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GRAIN DRIER-COOLER

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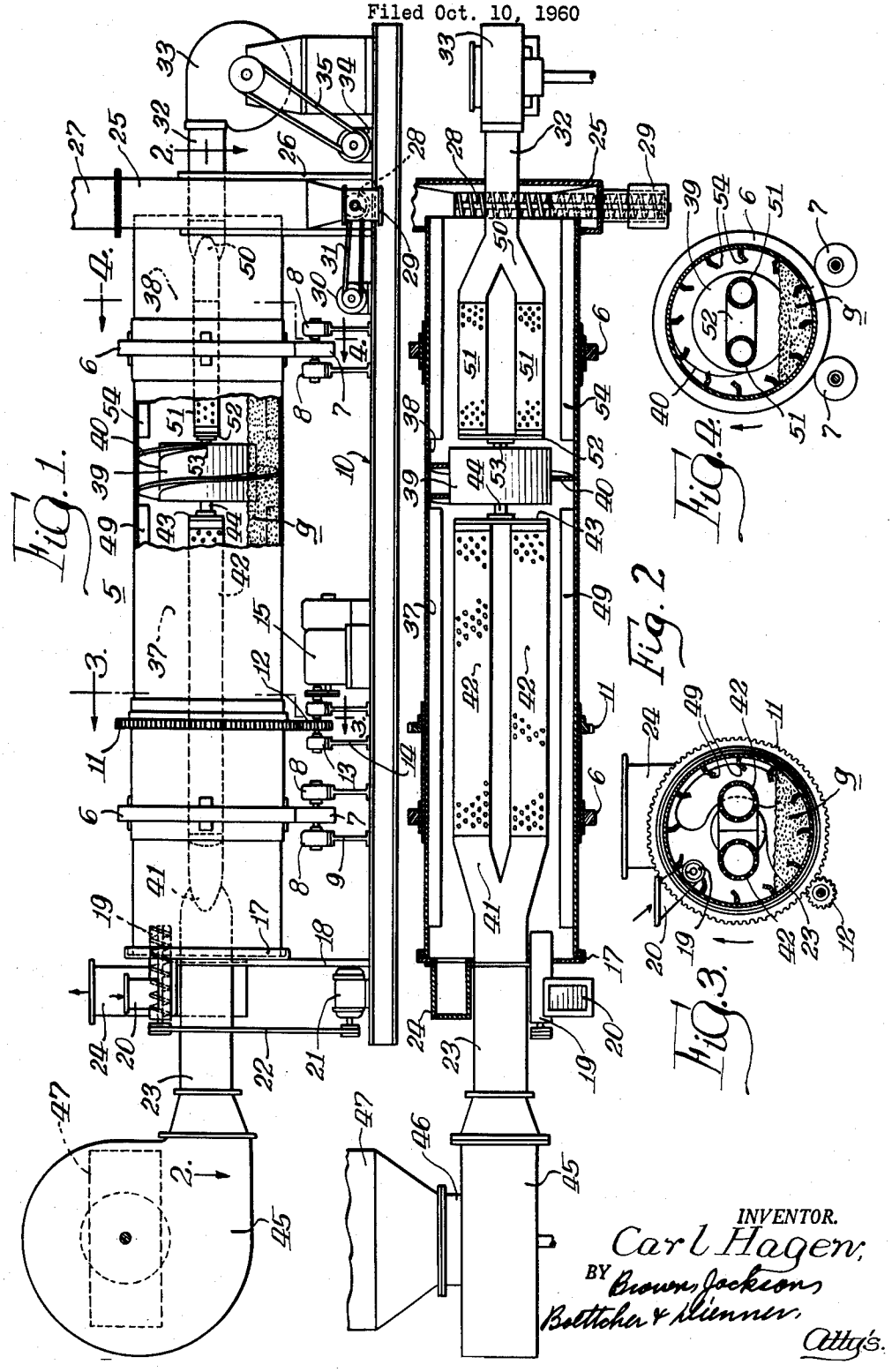


Fig. 1.

Fig. 4.

Fig. 2

Fig. 3.

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GRAIN DRIER-COOLER

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This invention relates to rotary driers, and has to do more particularly with a rotary drier for treatment of various granular materials, including grains such as corn, wheat, soybeans etc.

