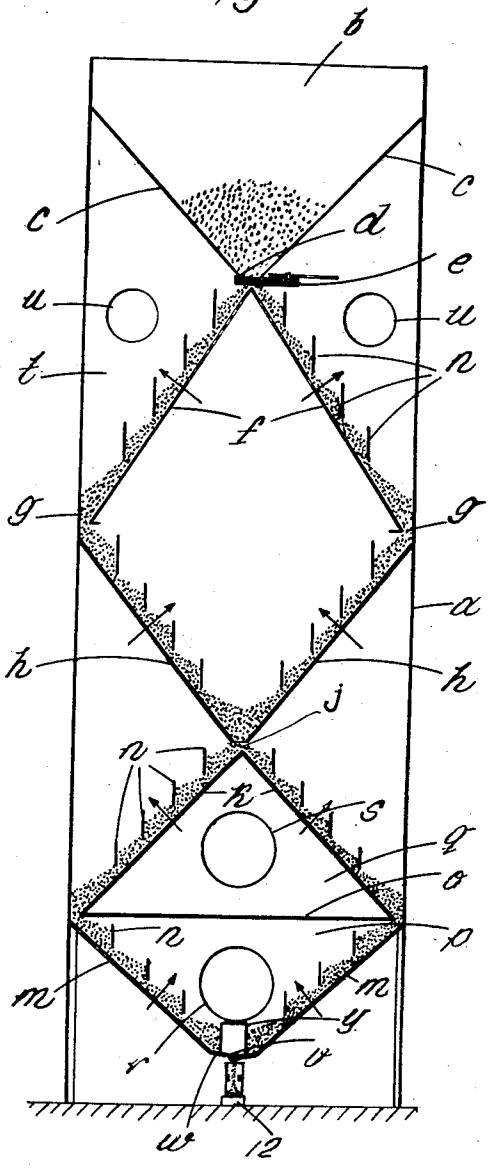
May 10, 1949. G. WOOD ET AL 2,469,424

MEANS FOR DRYING GRAIN

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Fig. 1.



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Fig. 2.

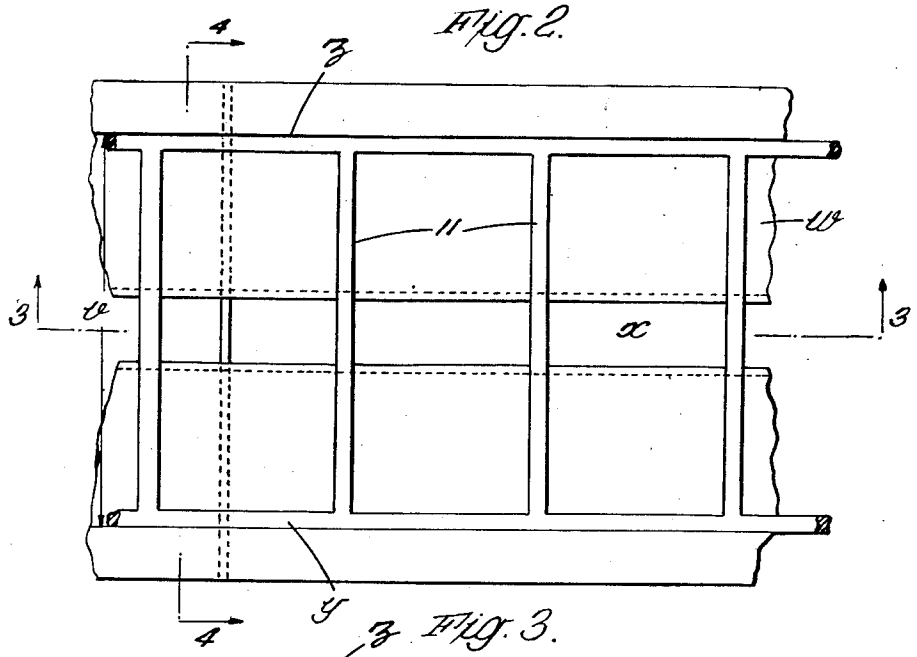
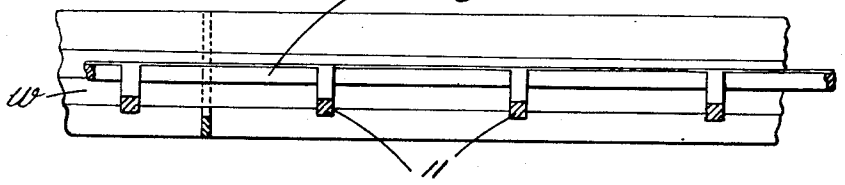


Fig. 3.



