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

(11) Publication number: **0 072 639**
A2

(12) EUROPEAN PATENT APPLICATION

(21) Application number: 82304037.3

(22) Date of filing: 30.07.82

(51) Int. Cl.³: F 26 B 17/12

(30) Priority: 18.08.81 GB 8125170

(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 dryers.

(57) A concurrent flow grain dryer of the type in which drying air passes through a drying column or tower in the same direction as grain falling down the column or tower the air being extracted through one or more ducts extending horizontally across the column or tower the ducts being open bottomed troughs having a closed top and sides extending downwards from the top wherein the boundary of the effective lower edge of each side of a duct is longer than the horizontal length of the duct.

The fact that the boundary edge is longer than the length slows down the air as it passes down and subsequently around the effective lower edge up into the duct so as to reduce the possibility of grain being carried into the duct by the air.

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The present invention relates to grain dryers.

In concurrent flow grain dryers where drying air is passed through the grain in a drying column it is known to provide ducts across the column through which the drying air is extracted. In these dryers both the air and grain flow downwards towards the ducts, air flows into the ducts and the grain carries on past the ducts. The ducts which have been used are formed as upturned open troughs so that each has a closed top and two sides extend generally parallel to each other downwardly from the top, the bottom being open. The air flows down the sides and then around the bottom free edge of the sides. In such dryers problems have been caused by the drying air which accelerates as it passes around a duct and then flows around the bottom edge of the sides, carrying some grain with it so that eventually the ducts become filled with grain which then has to be swept out of the ducts. In order to attempt to overcome this problem louvres were fitted in the sides. However this did not appreciably overcome the problem.

After considerable experimental work the problem was overcome by a dryer according to the present invention which comprises a column through which drying air and grain may be passed, drying air ducts extending substantially horizontally across the column, the ducts each having a closed top and sides extending downwards from the top, the boundary of the effective lower edge of each side exposable to grain in the column being substantially longer than the horizontal length of the duct exposable to grain in the column.

In a preferred embodiment the boundary of the effective

lower edge of each side is formed as a comb that is with a deeply indented edge. However different edge configurations may be provided. A castellated edge has been successfully tried. In order to strengthen the edge each side may be formed with closed slots the lower edge of which is then bent back across the slots so that the slots are open at the lowest portion of the edge. A comb is thus formed with the tips or comb teeth strengthened by the bent back portion. The free edge (as compared with the effective edge which is formed at the line where the lower edge is bent) may then be bent down inwardly of the effective edge.

The substantial lengthening of the boundary of the effective lower edge has the effect of lengthening the edge of the duct in contact with the grain which results in a substantial reduction of air flow speed at the lower edge. This reduces or eliminates the tendency of the drying air to pick up grain and draw this into each duct.

Further air moving downward outside the duct may seep into the duct through the comb gaps before reaching the bottom edge of the comb so that only a relatively small volume of air at relatively low velocity will reach the edge. The open slots allow grain to fall down through the slots without blockage.

The tops of each duct are preferably formed with a triangular apex, the apex angle being for example, 60°. This has been found to provide an advantage in assisting grain flow around the top of the duct.

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

Fig. 1 is a cross section through part of a dryer column of a grain dryer according to the invention showing several dryer ducts,

Fig. 2 is a perspective view of a dryer duct for the dryer of Fig. 1,

Fig. 3 is a perspective view of the comb plate of Fig. 2, and

Fig. 4 is a plan view of the comb plate of Fig. 3 before bending.

In Fig. 1 three ducts 2, 2' and 2" are shown mounted horizontally across a grain dryer column 3. In practice there will usually be more than three ducts and often more than one tier of ducts.

Drying air shown by firm arrows 4 is passed down through the column in which a descending bed of grain, shown by broken arrow 5, also flows. Drying air when it reaches the ducts 2 - 2" may flow through and beneath the straight duct sides 7 into the inside 8 of each duct one of which is shown in more detail in Fig. 2. The grain continues downwards below the ducts forming open surfaces 10 under each duct, whilst the drying air exits from an end of the duct.

The sides 7 of each duct are substantially vertical and parallel to each other and towards the bottom have a plate 14 welded, rivetted or bolted to them extending the sides downwards and providing a comb. The comb has teeth 16 and gaps 18 between the teeth open at the effective lower edge 19, so that the effective lower edge boundary formed by the sides and bottom edge 15 of the

teeth 16 and root 17 of the gaps 18 is very substantially longer than the horizontal length 20 of the duct. The plate 14 is bent slightly outwards (say 9°) about a line 21, and abruptly inwards (say 99°) about a line 22 to form the effective edge 19, the lines 21 and 22 being parallel with the elongate axis 24 of the duct. The plate 14 is slotted with closed slots which at the bend line form the comb gaps 18 above for ease of manufacture and for strength. The plate 14 is further bent downwards (say 90°) about a line 23 parallel with axis 24 to form a stiffening edge portion 25, the free edge of which is positioned inwardly of the effective edge 19.