It is desirable that grain, in general, be effectively dried and cooled preliminary to storage, particularly storage in bulk. My invention is directed to a drier comprising a drying section, in which the excess moisture is effectively removed from the grain and a cooling section in which the grain is cooled and finally dried preliminary to storage or shipment. An important object of my invention is the provision of a drier which is continuous in operation and, accordingly, has large capacity, and in which the grain is first dried to remove the major portion at least of the excess moisture therefrom, the grain then passing to and through a cooling area in which it is cooled and finally dried. More particularly, I provide a rotatably mounted drum having a drying section and a cooling section separated by means effective for preventing flow of air between the two sections, such means also being effective for continuously transferring the material under treatment from the drying section to the cooling section. Further objects and advantages of my invention will appear from the detail description.

In the drawings:

FIGURE 1 is a side view of a drier embodying my invention, the drum being partly broken away and shown in section and certain other parts being broken away.

FIGURE 2 is a sectional view taken substantially on line 2—2 of FIGURE 1, certain parts being shown in plan;

FIGURE 3 is a sectional view taken substantially on line 3—3 of FIGURE 1; and

FIGURE 4 is a sectional view taken substantially on line 4—4 of FIGURE 1.

The drier of my invention comprises a drum 5 of any suitable construction and of substantial length, which is rotatably supported by means of bands or tires 6 suitably mounted on drum 5 and resting upon rollers 7 rotatably mounted between bearing blocks 8 secured to cross I-beams 9 of a base frame 10. The drum 5 is rotated at appropriate speed by means of a ring gear 11 suitably secured thereon and meshing with a spur pinion 12 rotatably mounted between bearing blocks 13 secured on cross I-beams 14 of frame 10, pinion 12 being driven by an electric motor 15 appropriately mounted on the base frame 10. It will be understood that the drum 5 may be of any suitable construction and may be rotatably mounted and driven in any suitable known manner.

The drum 5 is closed at one end by a flanged cap 17 having a substantially air-tight fit with that end of the drum and supported by angle members 18 secured to and extending upward from the base frame 10. A screw feed conveyor 19 of known type extends through cap 17 for delivering grain to the drum 5, screw conveyor 19 receiving grain, from any suitable source, by means of a supply chute 20. The feed conveyor 19 may be driven in any suitable manner, conveniently by means of an electric motor 21 mounted on base frame 10 and having belt and pulley driving connection 22 to the shaft of screw conveyor 19. A heated air conduit 23 extends through cap 17 centrally thereof into drum 5, for supplying heated air to the drying section of the drum, as will be explained

more fully presently. An air outlet elbow 24 is secured to cap 17 at the opposite side of conduit 23 from the feed screw conveyor 19 and opens into drum 5 through cap 17, elbow 24 being in practice connected by a conduit (not shown) to a cyclone separator. A grain discharge and air outlet hood 25 extends snugly about the other end of drum 5 providing a substantially air-tight closure thereabout, hood 25 being suitably supported from frame 10 by angle members 26. An air outlet conduit 27 is attached to the upper end of hood 25 and extends therefrom to any suitable point of discharge. The lower portion of hood 25 converges downward to a discharge screw conveyor 28 of suitable known type extending beyond the sides of frame 10 and provided, at one end, with a downwardly directed discharge spout 29 for delivering the treated grain or other material to an underlying conveyor (not shown) for conveying it to a storage bin or other desired location. The screw conveyor 28 may be driven in any suitable manner, conveniently by means of an electric motor 30 mounted on base frame 10 and having belt and pulley driving connection 31 to the shaft of conveyor 28. A cool air conduit 32, connected to the discharge of a fan 33, which may be of any suitable known type, extends through the hood 25 into the adjacent end of drum 5. Fan 33 is suitably supported from the base and is driven in a suitable manner, conveniently by an electric motor 34 mounted on frame 10 and having pulley and belt driving connection 35 to the shaft of fan 33.

