Aug. 21, 1956 S. JONSSON 2,759,274

APPARATUS FOR DRYING GRAIN

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FIG. 2.

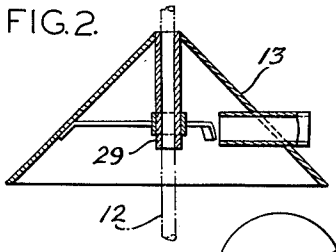


FIG. 1.

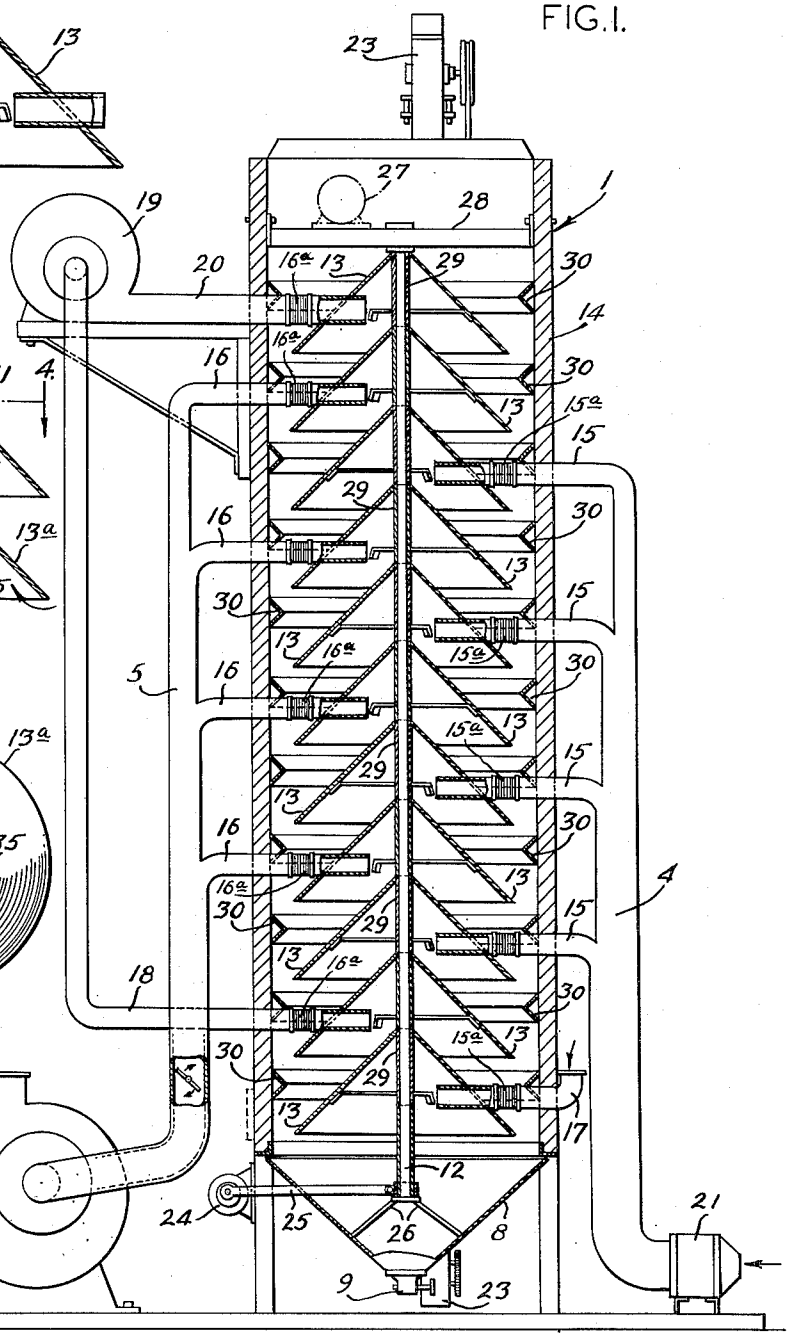


FIG. 3.

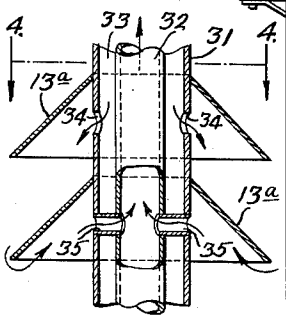
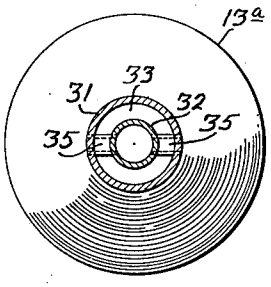


FIG. 4.



INVENTOR:
SIGVARD JONSSON

BY Howson & Howson

ATTYS.