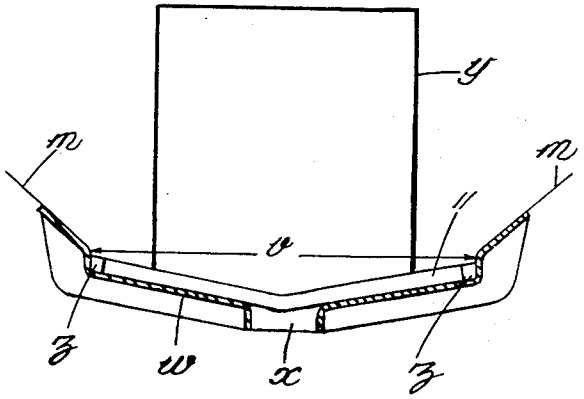


Fig. 4.

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MEANS FOR DRYING GRAIN

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3 Claims. (Cl. 34—65)

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It is necessary that newly harvested grain should be dried before it is stored in silos, for which purpose various devices of the hopper type have been provided through which the grain descends through a cross flow of dried air to absorb the moisture. Such means, however, are inefficient if the grain leaves the hopper in a more or less solid stream, and to overcome this the height of the means must be great to subject the grain to the dried air flow for a longer period. The aim of the present invention is to reduce the height of such a drier and at the same time to increase its efficiency.

This is accomplished, according to the invention, by means of a wide hopper having one or more narrow slots leading from the whole, or substantially the whole of the width of its bottom and by allowing the grain to slide in a thin layer or layers over one or more downwardly inclined beds of perforated or reticulated material through which drying air is drawn. Preferably two air circuits are employed, hot air being drawn through the upper part of the bed or beds and cold air through the lower part thereof, so that the grain is suitably cooled before it is delivered to the silo, the air thus drawn through the grain, together with all fumes, being then discharged outside the structure by externally situated fans which, therefore, tend to cause the air constantly to expand, the resistance to the flow of the air, e. g. as it passes through the bed or beds of grain increasing the suction effect and, consequently, the power of the air to carry away moisture.

The spreading of the grain into a thin layer on the, or each, bed is accomplished partly by the elongated slot at the bottom of the hopper and partly by arranging at a suitable distance above the, or each, bed a series of vertically disposed, preferably adjustable, baffle plates under which only a limited (variable) depth of grain can pass, the baffle plates being of such height, relatively to their separation from one another, that the grain cannot cascade over the top of a lower one.

The sides of the slot or slots of the hopper may be disposed to deliver grain from the same horizontal level to the upper surfaces of two perforated plates directly below the hopper. The greater dimension of such slot or slots is the full width of the hopper and the smaller dimension of such slot or slots may be adjustable so that this dimension may be maintained the same as the spacing of the baffles from the perforated plates.

In consequence of this arrangement, the grain is caused to flow as a shallow stream over each perforated plate and the individual grains are

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caused to roll, thus presenting all parts of their surfaces to the flow of air and ensuring intimate contact therewith. The hot air drawn through the grain at the upper part of the slope dries it efficiently and the cold air drawn through at the lower part of the slope removes heat which may have been taken up at the drying stage. At the bottom of the slope is provided a suitable gate or the like by which the rate of flow of the grain may be controlled, the grain building up in the spaces between the baffles and preventing further flow when the gate is closed.

According to a preferred embodiment of the invention there are arranged, in a drying tower or the like having a hopper as set out above but having only a single outlet slot, a plurality of pairs of inclined beds of perforated or reticulated material, alternate pairs being oppositely inclined and arranged to permit the passage of grain from one pair to the next and each of said beds having spaced above its upper surface a series of baffle plates, which may be adjustable, under which only a limited depth of grain can pass, the baffle plates of each series being of such height, relatively to their separation from one another that the grain cannot cascade over their tops, the lowermost pair or pairs of inclined beds (cooling beds) being separated by a partition from those above, except where space is left for the passage of grain, so that cold air may enter the tower or the like below the lowermost pair or pairs of beds and be exhausted from above said beds, but from beneath the partition, while hot air may be drawn in from above said partition, beneath the pair of drying beds next above the partition, and exhausted from above the uppermost pair of drying beds.

Preferably the pair of cooling beds, or the lowermost pair of cooling beds, when there are more than one pair, lead to an outlet above which is disposed a reciprocatory or other movable element to ensure uniform delivery of grain throughout the width of the plant.

For example, the cooling beds or the lowermost pair of cooling beds, may converge downwardly to a trough of very flat V-section, the trough having a central longitudinal delivery slot over which an obturator is disposed in spaced relation to the trough bottom, and a ladder-like member may be mounted to be reciprocated in the space between the obturator and the trough bottom so that direct outlet of the grain is prevented, the sides of this member and the spaces between its "rungs" extending lateraly beyond the sides of the obturator so that grain is collected in said spaces as

the member is reciprocated and passes through the delivery slot to a belt or other conveyor disposed therebeneath.

