (not illustrated).

Side panels 61 extend between the longitudinals 11 vertically upward to the curved side walls 18 of the drying chamber thus enclosing the burners at the sides so that air heated by the burners can enter the drying chamber through a plurality of screened entrances 62 formed in the curved wall 18 adjacent the junction of the panels 61 with the curved wall.

Inverted V-shaped guards 63 extend longitudinally over the burners 60, said guards being made of screened material thus preventing chaff and the like being deposited through the entrances 62 and onto the burners.

Draft control apertures 64 are formed within the base 13 immediately below the burners 60 controlled by sliding flaps 65 and it will be seen that air is drawn through these apertures, heated by the burners 60, passing through the screened guards 63 and then into the drying chamber via the entrances 62 and outwardly through the open upper side 20 of the drying chamber.

Situated under the lower portion of the drying chamber and extending the full length thereof is an auger tube

66 carrying a horizontally disposed auger flight 67 journalled for rotation within the end walls 68 of the tube and details of this portion of the invention are shown most clearly in FIGURE 5 of the drawings.

Means are provided selectively to discharge grain from the drying chamber into this horizontally disposed auger and tube, said means consisting of a plurality of substantially rectangular openings 69 formed in the base of the drying chamber. These apertures are selectively opened and closed by means of curved flaps 70 pivoted by one side edge thereof on pivot pins 71 adjacent one side edge of the apertures 69. In this connection reference to FIGURE 5 will show that the other side edge 72 of the flaps overlaps the portion 73 of the base of the drying chamber but in order to present a smooth interior surface to the drying chamber when the flaps are closed, a curved plate 74 is secured as by welding to the flaps 70 which just fits within the apertures 69 and also assists in stiffening the flaps 70.

Each of the flaps is provided with a lug 75 depending downwardly therefrom and connected by a link 76 to one end 77 of an operating bell crank pivoted upon pin 78 supported by brackets 79 secured to the underside of the drying chamber. The other arm 80 of the bell crank is formed by the operating handle 81, movement of which, in the direction of arrow 82, will open the flaps 70 to the position shown in phantom in FIGURE 5 thus permitting the grain to be dumped through the apertures 69 into the auger casing 66. In this connection, a conventional ratchet control 83 is incorporated within the handle 81 so that the flaps can be locked in the closed or open position.

An inverted V-shaped deflector 84 supported upon cross brackets 85 within the auger casing 66, exetnds the full length of the auger casing and facilitates the distribution of the grain to the auger flight 67.

In order to prevent heat from the burners 60 acting upon the grain which may remain within the auger flight 67, I provide elongated shroud panels 86 secured to the underside of the drying chamber and extending downwardly to the floor or base 13 of the supporting framework between the auger casing 66 and the burners 60.

Before proceeding with a description of the next portion of the invention, reference should be made to the means for driving the various components hereinbefore described. A source of power indicated schematically by reference character 87 is provided on a shelf bracket 88 on one side of the supporting framework 10. However, the source of power can readily come from a power takeoff of a separate unit if desired.

It is desirable that a speed reduction unit be incorporated but as this is conventional, it is not illustrated in the attached drawings.

A main drive shaft 89 is journalled for rotation within bearings 90 secured to one longitudinal member 11 upon one side of the assembly and a chain 91 extends between the source of power 87 and this drive shaft thus providing rotation thereto.

Chain wheels 92 are secured to the drive shaft adjacent each end of the drying chamber and further chain wheels 92' are secured to the extending ends of the spindle 47 of the agitator assembly 46'. Chains 94 extend around chain wheels 92' and 93 thus providing a drive for the rotation of the agitator assembly.

A pulley 95 is secured to the drive shaft adjacent one end thereof and a further pulley 96 is secured to the extending end of the auger flight shaft 97 of the horizontal auger flight 67. A belt 98 extends around pulleys 95 and 96 thus providing drive to the auger flight 67. However, it is not desired that this auger flight operate continuously, consequently a belt tightening assembly collectively designated 99 is provided so that power can be transmitted to the auger flight 67 when desired. This belt tightening assembly consists of an operating lever

100 including a ratchet assembly 101 and pivoted upon a pin 102 mounting same upon bracket 103 which in turn is supported upon the transverse member 12 of the supporting framework. A further, relatively short arm 104 is secured to pin 102 and moves with the lever 101, said arm 104 carrying a belt engaging pulley 105 so that movement of the lever 100 leftwardly with regard to FIGURE 1, causes the pulley 105 to engage the outer surface of the belt 98 thus tightening same and engaging it around pulley 96.

Grain augered horizontally by means of the auger flight 67 is discharged into an upwardly inclining auger assembly 106 shown in detail in FIGURE 2, it being understood that the lower end 107 of the auger casing communicates with the end 108 of the horizontal auger casing 66.

