(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 072 633**
A2

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: 82303928.4

(22) Date of filing: 23.07.82

(51) Int. Cl.³: F 26 B 17/12
F 26 B 25/00

(30) Priority: 18.08.81 GB 8125171

(43) Date of publication of application:
23.02.83 Bulletin 83/8

(84) Designated Contracting States:
AT CH DE FR IT LI NL SE

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(54) **Improvements in and relating to grain drying apparatus.**

(57) A grain dryer of the concurrent flow type wherein drying air is introduced into the top of a column above a grain bed in the column and grain is evenly distributed on to the top of the bed by a rotatable distributor which acts automatically to control the feed of grain in accordance with grain discharge. In accordance with a further feature the distributor is designed to avoid "ploughing" into a grain bed and so acts to maintain a flat top surface for the grain bed.

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The present invention relates to grain dryers and a method of feeding grain into such dryers.

In a grain dryer, particularly a concurrent flow hot air dryer, the design of the means whereby the grain and air are brought together is critical. In a concurrent flow hot air dryer, grain is fed into the top of a drying column and hot air is passed through the grain bed in the column in the same direction as the grain in the bed continuously flows down the column to a grain outlet. A low grain inlet temperature and rapid evaporation of moisture from the grain is required to keep it well below the air temperature and avoid heat damage. Moisture can only evaporate rapidly from the grain for a short time, due to the moisture gradients set up in the grain kernels so the time of direct exposure to the hot air must be short. On the other hand, if any grain is not exposed to the hot air at the start of drying it will remain wetter than required as it passes down the dryer column.

A grain dryer according to the present invention comprises a dryer column normally of circular cross section, means for feeding drying air into the top of the column, and means for feeding grain into the top of the column, the grain feed means comprising a distributor rotatably mounted in the dryer so as to distribute grain evenly around the top of a grain bed in an upper part of the column.

A method of drying grain according to the invention comprises feeding drying air into the top of a dryer column, feeding grain into the top of the dryer column and distributing it evenly around over the top of a grain bed in an upper part of the column.

In such a dryer and method according to the invention the grain is kept separate from the drying air and is thereby kept as cool as possible until it meets the drying air at the entry point to the bed. Virtually all the grain is then exposed, for a short time, to the inlet drying air. The grain on the top of the bed can be maintained in a flat level condition so that the air and grain move initially parallel to the column axis which results in uniform treatment of the grain.

Preferably the distributor is provided with an inlet coaxial with the column axis and an outlet or outlets which extend outwards from the inlet axis to or towards the inner periphery of the column.

In order to keep the grain being distributed as cool as possible it is advantageous to insulate the distributor. In order to simplify the distributor design and to avoid matching the outlets in a multi outlet distributor a single outlet is preferable, extending outwards from the inlet axis.

To avoid the necessity of matching distributor rotation rate to dryer output rate, the rotation rate may be substantially constant. However in this case if the dryer output rate is appreciably slower than the input rate the grain bed level will tend to rise and grain will tend to build up ahead of the distributor. To prevent the distributor from "ploughing" into the build up, the distributor is preferably provided with a leading surface angled upwardly from the plane of rotation in the direction of rotation and preferably the lower edge of the leading surface of the distributor is higher than the trailing edge. In an experimental model the distributor leading edge was 2 mm higher than the trailing

edge and this was satisfactory.

The speed of rotation of the distributor may be as low as 1 to 2 rpm but in an experimental model the speed was satisfactory at 15 rpm. It is therefore considered a speed range of 1-20 rpm is suitable.

An embodiment of the invention will now be described in detail by way of example with reference to the accompanying drawings in which:

Figure 1 is a cross section of the upper part of a grain dryer according to the invention having a rotating distributor,

Figure 2 shows a side elevation of a distributor for the dryer of Figure 1 the shape of which is different to that shown in Figure 1 and

Figure 3 is a section on the centre line (the axis of rotation) of the distributor of Figure 2.

