

C. H. CASPAR.  
DRIER.

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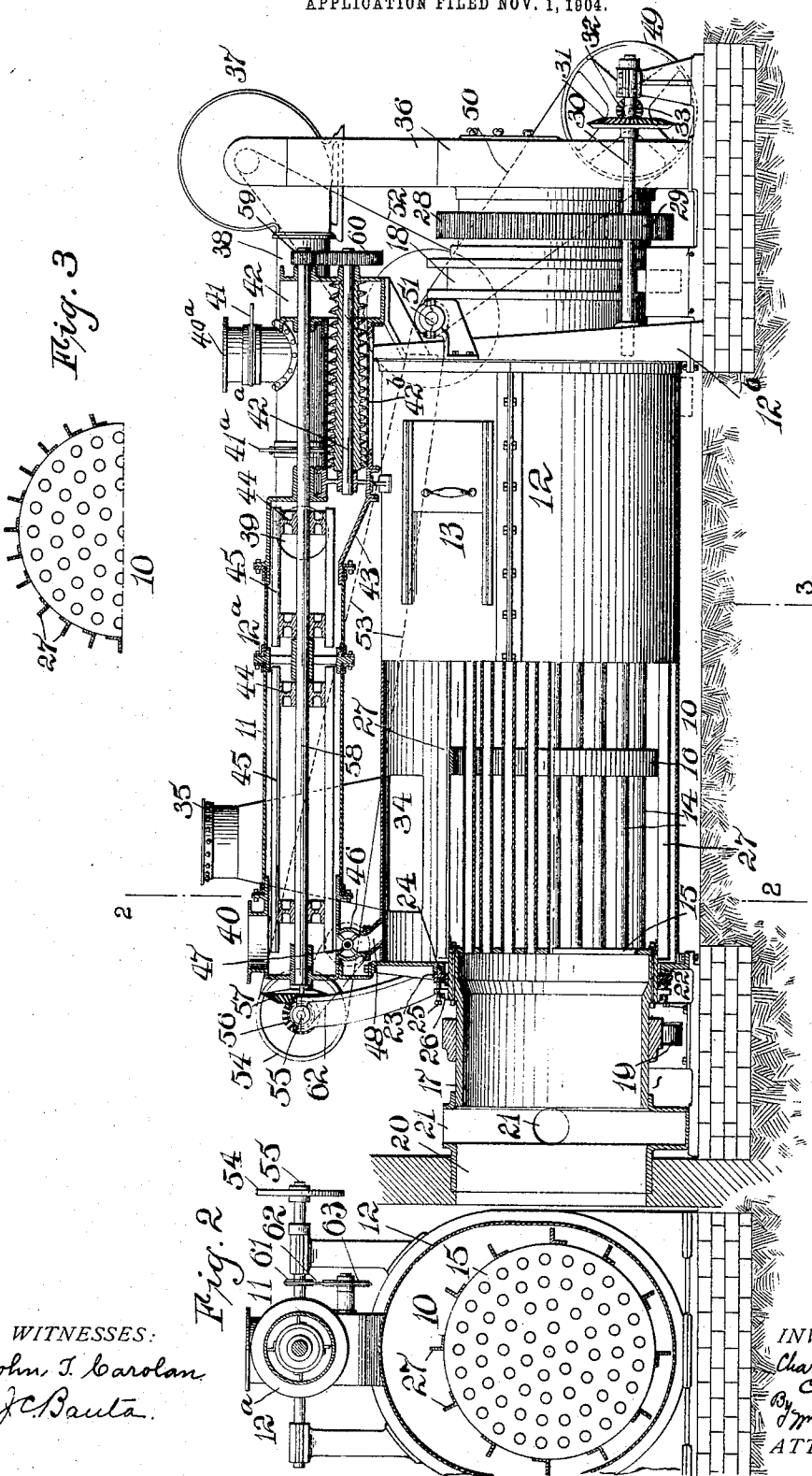


Fig. 3

Fig. 1

Fig. 2

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# UNITED STATES PATENT OFFICE.

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## DRIER.

SPECIFICATION forming part of Letters Patent No. 791,877, dated June 6, 1905.