As the grain flows between the ducts as seen in Fig. 1, the grain speed increases as does also the air speed. As the air turns into the duct the comb like lower edge of the duct slows the air to prevent the air drawing grains up into the duct and also the volume of air reaching the lower edge is reduced by the seepage of air through the slots as it travels down around the duct sides.

The apex 12 of the top of the duct is angled at 60° which smoothes the grain flow around the duct top and which helps to prevent dead areas of slow moving or immobile grain above the ducts.

Fig. 3 is another view of the comb plate of Fig. 2 and Fig. 4 shows the comb plate of Fig. 3 prior to bending.

An an example for a duct length of 2,500 mm, the slot widths may each be 1.2-1.4 mm with a tooth width of the slots 3.6-3.8 mm the gap length is 65 mm from edge 19 to root 17. It will thus be appreciated that the boundary length of the bottom effective edge of the duct is very substantially longer than the length of the duct.

The comb can be replaced by a castellated configuration but this is more difficult to construct and strengthen. Other configurations may be provided for instance the plate portion between bends 22 and 23 may be sloped downwards to assist in cleaning the duct and comb, or else this portion can be bent upwards but the comb configuration provides a very large lower edge boundary increase which effectively slows the air flow at the point where the drying air enters the duct. Seepage of air moving downwards with the grain is allowed before the bottom edge of the comb thus any air reaching this level will be relatively small in volume and at a low velocity.

Air seepage into the duct could be achieved via any suitable perforations with perforations smaller than the grain but this could easily become blocked if the comb arrangement of the invention were not followed. The comb arrangement enables the gaps between the comb teeth to be kept clear due to the effective open bottom end of the gaps.

What we claim is:

1. A concurrent flow grain dryer of the type in which drying air passes through a drying column or tower in the same direction as grain falling down the column or tower the air being extracted through one or more ducts extending horizontally across the column or tower the ducts being open bottomed troughs having a closed top and sides extending downwards from the top wherein the boundary of the effective lower edge of each side of a duct is longer than the horizontal length of the duct.

2. A grain dryer as claimed in Claim 1 in which the lower edge of each side wall is deeply indented to form a comb shape.

3. A grain dryer as claimed in Claim 2 in which the comb shape is provided by slots in the bottom area of the walls, the slotted portion being bent inwardly, near the ends of the slots to provide separated teeth at the bend line which forms the effective lower edge of the duct wall.

4. A grain dryer as claimed in Claim 3 in which the slots are provided in a separate plate attached to the duct wall, the plate edge being bent downwardly after the inward bend.

5. A grain dryer as claimed in any of the preceding claims in which the ducts have a triangular "roof" and then downwardly extending sides.

6. A grain dryer as claimed in any of the preceding claims having a number of ducts extending horizontally across the dryer side by side in one or more vertical positions.

7. A grain dryer substantially as hereinbefore

described with reference to the accompanying drawings.

8. A duct for a grain dryer substantially as hereinbefore described with reference to Figures 2 to 4 of the accompanying drawings.

Fig.1.

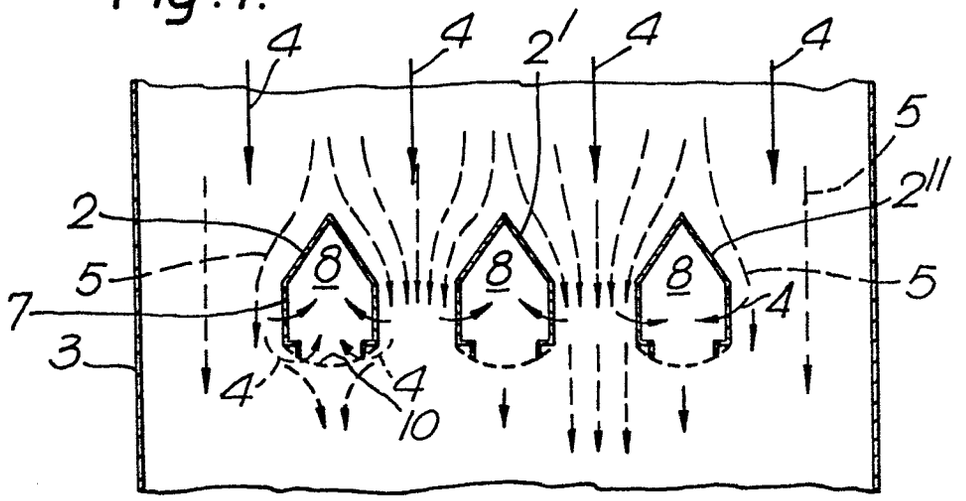

4
4
2'
4
4
5
2''
2
5
8
8
8
5
7
4
3
4'
4
10

Fig.2.