The dryer shown in Figure 1 has a cylindrical dryer column 1 with an inner wall 2 and an outer wall 3. The column has a triangular roof 4 in the centre of which is a grain inlet 5 forming part of means for feeding grain into the top of the column. The inlet 5 is coaxial with the column axis 6. Mounted in the upper portion or head of the column and connected to the grain inlet 5 is a rotatable distributor 8 forming part of the grain feed means.

The distributor 8 is rotatable about a top bearing 10 and has a lower bearing formed by a rail 12 on the inner wall 2 on which rail runs a wheel or roller 14 mounted on the outer wall 20 of the distributor 8.

The distributor 8 is insulated with a layer of insulation

16 on its top and sides. The bottom 18 of the distributor is open between the column axis 6 and the outer wall 20 of the distributor so that grain may be spread evenly out around the top 22 of the grain bed 24 in the column.

Also in the head of the column is a motor 28 arranged to drive the distributor 8 through a chain or belt 30 at for example a constant rate of between 1 and 20 rpm.

As the distributor rotates, grain passes through the inlet 5 to fill the body of the distributor and then falls from the open bottom 18 on to the top of the bed. The rotation causes the grain to be spread evenly around the bed. As the top surface of the bed rises to meet the bottom of the distributor the grain flow is restricted to maintain the correct bed height. As grain is discharged from the bottom of the dryer, the top surface of the bed falls and further grain is then spread on to the bed. The top surface of the bed is kept flat.

The space 34 above the grain bed 24 has a hot drying air inlet 32 in one side through which hot drying air passes into the space 34 above the top surface 22 of the grain bed 24. The drying air which is under pressure passes down through the bed 24 parallel to the axis 6 and is extracted through ducts 36 passing horizontally across the column and through the bed.

The grain itself also falls down the column around the ducts 36 to outlets 38 towards the bottom of the column where the grain is extracted by suitable means.

Figures 2 and 3 show a preferred embodiment of distributor shape.

The distributor 8' shown in Figures 2 and 3 has an

opening 18' at the bottom similar to that shown in Figure 1, and is similarly positioned in line with the axis 6' of the dryer column.

The end cross sectional view of Figure 3 looking from the outside of the dryer column towards the centre shows that the body is in the form of a tapering cylinder with the trailing rear wall 40 extending at an angle of about 58° to the top surface 22 of the grain bed and the leading front wall 42 at an angle of about 70°.

The leading edge 44 of the leading wall is bent first parallel with the top surface of the grain bed and then upwardly at an angle of about 20° and finally is turned further up to join a plate 46 which extends back to the wall 42.

The lower edge 48 of the trailing wall extends downwardly below the surface of the bed so that the outlet opening 18' is at an angle to the top of the bed as can clearly be seen in Figure 3, in the direction of travel of the distributor as indicated by arrow D.

As the distributor is rotated grain diagrammatically illustrated at 50 in Figure 3, which is at ambient temperature moves down the distributor to be deposited on the top of the grain bed where it is subjected to hot drying air.

If grain is not being discharged from the bottom of the dryer or is only being discharged slowly then the top surface of the bed rises. As the mouth or outlet 18' is angled in the direction of travel as explained above excess grain is forced into the mouth to prevent further grain being discharged on to the bed which could cause "ploughing" of the distributor into the grain.

It is also preferable that surfaces surrounding air space 34 above the grain bed 24 are insulated as well as hot air duct or ducts supplying drying air inlet 32 in the interests of heat

loss efficiency.

What we claim is:

1. A grain dryer of the concurrent flow type in which grain is fed into the top of a drying column of circular cross section and drying air is introduced into the column to flow down through the grain as the grain descends in the column towards grain outlet(s) in the lower portion of the column wherein the grain is fed into the top of the column through a distributor which is rotatably mounted in the upper part of the column and which is so designed as to distribute grain evenly onto the top of a grain bed in the column as the distributor rotates.

2. A grain dryer as claimed in Claim 1 in which the distributor has an outlet or outlets which extend outwardly from the axis of rotation to or towards the inner periphery of the column.