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*To all whom it may concern:*

Be it known that I, CHARLES HAYES CASPAR, of Wilkesbarre, in the county of Luzerne and State of Pennsylvania, have invented a new and Improved Drier, of which the following is a full, clear, and exact description.

My invention relates to improvements in driers such as are adapted for drying brewers' grains and other small grains and loose materials.

The object of my invention is to produce a comparatively simple and efficient apparatus which will quickly and thoroughly dry materials of the kind specified. Many of the devices used for this purpose have the hot air or gases strike at once on the wet material to be dried, and in the case of brewers' grains it is found that this often blisters the protein of the grain and otherwise injures it. My invention is intended to obviate this difficulty and at the same time hasten thorough drying. This I accomplish by arranging the apparatus and constructing the parts so that the hottest air and gases strike the material when it is comparatively dry, whereas the partially-cooled gases and air act on the material when it is in its wettest condition.

My invention is also intended to improve certain details of construction to provide for evenly distributing wet material and keep it in a properly-spread condition to be quickly acted on and dried.

The invention also comprises other details of construction, which will be hereinafter described.

With the above and other ends in view my invention consists of certain features of construction and combinations of parts, which will be hereinafter described and claimed.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar figures of reference indicate corresponding parts in all the views.

Figure 1 is a side elevation, partly in central vertical section, of my improved apparatus. Fig. 2 is a cross-section on the line 2 2 of Fig. 1; and Fig. 3 is a broken detail on the

line 3 of Fig. 1, showing a detail of the lower drum.

The drier has a lower and upper drum 10 and 11, contained, respectively, in suitable shells 12 and 12<sup>a</sup>. The main or lower shell 12 is also provided with a suitable manhole arrangement 13, and it has a battery of longitudinally - arranged parallel air - pipes 14, through which hot air is passed, as hereinafter described, these pipes being grouped and suitably held in the end sheets 15 and collars 16. The drum is also provided with end trunnions 17 and 18, which are rigidly secured thereto, and the trunnion 17 has one open end 20, suitably supported in a furnace-wall to receive hot air and gases, this trunnion having also an enlargement with openings 21 therein for regulating the temperature. The drum is mounted on suitable rollers 19 and can be turned in any convenient way, though I show mechanism for doing it.

To provide for a tight connection between the ends of the shell 12 and the trunnions 17 and 18, the joint shown at the left hand in Fig. 1 can be conveniently used. Here the end sheet of the shell is provided with a circumferential groove 22, extending around the opening for the trunnion 17, and this groove receives the lip 24 of the collar 23, which is mounted to slide on the trunnion and which can be set up by the screws 25, which are mounted in ears 26, which are fast on the trunnion. The groove 24 can be suitably packed, and thus a simple and tight joint is made.

The drum 10 is provided with peripheral paddles or agitators 27 in the form of angle-irons. The only novel feature about the agitators or paddles is that at the end of the machine next the air-inlet there are only half as many paddles as on the opposite end. This can be seen by reference to Figs. 2 and 3. The object of this arrangement is to provide a more even distribution of the material to be dried. When it is wet and delivered upon the end next the air-inlet, it requires more space to spread and to be properly acted on

by the air than is the case where it is partially dried, and so the arrangement described accomplishes this purpose perfectly, though obviously a greater or less number of paddles 5 can be used at the different ends.

While any suitable operating means can be used for driving any of the mechanism here described, I have shown a simple method of operation, and for turning the lower drum 10 the trunnion 18 is provided with a gear-wheel 28, which meshes with a pinion 29 on the shaft 30, this being mounted in suitable bearings and having a gear 31 meshing with a gear 32 on the shaft 33, which can also be 15 mounted in any convenient way and which can likewise be turned in any suitable manner. The vapor and moisture accumulating in the lower shell 12 pass off through the flues 34 and pipe 35. The vapor from the shell 12<sup>a</sup> 20 passes off through the outlet 40.

The hot air is exhausted from the shell 12 through a pipe 36, and the blower 37, connected with the pipe, delivers the said hot gases through a pipe 38 and opening 39 into 25 the upper shell 12<sup>a</sup>. The pipe 38 has a bypass 40<sup>a</sup>, provided with a damper 41, and it also has a damper 41<sup>a</sup>, so that, if desired, the air can be shut off from the upper shell 12<sup>a</sup>.