Grain is augered upwardly by means of the auger 106 and discharged via spout 109 into a cooling chamber collectively designated 110 situated at one end of the supporting framework adjacent one end of the drying chamber 17. This cooling chamber which is supported upon vertical members 111, is substantially box like in configuration and is made of screened walls 112 with an inverted frustro-pyramidal base 113 also manufactured of screened material.

A source of cooling air 114 is supported upon an offstanding shelf 115 and consists of a fan (not illustrated) driving cool air through a duct 116 to the interior of an air distribution enclosure 117. This distribution enclosure is a hollow box like structure also made of screened material and having sloping upper sides 118. The grain from spout 109 is discharged onto these upper sides 118 thus facilitating the distribution of grain as it falls within the cooling chamber so that cool air passing from the unit 114 passes upwardly through the grain. In this connection, I provide an air deflector 119 within the air distribution enclosure to facilitate the even distribution of the cooling as it passes upwardly through the enclosure 117.

A further upwardly inclining auger assembly 120 communicates with the lower side 121 of the cooling chamber, the lower end of the casing 122 extending into the base 121. Grain is thus augered from the cooling chamber upwardly and discharged via spout 123 to a convenient storage location.

A pulley 124 is secured to the main drive shaft 89 and a further pulley 125 is secured to the source of cool air 114, belt 126 extending around these two pulleys thus providing selectively, a drive for the source of cooled air 114. In this connection a similar belt itghtening assembly to the hereinbefore described belt tightening assembly 99 is provided and operated by the lever 127 as shown in phantom.

A pulley 128 is also secured to the main drive shaft 89 with a further pulley 129 secured to the lower end of the auger assembly 120, belt 130 extending around these two pulleys and providing selective drive means to the auger assembly 120. A belt tightening assembly also is provided for this belt, the details being similar to the belt tightener assembly 99 hereinbefore described and operated by lever 131.

The auger assembly 106 is driven by a belt 132 passing around pulleys 133, 134 on the drive shaft 89 and auger assembly, respectively, a belt tightener 99' being provided for the belt 132 and actuated by the lever 100 through the medium of the pin 102.

The sequence of operation is as follows. A measured quantity of grain is placed within the preloading hopper 21 which is then discharged to the drying chamber by the means shown in FIGURE 6. The burners 60 supply a source of hot air through the entrances 62 and the agitator assembly 45' continuously elevates and dumps the grain through the hot air flowing through the drying chamber. While this grain is being dried, a further load

may be deposited within the preloading chamber 21. When the grain within the drying chamber 17 has been exposed to the drying air for the requisite time, flaps 70 are operated by means of lever 31 thus dumping the grain into the horizontally disposed auger tube 66.

Since various modifications can be made in my invention as hereinabove described, and many apparently widely different embodiments of same made within the spirit and scope of the claims without departing from such spirit and scope, it is intended that all matter contained in the accompanying specification shall be interpreted as illustrative only and not in a limiting sense.

What I claim as my invention is:

1. In a grain dryer, the combination of a horizontal base plate, a substantially cylindrical hollow body mounted horizontally above said base plate and defining a drying chamber therein, said body having closed ends, a bottom portion, a pair of side portions and a top portion provided with an outlet opening for drying gases, means on the upper portion of said body for delivering grain to be dried into said chamber, a screw conveyor for dried grain provided longitudinally on said base plate below said body, the bottom portion of the body being formed with a dried grain outlet opening communicating the bottom of said chamber with said conveyor, a grain agitator rotatably mounted in said chamber, said grain agitator comprising a shaft extending axially in said chamber and rotatably journalled in the closed ends of said body, pairs of arms extending radially from said shaft, a horizontally elongated scoop carried by the outer ends of each pair of said arms, said scoop having a closed outer wall, a pair of closed side walls and an open inner portion oriented radially with respect to said shaft so that the open inner portion is uppermost when the scoop is in the bottom portion of said chamber but is lowermost when the scoop is in the upper portion of the chamber to permit grain to fall from the scoop to the bottom portion of the chamber, means carried by one side wall of each scoop and in wiping contact with the bottom and side portions of said body for gathering and delivering grain from the bottom portion of said chamber into the scoop, a pair of vertical side plates extending downwardly from the side portions of said body to said base plate, a pair of longitudinal partitions disposed at opposite sides of said conveyor and extending downwardly from the bottom portion of the body to the base plate in inwardly spaced relation from the respective side plates, said side plates and said partitions coacting with the bottom and side portions of said body and with the base plate to define a pair of burner compartments, burners provided in said compartments, the side portions of said body being provided with screened openings communicating said burner compartments with said chamber, openable closure means provided for the grain outlet opening in the bottom portion of said body, a dried grain cooler provided on said base plate at one end of said body, and means for delivering dried grain from said conveyor to said cooler.

2. The device as defined in claim 1 wherein said means carried by one side wall of each scoop comprises a wiper plate superposed on said one side wall of each scoop, and means adjustably securing said wiper plate to said one side wall for movement of the wiper plate toward and away from the bottom and side portions of said body to effect a wiping contact therewith.

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