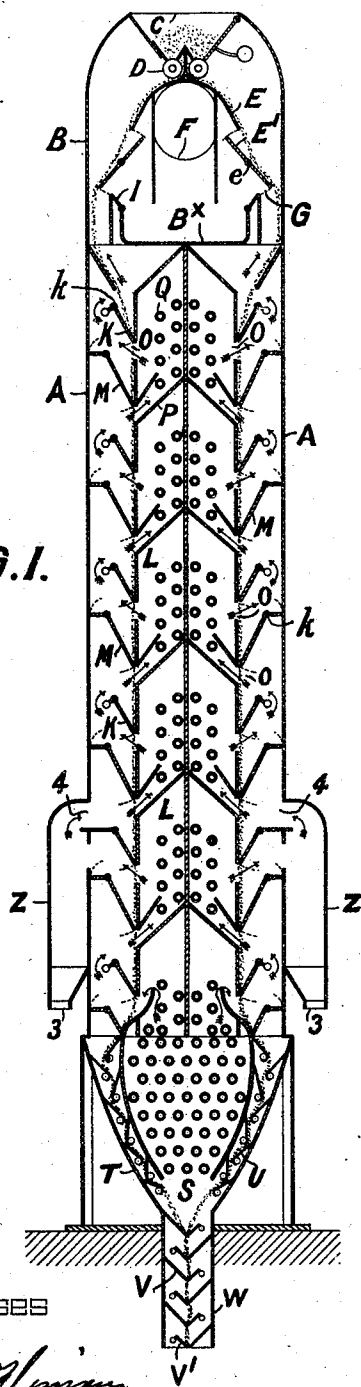


R. HORNER.  
APPARATUS FOR CONDITIONING GRAIN, &c.

APPLICATION FILED JUNE 7, 1904.

4 SHEETS—SHEET 1.

FIG. 1.



Witnesses

J. H. Horner  
William J. Smith.

FIG. 2.

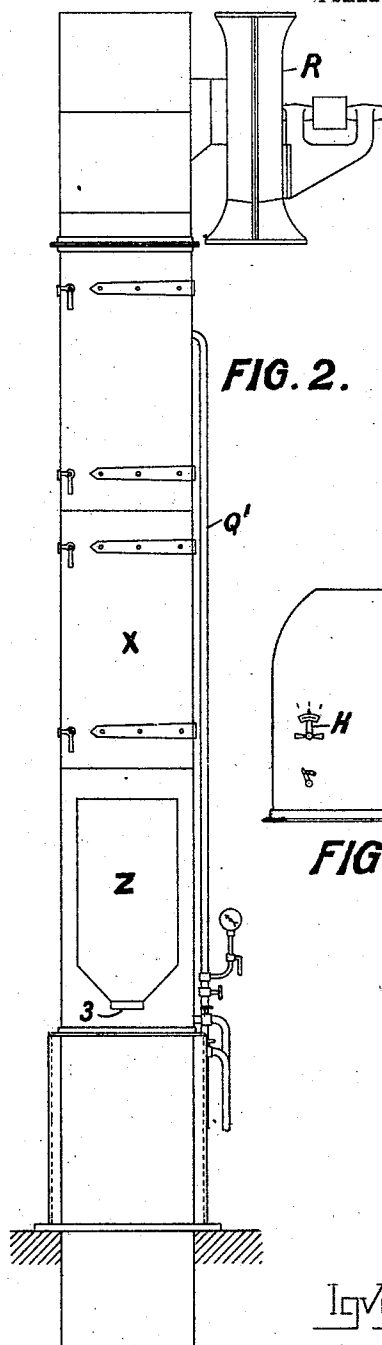
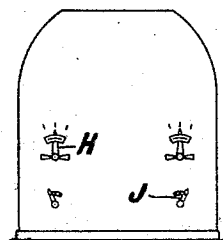


FIG. 3.



Inventor

Richard Horner  
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Attorney

No. 785,554.

PATENTED MAR. 21, 1905.