The wet grain or other material to be dried 30 is delivered into the hopper 42 and upon a horizontal screw conveyer 42<sup>a</sup>, which is held at one end of the apparatus in the shell 12<sup>a</sup>, and it will be noticed that the hub of the conveyer is largest at its discharge end and that 35 the screw-threads gradually grow closer together as the discharge end is reached. The result is that the wet material is gradually squeezed as it is forced through the conveyer, thus forcing the water out and through the 40 screen 42<sup>b</sup>, while at the same time a thin even quantity is discharged from the conveyer. After leaving the conveyer the material is forced up the incline 43, which has a tendency to still further drain the material, and from here 45 it passes through the upper drum 11, which is made in two sections comprising the cores 44 and the angle-irons or paddles 45, attached thereto. The paddles or angles 45 work the material toward the discharge end of the shell 50 12<sup>a</sup>, and here it passes through the regulating or feed valve 46, which contains the rotary valve-stem carrying the blades 47, and this can be speeded so as to feed the material at the desired rate down through the chute 48 55 upon the lower drum 11.

As above remarked, any suitable means can be used for driving the several parts; but to avoid confusion I will trace the driving mechanism, which is shown in a general way. The 60 shaft 33 has a pulley 49, which by means of a belt 50 drives the shaft 51, which is journaled in suitable bearings and which has a pulley running a belt 52, which drives the shaft of the blower 37. A belt 53 from the shaft 51

also extends along the side of the apparatus 65 and drives a belt 54 on a shaft 55, which by means of gears 56 and 57 turns the shaft 58, which extends longitudinally through the upper shell 12<sup>a</sup> and carries the sections of the drum 11. The shaft 58 also connects, by means 70 of gears 59 and 60, with the shaft of the screw conveyer 42<sup>a</sup>. The shaft 55 connects, by means of a pulley 61, belt 62, and pulley 63, with the stem of the valve 47; but obviously any suitable means for driving the aforesaid parts can 75 be substituted for the means specified.

From the foregoing description it will be seen that the wet grain which enters the hopper 42 will be squeezed by the screw conveyer and distributed into the upper shell 12<sup>a</sup>, while 80 the first inrush of water will pass out through the screen 42<sup>b</sup>. The wet material will be met in this shell 12<sup>a</sup> by the hot air and gases, which, however, have become partially cool by reason of passing through the lower shell 12, and so 85 will not be hot enough to injure the material under treatment. The material will be forced along by the blades 45 and fed at the required rate through the valve 46 and chute 48 to the first end of the drum 11, where it will be thor- 90 oughly agitated and dried, and as it becomes nearly dry it will be received by the more numerous paddles 27 of the lower drum, and thus thoroughly agitated, and finally discharged at 12<sup>b</sup> in a dry condition. 95

Having thus fully described my invention, I claim as new and desire to secure by Letters Patent—

1. An apparatus of the kind described, comprising upper and lower drums, means for 100 drawing hot air and gases through the lower drum and into and through the upper drum, and means for feeding material through the upper drum and discharging it into the lower drum, the hot-air currents being directed to 105 travel in the same direction as the grain in each drum.

2. An apparatus of the kind described, comprising plural compartments delivering one 110 into the other, means for forcing material to be dried through said compartments, and means for forcing a heating medium through said compartments, said heating medium traveling in each compartment in the same direction as the material to be dried, but entering 115 and discharging from the apparatus at ends opposed to the entrance and discharge respectively, of the material.

3. An apparatus of the kind described, comprising upper and lower drums contained in 120 separate shells, means for feeding material longitudinally through the upper drum and discharging it into the lower drum, a valve regulating the feeding of material from the upper to the lower drum, means for forcing 125 hot air through the lower drum, and means for delivering the air from the lower to the upper drum.

4. In an apparatus of the kind described, the combination of a heating-drum adapted to convey material therethrough, an inclined way leading upward to the said drum, a screw conveyer delivering to the incline, and a screen inclosing the conveyer.

5. In an apparatus of the kind described, the combination of the heating-drum having end trunnions, the containing shell inclosing

the drum and extending around the trunnions, the said shell having a continuous groove around each trunnion, the collar on the trunnion having a lip which enters the groove of the shell, and means for adjusting the collar.

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Witnesses:

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