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APPARATUS FOR DRYING GRAIN

Sigvard Jonsson, Stockholm, Sweden, assignor to AB Svenska Flaktfabriken, Stockholm, Sweden

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5 Claims. (Cl. 34—164)

The present invention relates to drying of grain or like material in a drier working continuously with an entirely filled drying tower, said material being supplied to the upper end of the tower and discharged by discharging means at the lower end of the tower and subjected to a gaseous medium during its passage down through the tower. The drying medium is supplied to the material by means of at least one fan and is distributed through the material by means of distributing means disposed in the tower and provided with inclined side surfaces along which the material slides during its passing down through the tower. As air is generally used as medium the term "air" will be used in the following part of the specification and in the claims. In prior known driers of this kind there are many drawbacks which have resulted in disturbances in the drying process and have made it necessary to carefully inspect the drier. These drawbacks have also resulted in a decrease in the drying effect and the quality of the drying material. These drawbacks are especially accentuated by driers for grain. This is due to the fact that the existing driers have not been properly constructed especially in respect to the medium distributing means and the discharging means for the material.

In driers of different types for grain hot air is blown through slots of different sizes from one of the sides of the drying tower. The wet air is generally discharged from the tower through slots disposed on the opposite side of the tower. The grain will, however, be more heated at the inlet end than at the outlet end of the tower due to the provision of an air distributing chamber which entirely covers one of the sides of the tower. This will cause an uneven drying of the grain. Furthermore the air distribution will be uneven as more air will pass the grain which is adjacent the inlet side for hot air into the tower than will pass the grain which is situated at a greater distance from this point. It is also found that if the grain is unevenly heated there will occur "sweating" which has a tendency to cause agglomeration in the grain particles resulting in an uneven flow or passage of the grain through the dryer. This uneven flow will be inclined by the friction which occurs between the grain particles and the slanting surfaces of the air distributing means placed in the passageway for the grain. These air distributing means extend through the tower and are constructed as Λ-shaped beams, so-called ventilating beams. There will also occur friction on the upper part of the discharging means for the material. This means consists of a pair of crosswise Λ-shaped discharge distributors with squared sections and with a discharge opening at each corner. Below these distributors a discharge funnel is located provided with a valve-governed discharge opening for emptying the tower. The shape of the above mentioned parts and the central location of the outlet openings will, in combination with the above mentioned friction, result in an uneven resistance—reckoned in cross section—against the flow of the material. The material will thus flow more rapidly at certain points than at other points.

In order to obtain a better drying efficiency and a more even quality of the grain the flow through the tower of the material must necessarily take place as evenly and uniformly as possible. According to the present invention certain steps are taken for this purpose. The main step is to eliminate to a high degree the friction between the material and the above mentioned slanting surfaces of the air distributing means and/or the discharging means for the material. This is accomplished by vibrating the material during its passing down through the tower and/or the discharging means for the material at least in the layers which move most adjacent to the slanting surfaces of the air distributing means and the discharging means for the material. For this purpose a vibrator can be adapted to the wall of the tower in such manner that this wall and the set of air distributing means are vibrated during the drying. By using discharging means of the above mentioned kind a vibrator can be adapted to the discharge distributor preferably mounted on the underside of said distributor in the central hood. The discharge funnel is disposed below the distributor and mounted in such a manner that the funnel is not influenced by the vibration of the discharge distributor.

The air distributing means may be constructed as Λ-shaped beams but in order to obtain a more even air distribution and a more simple construction of the drying tower, the air distributing means may consist of a number of uniform hoods arranged over each other on a shaft in the tower. The horizontal section in top view of the hoods is uniform with the cross section of the tower and —vertically viewed—every second hood of the drying section communicates by means of a pipe with a distributor for incoming drying medium (air) which extends along the exterior of the tower. The other hoods of this section communicate with a wet air collecting duct which extends along the opposite exterior of the tower.

The invention will be described more particularly hereinafter with reference to the accompanying drawings in which different embodiments of the invention are illustrated and in which

Fig. 1 is partly in side view and partly in sectional elevation another embodiment of a drying tower in accordance with the invention.

Fig. 2 is in sectional elevation an air distributing hood for a drying tower as shown in Fig. 1.

Fig. 3 is in cross section and partly in side view a third embodiment of the invented apparatus, intended to be built in existing drying towers.

Fig. 4 shows the apparatus along line 4—4 of Fig. 3.

Referring now to Fig. 1 the air distributing means consist of a number, in the present case **11**, of uniform hoods **13** arranged over each other on an axle or shaft **12** extending centrally through the tower **1**. The hoods **13** are uniform with the section of the tower **1** and have such a width that the desired quantity of material can, per unit of time, pass between the outer edge of the hoods and the wall **14** of the tower. The apparatus includes a cooling section consisting of two bottom hoods, a drying section consisting of eight hoods disposed next above the cooling section and lastly a pre-heating section consisting of the top hood.