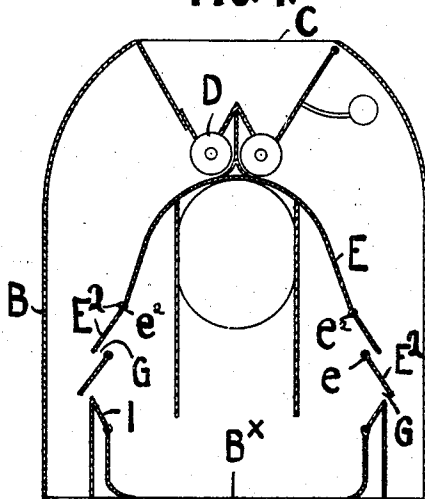
R. HORNER.

# APPARATUS FOR CONDITIONING GRAIN, &c.

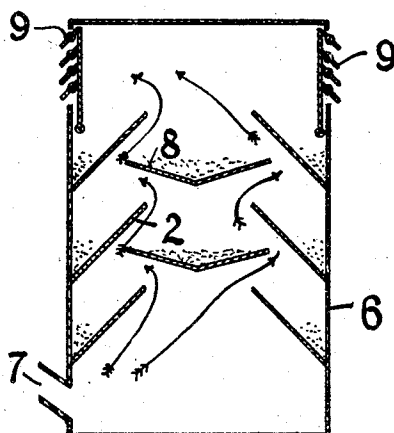
APPLICATION FILED JUNE 7, 1904.

4 SHEETS—SHEET 2.

**FIG. 4.**



**FIG. 5.**



## Witnesses

J. A. Homan  
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 APPLICATION FILED JUNE 7, 1904.

4 SHEETS—SHEET 3.

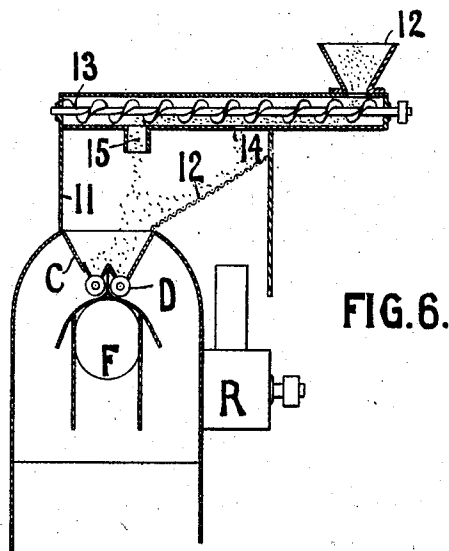


FIG. 6.

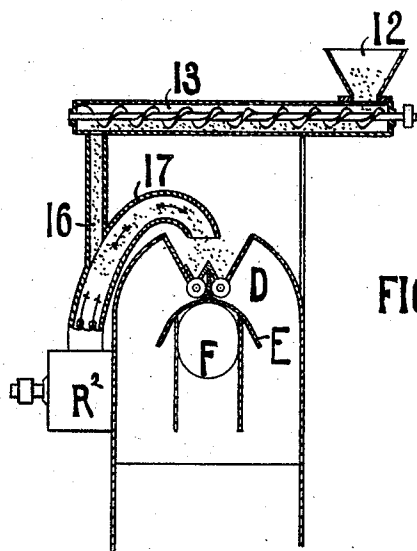


FIG. 7.

Witnesses

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*William J. Firth*

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*Richard Horner*  
 by *Henry Connors*  
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APPARATUS FOR CONDITIONING GRAIN, &c.

APPLICATION FILED JUNE 7, 1904.

4 SHEETS—SHEET 4.

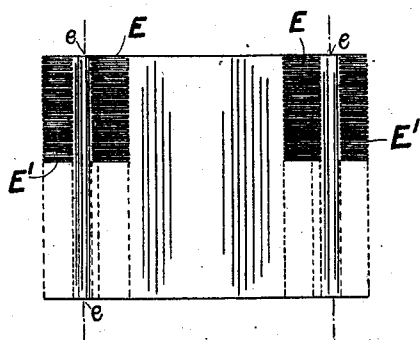
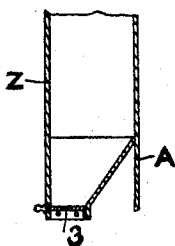


FIG. 8.

FIG. 9.



Witnesses

*S. H. Horner*  
*William J. Firth*

Inventor:

*Richard Horner*  
By his Attorney  
*Henry Conwell*

# UNITED STATES PATENT OFFICE.

RICHARD HORNER, OF YORK, ENGLAND.

## APPARATUS FOR CONDITIONING GRAIN, &c.

SPECIFICATION forming part of Letters Patent No. 785,554, dated March 21, 1905.