The drum 5 is separated interiorly into a drying section 37 and a cooling section 38, by means of a cylindrical separator 39 disposed within drum 5 in concentric spaced relation thereto, and spiral vane 40 extending about separator 39, bridging the space between the later and the wall of drum 5 and welded to the latter and to the separator 39. Preferably the separator 39 is of hollow construction and is closed at both ends. The heated air conduit 23 is provided, at its inner end, with a Y connector 41. Two supplementary conduits 42 extend from the arms of connector 41 inwardly of the drying section 37 and are closed at their inner ends. The inner ends of the supplementary conduits 42 are secured together by a plate 43 which is pivoted at 44 on the adjacent end of separator 39 centrally thereof. The supplementary conduits 42 are provided with a large number of small perforations, as shown, for admitting high velocity streams or jets of heated air to the drying section 37. At its outer end the conduit 23 is connected to the discharge of a fan 45 of suitable known type driven in a suitable manner, conveniently by an electric motor (not shown). The intake of fan 45 is connected, through a short conduit or neck 46, to the housing of a heater 47 the inlet of which is open to atmosphere. The heater 47 preferably is a known type of gas fired space heater, though any suitable type of heater may be employed within the broader aspects of my invention. As will be understood, air is drawn through the heater 47 by the fan 45 and the heated air is delivered by means of the conduit 23 and the supplementary conduits 42 to the interior of the drying section 38, from which the heated air and the contained moisture escape through the elbow 24 and associated conduit, preferably being directed into a cyclone separator for separating out particles of foreign materials entrained by the air.

The grain or other material to be dried is delivered to the drying section 37 at such a rate that the height of the grain in the lower portion of section 37 extends above the bottom of the separator 39 which, in conjunction with the material under treatment and the vane 40, provides an effective air seal between the sections 37 and 38 of drum 5. The drying section 37 is provided with interior flights 49 extending the major portion of

the length thereof and suitably disposed for raising the grain from the lower portion of the drum and cascading it over the supplementary conduits 42, the falling grain being subjected to the streams of heated air projected through the perforations of conduits 42. In that manner the grain is thoroughly and rapidly dried without excessive or injurious heating thereof. In practice the drum 5 may be inclined downward toward the hood 25 to cause flow of grain toward the separator 39, as is known, or the flights 49 may be disposed at an appropriate angle to produce a screw effect for feeding the grain toward the separator 39, as is also known. The drum 5 is rotated in proper direction to assure that the vane 40 will transfer the grain *g* from the drying section to the cooling section, the direction of rotation of the drum 5 being counterclockwise as viewed from the feed end thereof, i.e. clockwise as viewed in FIGURES 3 and 4 and as indicated by the arrow in each of the latter figures.

The cooling air conduit 32 is provided at its inner end with a Y connection 50 to the arms of which are attached two supplementary conduits 51 closed at their inner ends and connected together by a plate 52 pivoted at 53 on the adjacent end of the separator 39 centrally thereof. The supplementary conduits 51 are provided with a large number of small perforations for discharging cooling air therefrom in high velocity jets or streams. Cooling section 38 is also provided with interior flights 54 for lifting the grain and cascading it downward over the conduits 51, the falling grain being subjected to numerous streams of high velocity cooling air effective for quickly cooling the grain and removing any residual moisture present thereon. The now thoroughly dried and cooled grain is discharged from the cooling section 38 into the hood 25 and passes downward to the discharge screw conveyor 28 which delivers the grain through spout 29 to a suitable conveyor (not shown) or, if desired, to a suitable receptacle. As will be understood, the screw conveyor 28 provides, in cooperation with the material therein, closure means effective for preventing objectionable escape of air therethrough. The feed screw conveyor 19 is likewise effective, in cooperation with the material therein, for preventing objectionable escape of air therethrough.

It will be understood that changes in detail may be resorted to without departing from the field and scope of my invention, and I intend to include all such variations, as fall within the scope of the appended claims, in this application in which the preferred form only of my invention has been disclosed.

I claim:

1. In grain drying and cooling means, a drum of substantially uniform interior diameter mounted for rotation about a substantially horizontal axis, means separating said drum interiorly into a drying section and a cooling section, said separating means comprising an imperforate separator disposed within said drum in substantially concentric spaced relation thereto and remote from both ends thereof and a substantially helical vane bridging the space between and secured to said separator and drum, said vane extending about said separator for at least the full circumference thereof and said sections being respectively of a length substantially greater than said separator, closure means for the ends of said drum, a heated air conduit extending through the drying section end closure means coaxially with said drum and through said drying section with its inner end supported by said separator coaxially therewith, said conduit being spaced between its ends from the wall of the drum and provided with heated air discharge openings, means for supplying cooling air to said cooling section, and means for supplying grain to said drying section adjacent the outer end thereof, the end closure means for said cooling section having means for discharging grain therefrom.