Each second hood **13** in the drying section communicates by means of a pipe **15** with the inlet distributor **4** for drying air which distributor extends along one side of the tower wall **14**, while the other hoods **13** of this section communicate by means of a pipe **16** with the wet air collector **5** extending along the opposite side of the tower **1**. The pipes **15** and **16** are slidingly inserted through the walls of the hoods **13** and may be provided with flexible connections **15***a* and **16***a* intermediate the hoods **13** and the tower wall **14**. One of the hoods, the lowest one of the cooling section, com-

municates by means of a pipe 17 with the atmosphere, while the upper hood of the cooling section communicates by means of a pipe 18 with the suction side of a fan 19. The pressure side of this fan communicates by means of a pipe 20 with the distributing hood 13 of the pre-heating section, i. e. the top hood 13.

The distributor 4 for incoming air is connected to a heat source 21 in which air entering the tower from the atmosphere is heated. The wet air collector 5 communicates with the suction side of a fan 22 which sucks air from the heat source 21 through the material in the tower via the distributing hoods. The air will thus be evenly distributed over a section of the material in the tower. The cooling section can of course consist of more than two distributing hoods. The pre-heating section can also consist of more than one such hoods.

It is not necessary to use a special discharge distributor for the drying material. The mass of the drying material can rest directly in a discharge or emptying funnel 8 provided with a valve-governed outlet 9. Well-known elevators for the material are shown at 23 (below) and 23*a* (at the top of Fig. 1).

In a drying tower according to Fig. 1 a vibrator 24 is arranged on the outer side of the lower part of the tower. The vibrator is arranged to influence the centrally extending axle 12 by means of transmission means 25. The whole set of air distributing hoods 13 can thus be vibrated via the axle 12. The lower end of the axle 12 is furthermore rigidly connected by means of a spider 26 with the discharge funnel 8 so that vibrations are transmitted to this funnel. A vibrator 27 (see the dotted lines in Fig. 1) can also be mounted on a cross bar 28 located at the top of the tower 1, and carrying the central axle 12 and the air distributing hoods 13.

As is evident from Fig. 2 each air distributing hood 13 is suitably provided with a central sleeve 29. The sleeves can be straight on the centre axle 12. The sleeves have such a length that the desired space is provided between the hoods 13 and the sleeves constituting a medium distributing arrangement when the ends of the sleeves 29 are resting on each other along the axle 12.

Oblique guiding plates 30 are suitably arranged on the inside of the wall of the tower and located approximately halfway between the hoods 13.

An existing empty tower made for instance of concrete can in accordance with the invention easily be completed by carrying out the embodiment according to Figures 3 and 4 where the means for air distribution and air evacuation are built together with the inlet distributor and the wet air collector to a standardized unit which can be inserted in the tower. The central axle consists in this case of two concentric tubes 31 and 32. The space 33 between the outer tube 31 and the inner tube 32 can be used as inlet distributors for drying air and the inner tube 32 can be used as wet air collector. In this case the air currents will have the direction as shown by the arrows in Fig. 3. By this arrangement every second hood 13*a* communicates with the space 33 by means of openings 34 in the outer tube. The other hoods 13*a* communicate with the inner tube 32 by means of the pipes 35 extending through the space 33. The above mentioned arrangement is very simple and practical and can be pre-fabricated in sections each consisting of a small number of hoods 13*a*.

By the vibratory motion of the grain particles there will also be a mutual motion. The particles can thus be more effectively subjected to the drying air resulting in an increased drying effect in comparison with prior known processes.

It will be understood that various changes in details of construction and arrangement can be made to suit different materials and different conditions of use and that the invention is not restricted to the particular construction and arrangement shown and described herein.

What I claim is:

1. In a drying tower for grain and like material, an inlet for said material adjacent the top of said tower, an outlet adjacent the bottom thereof, means restricting the outlet to afford complete filling of the tower by said material, a longitudinal axle mounted centrally in said tower, a series of spaced vertically aligned upwardly projecting hollow conical members mounted coaxially on said axle and extending outwardly into close proximity to the side walls of the tower in the path of travel of said grain to direct the same outwardly against the walls of said tower, means to supply drying medium to the interior surfaces of alternate members of said series for outward flow into the material to entrap the moisture therein and dry the same, suction means in fluid connection with the interior surfaces of the intermediate members of said series to withdraw the moisture-laden medium from the material, and means to vibrate said axle to assist the flow of material through the tower.

2. A device according to claim 1 including means to supply a cooling medium to the interior of the lowermost member of said series for outward flow into the material to entrap the heat therefrom and cool the same, and suction means connected to the interior of the upwardly adjacent member of said series to withdraw the heated medium from said material.

3. A device according to claim 1 including oblique guiding plates mounted on the interior wall of said tower projecting inwardly intermediate the members of said series to support the material in said tower during its downward travel therethrough.

4. A device according to claim 1 wherein each said conical member comprises a central sleeve slidably engaged on said axle to mount said member on said axle in spaced vertical alignment with the remaining members of said series.

5. A device according to claim 1 wherein said central axle comprises a pair of coaxial tubular members mounted one within the other, wherein further one of said tubular members comprises a supply duct for the drying medium and is connected to the intermediate members of said series, and the other of said tubular members comprises an outlet duct for the drying medium and is connected to the alternate members of said series.

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