3. A grain dryer as claimed in Claim 2 in which the distributor has a single outlet extending radially outwardly from a point at or adjacent the axis of rotation to a point at or adjacent the inner periphery of the column.

4. A grain dryer as claimed in any of the preceding claims wherein the distributor has a single inlet coaxial with the column axis.

5. A grain dryer as claimed in any of the preceding claims in which the distributor drive is such that the distributor may be rotated at a constant pre-determined speed.

6. A grain dryer as claimed in any of the preceding claims in which the leading lower edge of the distributor is bent upwardly away from the plane of the grain bed.

7. A grain dryer as claimed in any of the preceding claims in which the edge of the leading wall of the distributor

is at a level above that of the edge of the trailing wall.

8. A method of feeding grain to a grain dryer of the concurrent flow type wherein heated air is fed into the top of the dryer column and grain is also fed into the top of the column by distributing it evenly over the top of a grain bed in the column, the top flat surface of the grain bed being open to drying air introduced into the column.

9. A grain dryer substantially as hereinbefore described with reference to the accompanying drawings.

Fig. 1.

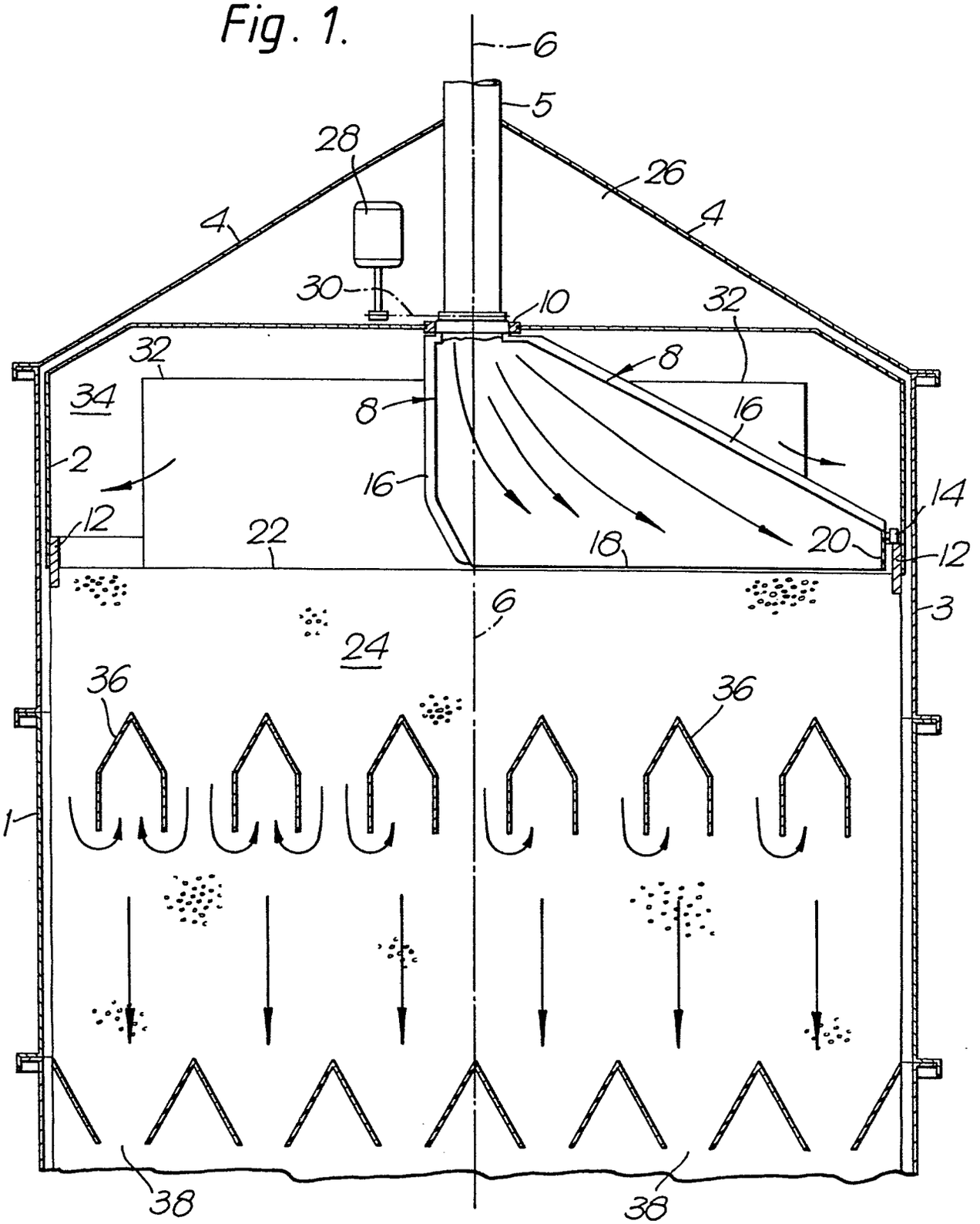
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Fig. 2.