2. In grain drying and cooling means, a drum of substantially uniform interior diameter mounted for rotation about a substantially horizontal axis, means separating said drum interiorly into a drying section and a cooling section, said separating means comprising an imperforate separator disposed within said drum in substantially concentric spaced relation thereto and remote from both ends thereof and a substantially helical vane bridging the space between and secured to said separator and drum, said vane extending about said separator for at least the full circumference thereof and said sections being respectively of a length substantially greater than said separator, stationary closure means for the ends of said drum, a heated air conduit substantially coaxial with said drum extending through the drying section end closure means and to said separator and pivotally mounted thereon at its inner end, said conduit being provided with heated air discharge openings, means for supplying grain to said drying section through said end closure means therefor, means for supplying cooling air to said cooling section, and means for discharging grain from said cooling section through the end closure means therefor.

3. In grain drying and cooling means, a unitary drum of substantially uniform diameter mounted for rotation about a substantially horizontal axis, means separating said drum interiorly into a drying section and a cooling section, said separating means comprising a substantially cylindrical separator closed at its ends disposed within said drum in substantially concentric spaced relation thereto and remote from both ends thereof and a substantially helical vane bridging the space between and secured to said separator and drum, said vane extending about said separator for at least the full circumference thereof and said sections being respectively of a length substantially greater than said separator, stationary closure means for the ends of said drum, a heated air conduit substantially coaxial with said drum extending through the drying section end closure means and to said separator and pivotally mounted thereon at its inner end, said drying section having interior flights effective for raising the grain from the lower portion thereof and cascading it downward over said conduit and the latter having upwardly and outwardly directed heated air discharge openings, means for supplying grain to said drying section through said end closure means therefor, means for supplying cooling air to said cooling section, and means for discharging grain from said cooling section through the end closure means therefor.

4. In grain drying and cooling means, a drum mounted for rotation about a substantially horizontal axis, means separating said drum interiorly into a drying section and a cooling section, said separating means comprising a substantially cylindrical separator closed at its ends disposed within said drum in substantially concentric spaced relation thereto and remote from both ends thereof and a substantially helical vane bridging the space between and secured to said separator and drum, said vane extending about said separator for at least the full circumference thereof and said sections being respectively of a length substantially greater than said separator, closure means for the ends of said drum, a heated air conduit extending through the drying section end closure means coaxially with said drum and through said drying section with its inner end supported by said separator coaxially therewith, said conduit being spaced between its ends from the wall of the drum and provided with heated air discharge openings, means for supplying grain to said drying section adjacent the outer end thereof, and means for supplying cooling air to said cooling section, the end closure means for said cooling section having means for discharging grain therefrom.

5. In grain drying and cooling means, a drum mounted for rotation about a substantially horizontal axis, means separating said drum interiorly into a drying section and a cooling section, said separating means comprising a substantially cylindrical separator closed at its ends disposed within said drum in substantially concentric spaced

relation thereto and remote from both ends thereof and a substantially helical vane bridging the space between and secured to said separator and drum, said vane extending about said separator for at least the full circumference thereof and said sections being respectively of a length substantially greater than said separator, stationary closure means for the ends of said drum, a heated air conduit substantially coaxial with said drying section extending through the end closure means therefor and to said separator and pivotally mounted thereon at its inner end, said conduit being provided with heated air discharge openings, means for supplying grain to said drying section through said end closure means therefor, a cooling air conduit substantially coaxial with said cooling section extending through the end closure means therefor and to said separator and pivotally mounted thereon at its inner end, said conduits being respectively provided with air discharge openings, means for supplying grain to said drying section through said end closure means thereof, and means for discharging grain from said cooling section through said end closure means therefor.

6. In grain drying and cooling means, a drum mounted for rotation about a substantially horizontal axis, means separating said drum interiorly into a drying section and a cooling section, said separating means comprising a substantially cylindrical separator closed at its ends disposed within said drum in substantially concentric spaced relation thereto and remote from both ends thereof and a substantially helical vane bridging the space between and secured to said separator and drum, said vane extending about said separator for at least the full circumference thereof and said sections being respectively of

a length substantially greater than said separator, stationary closure means for the ends of said drum, a heated air conduit substantially coaxial with said drying section extending through the end closure means therefor and to said separator and pivotally mounted thereon at its inner end, said conduit being provided with heated air discharge openings, means for supplying grain to said drying section through said end closure means therefor, a cooling air conduit substantially coaxial with said cooling section extending through the end closure means therefor and to said separator and pivotally mounted thereon at its inner end, said sections respectively having interior flights effective for raising the grain from the lower portion of the section and cascading it downward over the conduit and said conduits respectively having upwardly and outwardly directed air discharge openings, means for supplying grain to said drying section through said end closure means thereof, and means for discharging grain from said cooling section through said end closure means therefor.

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