Application filed June 7, 1904. Serial No. 211,559.

*To all whom it may concern:*

Be it known that I, RICHARD HORNER, miller, a subject of the King of Great Britain, and a resident of Heworth, York, in the county of York, England, (whose post-office address is Woodbine House, Heworth, York, aforesaid,) have invented certain new and useful Improvements in and in Apparatus for Conditioning Grain and other Granular Material, (for which application has been made in Great Britain, No. 3,872, dated 18th day of February, 1903,) of which the following is a specification.

This invention relates to apparatus for drying and conditioning grain, beans, oats, and other granular material. It is adapted to take the place of the usual whizzer.

The invention will be understood from the following description, reference being had to the accompanying drawings, in which—

Figure 1 is a vertical section of my apparatus; Fig. 2, a side elevation; Fig. 3, a front elevation of the receiving-chamber; Fig. 4, a vertical section of the receiving-chamber, showing a slight modification in the valves or combs; Fig. 5, an enlarged sectional view of the second dust-chamber; Figs. 6 and 7, detail views of accessories to utilize the hot air. Fig. 8 is a plan view of the grids seen on a small scale in Fig. 1. Fig. 9 is a sectional detail view, on a relatively large scale, of a dust-collector and the door at the bottom thereof.

In carrying the invention into effect I provide vertical casings or trunks A, arranged upright in a straight line at opposite sides of a middle upright chamber L, down which trunks the material to be dried flows and up which a current of air for drying the material is caused to ascend by the suction-fan R. This air-current is heated by the hot-water or steam pipes S and again reheated at intervals by the pipes Q. At the top of the trunks A is a receiving-chamber B, fitted with a hopper C and feed-rollers D, and below this hopper C in the receiving-chamber B there are at each side a series of combs or grids E E', so arranged that as the wet grain passes over the combs they permit the water, assisted by the upward current of air, to drain from the produce and drain off into the tank B<sup>x</sup>, from whence it is

discharged by a pipe. Some of the combs—viz., E'—are hinged or pivoted at e, so that they form valves and can be set to different angles relatively to the other combs, and when so set an opening G is left between them and the adjacent stationary parts, through which openings the air-current is drawn by the exhaust-fan. The air-current, in fact, is drawn in an opposite direction to the thin stream of descending produce as it falls over the combs E E', and the air is forced to pass through this thin descending stream and through the combs, also through the openings aforesaid, thus drawing off the water from the grain. The combs, however, can be so set that they are closed against the adjacent fixed parts, in which case the only exit for the air-current is actually through the combs themselves. Outside indexes H can be employed, so as to indicate the exact angle to which the adjustable combs are set, and thus the opening can be regulated to a nicety or closed altogether. Valves I are also provided in the receiving-chamber for regulating the outlet or discharge of air. When these are closed, the entire air-current finds its exit at the combs. By opening these valves I, however, part is drawn out (through the descending stream of produce) direct to the fan without passing through the combs at all. Thus these valves I allow air that is not required to pass through the combs E E' to be passed direct to the fan.

J represents outside indexes for the valves I.

The hinged combs may be as shown in Fig. 4, in which two combs E<sup>2</sup> are provided, hinged at e<sup>2</sup>, instead of a single valve hinged at middle.

The trunks A, to which the wheat passes when delivered thereto by the receiving-chamber B, are provided at intervals throughout their length with valves K M. These can each consist of a hinged plate sloping downward from the hinge k toward the inside walls of the trunk A and are so arranged as to check the rush of wheat and allow of only a thin stream of grain flowing through between the edge of the plate and the inner wall of the trunk. They also enable the rate of descent being regulated to a nicety. The inside wall of the trunk immediately below each au-