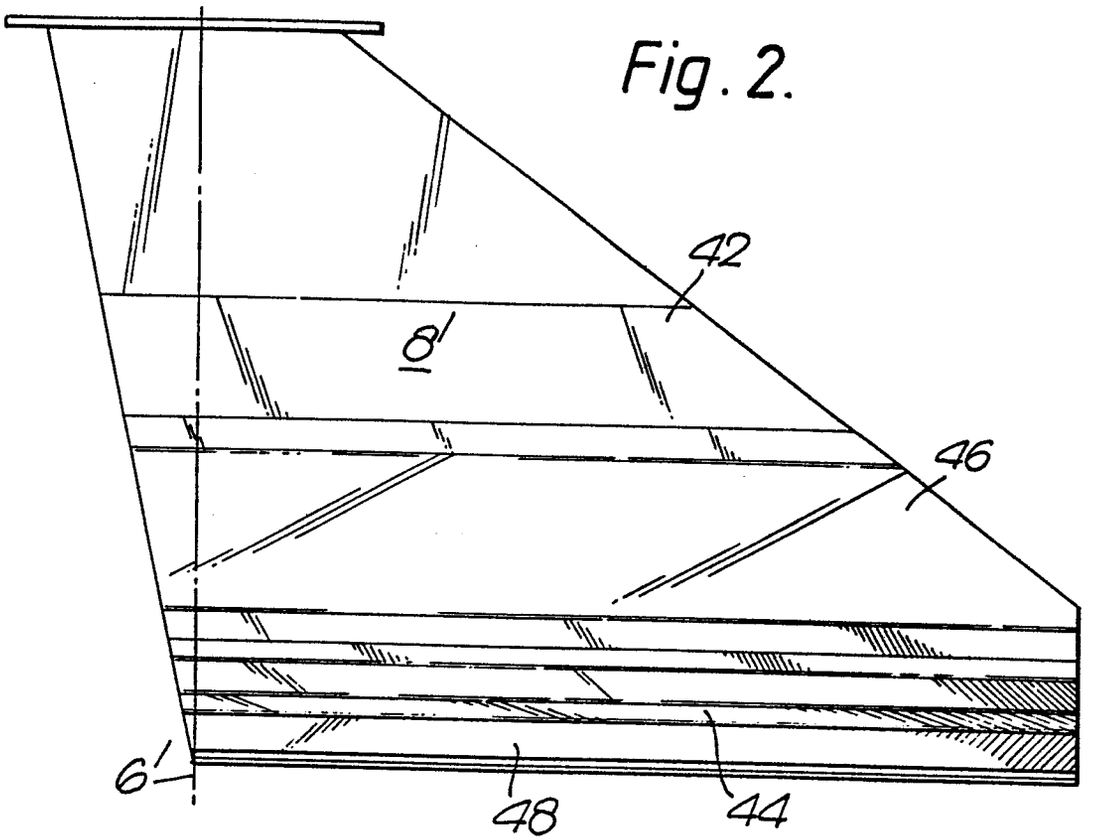

Fig. 3.