The preferred form of the invention is illustrated by the accompanying drawings wherein Figure 1 is a somewhat diagrammatic sectional side elevation of a drier; Figure 2 is a fragmentary plan of the outlet portion of the drier shown on an enlarged scale; Figure 3 is a sectional side elevation thereof on the line 3—3, Figure 2; and Figure 4 is a cross-section on the line 4—4, Figure 2, showing also a detail not included in Figures 2 and 3.

As depicted in these drawings there is arranged at the top of a tower *a* of rectangular plan a hopper *b* the lower walls *cc* of which converge to a narrow slot *d* running the full width of the hopper and beneath which is disposed a screw operable plate *e* to open or close the slot *d* from back to front. Beneath this hopper *b* are arranged a pair of downwardly divergent perforated plates *ff* which extend the full width of the tower *a* and almost to the front and back walls thereof leaving gaps as at *gg*. Beneath these plates *ff* is a second pair of similar plates *hh* which, however, converge downwardly, but less steeply a narrow slot *j* being left between their lower ends. Beneath this second pair of plates *hh* is arranged a third pair of similar plates *kk* which diverge downwardly, but still less steeply and so on according to requirements, the lowermost pair of drying beds *kk* being downwardly divergent and leading to a pair of downwardly covergent perforated plates *mm*, hereinafter called the cooling plates or beds.

Although in the present example three pairs of drying plates *ff*, *hh* and *kk* and one pair of cooling plates *mm* are shown, it is to be understood that in some cases these numbers may be increased, but the total area of the cooling plates should be not less than one third of the total area of the drying plates, the total number of pairs of drying and cooling plates being an even number so that the drying plates of the uppermost pair are downwardly divergent and the cooling plates of the lowermost pair are downwardly convergent.

Above each of all these plates is arranged a series of vertical baffle plates *n* . . . which are so spaced from one another and above the plate that grain will pass between their lower edges and the perforated plate therebeneath but will not cascade over their tops.

Beneath the lowermost pair of drying plates *kk* is disposed a partition *o* which separates the spaces *p* and *q* between the downwardly convergent cooling plates *mm* and the downwardly divergent drying plates *kk*, respectvely, so that cold air may be drawn through a duct as at *r* from the space *p* beneath the partition *o* and through said plates *mm* and the grain thereon, while hot air may be drawn through a duct as at *s* into the space *q* above the partition *o*, up through the tower *a*, passing through the drying plates *kk*, *hh* and *ff*, and the grain thereon, and out of the tower *a* via the space *t* above the uppermost pair of drying plates *ff* and ducts as at *uu*.

Between the lower edges of the downwardly convergent cooling plates *mm* is an opening or slot *v* of which the cross dimension is greater than the cross dimension of the opening or slot between the lower edges of the downwardly convergent drying plates *hh*, and beneath this opening or slot *v*, and spaced from the cooling plates *mm* is a trough *w* of very flat V-section form with a central longitudinal delivery slot *x* above which, and also spaced from the trough *w*, is a box-like obturator *y* (see especially Figure 4) which prevents direct escape of the grain. Mounted to reciprocate in the trough *w*, in the space between the trough *w* and the obturator *y*, is a ladder-like member the sides *z* of which, and the spaces between its "rungs" *11*, extend beyond the obturator *y* so that the grain flowing down the cooling plates *mm* may enter said spaces, be evenly distributed over the width of the drier and pass under the obturator *y* to the delivery slot *x*, whence it drops to a belt *12* Figure 1 (or other convenient form of conveyor) disposed therebeneath.

If desired, the baffle plates *n* . . . may be adjusted vertically.

Owing to the spreading of the grain into shallow layers and the intimate contact of the drying air with the descending grain, the height of the plant can be relatively small. Moreover, the arrangement is such that it is unnecessary to control the flow of grain leaving the hopper *b*, nor is it necessary to control the flow leaving the drier unless it be required to stop delivery therefrom. There is no possibility of any interruption in the flow of grain through the drier as long as there is grain in the hopper *b*, and drying continues until the grain begins to empty from the last pair of drying plates.