5 automatic valve is provided with holes or pas-  
 sages O, leading to the middle upright cham-  
 ber L, and each alternate valve M in the trunk  
 A forms a partition which divides the trunk  
 10 A into a series of chambers and prevents the  
 air passing straight upward. The middle  
 chamber L is also divided up into compart-  
 ments by partitions P. The air is therefore  
 forced to pass in a circuitous course from the  
 15 trunk A through these holes O and the de-  
 scending stream of produce into the middle  
 chamber L and from thence out through the  
 succeeding holes O and descending stream of  
 produce again into the trunk A, and so on,  
 20 thus causing the air to take a very devious  
 course back and forth through the wheat, and  
 this passing of the air through the stream of  
 produce is repeated again and again before  
 the air finally reaches the receiving-chamber  
 25 B at the top of the apparatus. The air is re-  
 heated in the middle chamber L after each  
 passage through the cold and wet wheat as it  
 travels up the machine, for which purpose  
 heating-pipes Q are fitted therein. This re-  
 30 heats the air after each contact with the wheat  
 and also converts any remaining water quickly  
 into steam, which steam is immediately drawn  
 off by the fan. There is also provided means  
 for collecting and drawing off any chaff or  
 35 dust which may accumulate without interfer-  
 ing with the proper working of the machine  
 in any way—namely, a dust-collector Z and a  
 second dust-collector 6. The former com-  
 prises chambers Z, located near the bottom of  
 40 the machine. The upward air-current enters  
 the upper part of this chamber and leaves it  
 at 4, depositing the dust, however, in the  
 chamber and allowing it to fall into the bot-  
 tom thereof, from whence it can be removed  
 45 from time to time as required through the  
 doors 3. These doors are shown in detail in  
 Fig. 9. The other dust-collector, 6, is located  
 near the fan R and will be hereinafter de-  
 scribed.  
 50 The pipe Q in the heating-chambers L is sup-  
 plied with steam by the pipe Q', which is fitted  
 with a steam-gage 5.

At the bottom of the apparatus are the  
 heating, cooling, and discharging appliances.  
 55 The heating appliance consists of passages T,  
 one at each side of the main heating appar-  
 atus S, which latter heats the air-supply and  
 supplies heat to the heater in the middle  
 chamber L. These passages are fitted with a  
 60 series of chutes or plates U, which are highly  
 heated by the main heating apparatus, where-  
 by a very high temperature is imparted to the  
 wheat, if required, there being no circulation  
 of air through these side passages T. The  
 65 two passages converge toward a single pas-  
 sage W below the main heating apparatus S,  
 through which the cold-air supply is drawn.  
 A series of chutes or baffles V V' are placed  
 in the passage W, which allow the cold air to  
 play upon it, and thus chill it down after be-

ing highly heated as it is being discharged.  
 The baffles V' are hinged, so as to enable the  
 size of the orifice between them and the edges  
 of V to be regulated, and the air passes back  
 and forth through the material as it descends  
 70 in a thin stream. The heat abstracted from  
 the produce in the cooling appliance V is  
 taken up by the air, thus slightly heating it  
 before entering the heating-chamber. The air  
 by this heating apparatus is raised to a very  
 75 high temperature and is divided up and drawn  
 to both trunks A of the machine, down which  
 the wheat is falling. Doors X are provided  
 for giving access to each chamber or pair of  
 chambers in the trunks. The actual heating  
 80 parts are so constructed or protected that  
 there is no danger of the wheat being scorched  
 or burned, the object being to have a machine  
 that will cause the grain to go effectually  
 through all the processes in one operation and  
 85 by the means of one current of air which is  
 caused to pass through the machine, which  
 latter has such a gentle action as will obviate  
 all danger of the wheat being roughly used or  
 broken in any way. 90

The mode of action is as follows: The ex-  
 haust-fan R being put into operation a stream  
 of cold air is drawn through the passage V  
 into the main heating apparatus S, where it is  
 heated, and the heated air is then divided up  
 95 and drawn into both trunks A. This heated  
 air therefore entering the trunks comes into  
 contact with the falling grain, extracting the  
 moisture and drying the grain, also drain-  
 ing off any chaff or dust and depositing it in  
 100 chamber Z. The air takes a very devious  
 course back and forth through and across the  
 produce and at the same time is reheated af-  
 ter each passage through the cold and wet  
 wheat in the chamber L. Consequently should  
 105 the hot air have become cooled it is at once  
 reheated in the middle chamber L, so that by  
 the time it reaches the top of the machine  
 it has effectually dried the produce and is  
 drawn off through outlet F. This air, carry-  
 110 ing a certain amount of dust in suspension,  
 is discharged into the second dust-collector  
 6, hereinbefore referred to. It is shown in  
 Fig. 5. 7 is the air-trunk from the fan, through  
 which the air is driven by the fan R into the  
 115 chamber 6. Inside this chamber are hoppers  
 2 and baffles 8. The dust-laden air having en-  
 tered this chamber 6, ascends therein against  
 the baffles 8, the dust falling into the hoppers  
 2. As the air-current is baffled in its ascent,  
 120 the dust is bound to be deposited in the hop-  
 pers. The air, free from dust, escapes through  
 the valves or louvers 9 at top, these being  
 weighted to keep them just open. Should,  
 however, the wind be blowing against them,  
 125 the louvers at the side the wind is blowing  
 against will close by the wind-pressure against  
 them, while the others remain open and air-  
 current passes steadily through them. This  
 prevents the wind from any quarter working 130