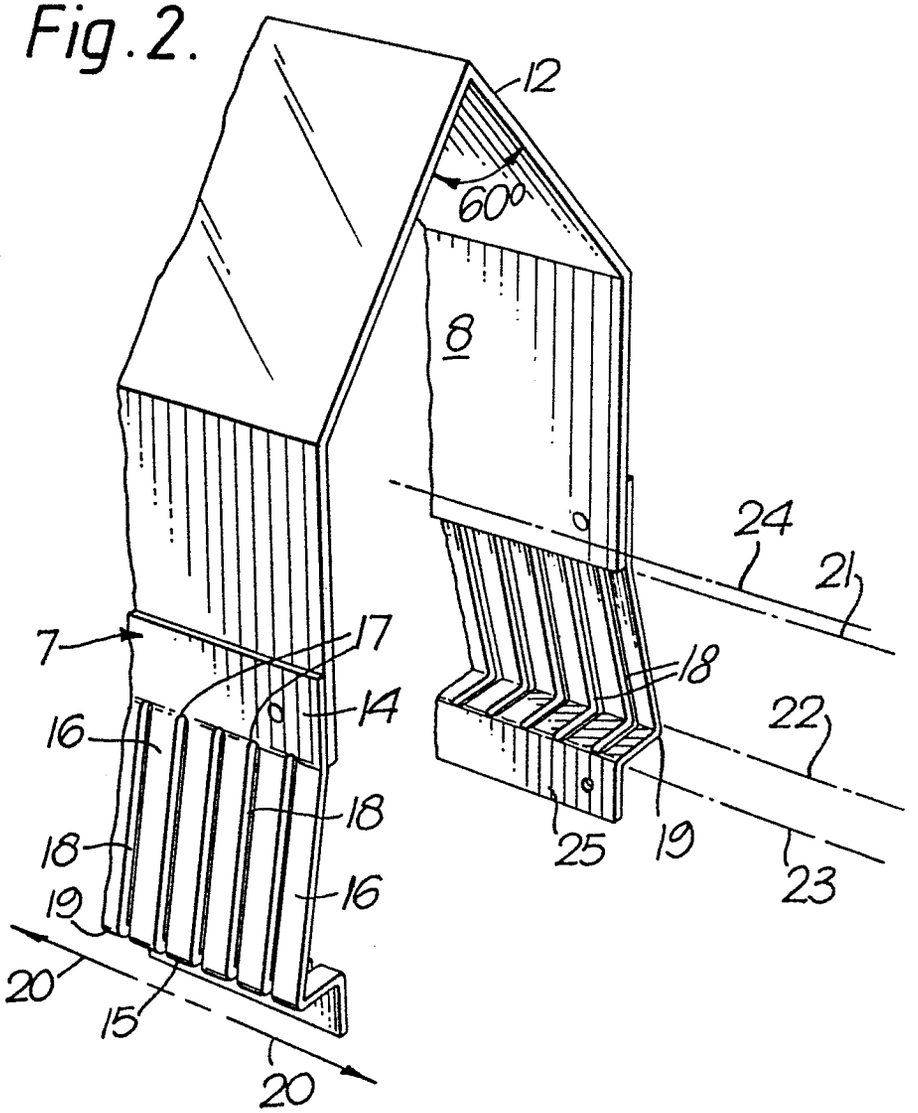

12
60°
8
24
21
7
17
18
16
14
22
18
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25
19
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16
23
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20

Fig.3.

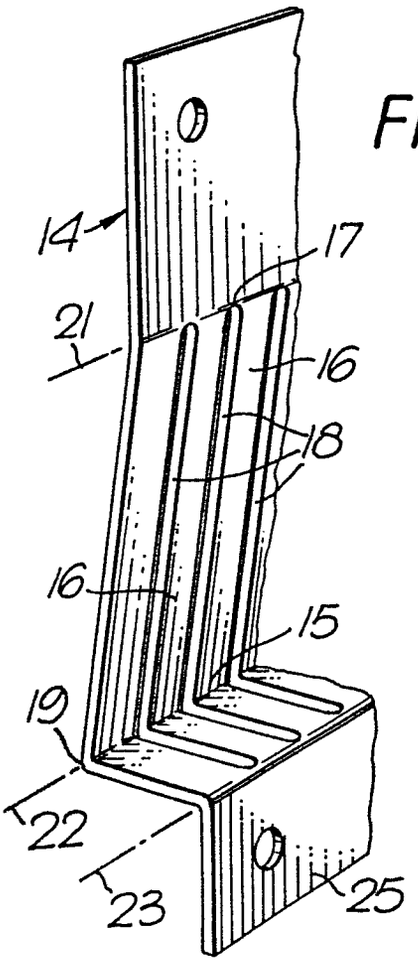


Fig.4