We claim:

1. Means for drying grain comprising a wide hopper having a narrow slot leading from substantially its full width at its bottom, a drying chamber therebelow, and means for conveying grain delivered from said slot through said chamber in wide shallow streams while exposing the grain therein to a drying atmosphere, said means comprising a plurality of substantially flat bed plates of foraminous material arranged in said chamber in superimposed pairs with the bed plates of said pairs alternately divergent and convergent in downward direction, each bed plate having its transverse axis horizontal and its longitudinal axis inclined at an acute angle to horizontal, the bed plates of the uppermost pair being downwardly convergent and having their upper edges disposed together below and spanning the width of said slot so that they receive and convey grain therefrom upon their upper surfaces, gaps between the lower edges of the divergent bed plates and the walls of said chamber and between the adjacent lower edges of the convergent bed plates so that grain may pass down the superimposed bed plates successively to the bottom of said chamber, a multiplicity of spaced apart baffle plates disposed above and extending horizontally across each bed plate at a distance therefrom to pass a wide shallow stream of grain between each baffle plate and its bed plate, each baffle plate extending vertically to a height above the level of repose of grain adjacent thereto on its bed plate so that the grain will not cascade over the tops of said baffle plates, said chamber having an outlet for a drying atmosphere above said uppermost pair and having an inlet for such atmosphere beneath a lower pair of said bed plates so that air passed from the inlet to the outlet will flow through the bed plates therebetween, a partition extending substantially across said chamber between said lower pair and a lowermost pair of bed plates therebelow, and an outlet for a cooling atmosphere in said chamber beneath said partition so that cold air may

be drawn through the lowermost bed plates and exhausted from beneath said partition.

2. Means for drying grain comprising a wide hopper having a narrow slot leading from substantially its full width at its bottom, a drying chamber therebelow, and means for conveying grain delivered from said slot through said chamber in wide shallow streams while exposing the grain therein to a drying atmosphere, said means comprising a plurality of substantially flat bed plates of foraminous material arranged in said chamber in superimposed pairs with the bed plates of said pairs alternately divergent and convergent in downward direction, each bed plate having its transverse axis horizontal and its longitudinal axis inclined at an acute angle to horizontal, the bed plates of the uppermost pair being downwardly convergent and having their upper edges disposed together below and spanning the width of said slot so that they receive and convey grain therefrom upon their upper surfaces, gaps between the lower edges of the divergent bed plates and the walls of said chamber and between the adjacent lower edges of the convergent bed plates so that grain may pass down the superimposed bed plates successively to the bottom of said chamber, a multiplicity of spaced apart baffle plates disposed above and extending horizontally across each bed plate at a distance therefrom to pass a wide shallow stream of grain between each baffle plate and its bed plate, each baffle plate extending vertically to a height above the level of repose of grain adjacent thereto on its bed plate so that the grain will not cascade over the tops of said baffle plates, said chamber having an outlet for a drying atmosphere above said uppermost pair and having an inlet for such atmosphere beneath a lower pair of said bed plates so that air passed from the inlet to the outlet will flow through the bed plates therebetween, a partition extending substantially across said chamber between said lower pair and a lowermost pair of bed plates therebelow, an outlet for a cooling atmosphere in said chamber beneath said partition so that cold air may be drawn through the lowermost bed plates and exhausted from beneath said partition, said lowermost bed plates being downwardly convergent, an outlet for grain adjacent their lower edges, and movable means cooperating with said grain outlet for regulating the discharge of grain therethrough.

3. Means for drying grain comprising a wide hopper having a narrow slot leading from substantially its full width at its bottom, a drying chamber therebelow, and means for conveying grain delivered from said slot through said chamber in wide shallow streams while exposing the grain therein to a drying atmosphere, said means comprising a plurality of substantially flat bed plates of foraminous material arranged in said chamber in superimposed pairs with the bed plates of said pairs alternately divergent and convergent in downward direction, each bed plate having its transverse axis horizontal and its longitudinal axis inclined at an acute angle to horizontal, the bed plates of the uppermost pair being downwardly convergent and having their upper edges disposed together below and spanning the width of said slot so that they receive and convey grain therefrom upon their upper surfaces, gaps between the lower edges of the divergent bed plates and the walls of said chamber and between the adjacent lower edges of the convergent bed plates so that grain may pass down the superimposed bed plates successively to the bottom of said chamber, a multiplicity of spaced apart baffle plates disposed above and extending horizontally across each bed plate at a distance therefrom to pass a wide shallow stream of grain between each baffle plate and its bed plate, each baffle plate extending vertically to a height above the level of repose of grain adjacent thereto on its bed plate so that the grain will not cascade over the tops of said baffle plates, said chamber having an outlet for a drying atmosphere above said uppermost pair and having an inlet for such atmosphere beneath a lower pair of said bed plates so that air passed from the inlet to the outlet will flow through the bed plates therebetween, a partition extending substantially across said chamber between said lower pair and a lowermost pair of bed plates therebelow, an outlet for a cooling atmosphere in said chamber beneath said partition so that cold air may be drawn through the lowermost bed plates and exhausted from beneath said partition, said lowermost bed plates being downwardly convergent into a trough of flat V-section spanning the space between their lower edges, said trough having a central longitudinal discharge slot, a reciprocable grain feeding member in said trough formed of spaced bars extending across said slot and sides joining said bars adjacent the sides of said trough, and an obturator overlying said member of greater width than said slot and of smaller width than said trough.

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