against the fan. This dust-collector is made of fireproof material. The valves K M in the trunks A check the wheat in its fall and cause it to descend in thin streams, so that the air-currents may act upon it with the greatest possible effect. The devious course which the air-current takes facilitates the hot air getting free access to every particle of the material to extract moisture therefrom. By adjusting the valves K M in the trunk A the weight of discharge is regulated to a nicety. Finally, before leaving the machine the grain is subjected to the final heating operation in the passages T, (here it is not subjected to air-currents at all,) and then the grain is finally exposed to a current of cold air, which is drawn through V into the apparatus by the suction of the exhaust-fan R. This arrangement dispenses with the use of a separate whizzer and makes the apparatus self-contained. The intermediate sloping plates K in the trunks might, perhaps, in some cases be dispensed with or made fixtures instead of hinged.

The fan R discharges air at  $85^{\circ}$  to  $95^{\circ}$ . In order to utilize this, I propose putting, as shown in Fig. 6, a loose hopper 11 on the top of C and fixing a foraminous plate 12 in this hopper. The hot air from the fan R is discharged so as to pass through the perforations in this plate 12 and blow the grain onto the feed-rollers D, thus partly drying it before it reaches the machine. The wet grain is fed into the receptacle R and from thence fed forward by the worm 13 into the hopper 11, into which it falls at 14 and 15. In Fig. 7 the grain is fed forward in a similar manner, but falls through the chute 16 into the pipe 17. Here it meets the ascending stream of hot air from the fan R<sup>2</sup> and is discharged, so that the direction of the stream of grain is diverted and is delivered by the current of air to the feeding-rollers D, the action of the hot air partly drying it.

I declare that what I claim is—

1. An apparatus for drying and conditioning wheat or other granular materials, comprising upright casings, a middle upright chamber between, hinged doors or valves in the casings sloping downward from the hinge in such manner as to allow the granular material to descend in thin streams, holes or passages into said middle chamber located at intervals, through which a current of hot air, reheated at intervals, is passed back and forth across these descending streams, in such a manner as to extract moisture therefrom and effect

the drying of the granular material substantially as described.

2. An apparatus for drying and conditioning grain and other granular material, having straight upright trunks for the streams of descending material, said trunks being provided with holes or passages for air, sloping hinged plates or partitions which divide the said trunks into compartments, leaving passages sufficient to enable thin, approximately vertical descending streams of granular material to pass, heating-chambers located in close proximity to the trunks, also divided into compartments and so connected to the trunks at intervals by said holes or passages that currents of air drawn upward through the trunks will be obliged to pass through these holes and the descending streams of material into said heating-chambers, and from these out through succeeding holes and the descending streams of material, again into the trunks, and so on, the air being reheated in the heating-chambers every time after its passage through the material, substantially as described.

3. In apparatus for conditioning and drying grain or other granular material, the combination with the upright trunks through which the material descends, of a receiving-chamber at top thereof, means for feeding in wet material, combs or grids over which the wet material is caused to flow in thin streams, so as to permit water to drain from the material before being delivered into the trunks, and through which and through the thin stream of material an air-current is passed by a fan, to further draw off water from the material and the said fan, substantially as described.

4. In drying or conditioning apparatus of the kind mentioned, a receiving-chamber formed at each side with fixed combs or grids E, and combs or grids hinged so as to be adjustable to enable them to be set at an angle relative to the adjacent stationary combs and leave an opening between, over which the descending produce will fall, and through which and the descending stream of granular material, air-currents are passed laterally, substantially as described.

In witness whereof I have hereunto signed my name, this 23d day of April, 1904, in the presence of two subscribing witnesses.

RICHARD HORNER.

Witnesses:

CHAS. GILLIARD,

ALFRED STANLEY HOUGHTON.