G. E. SHATTO.

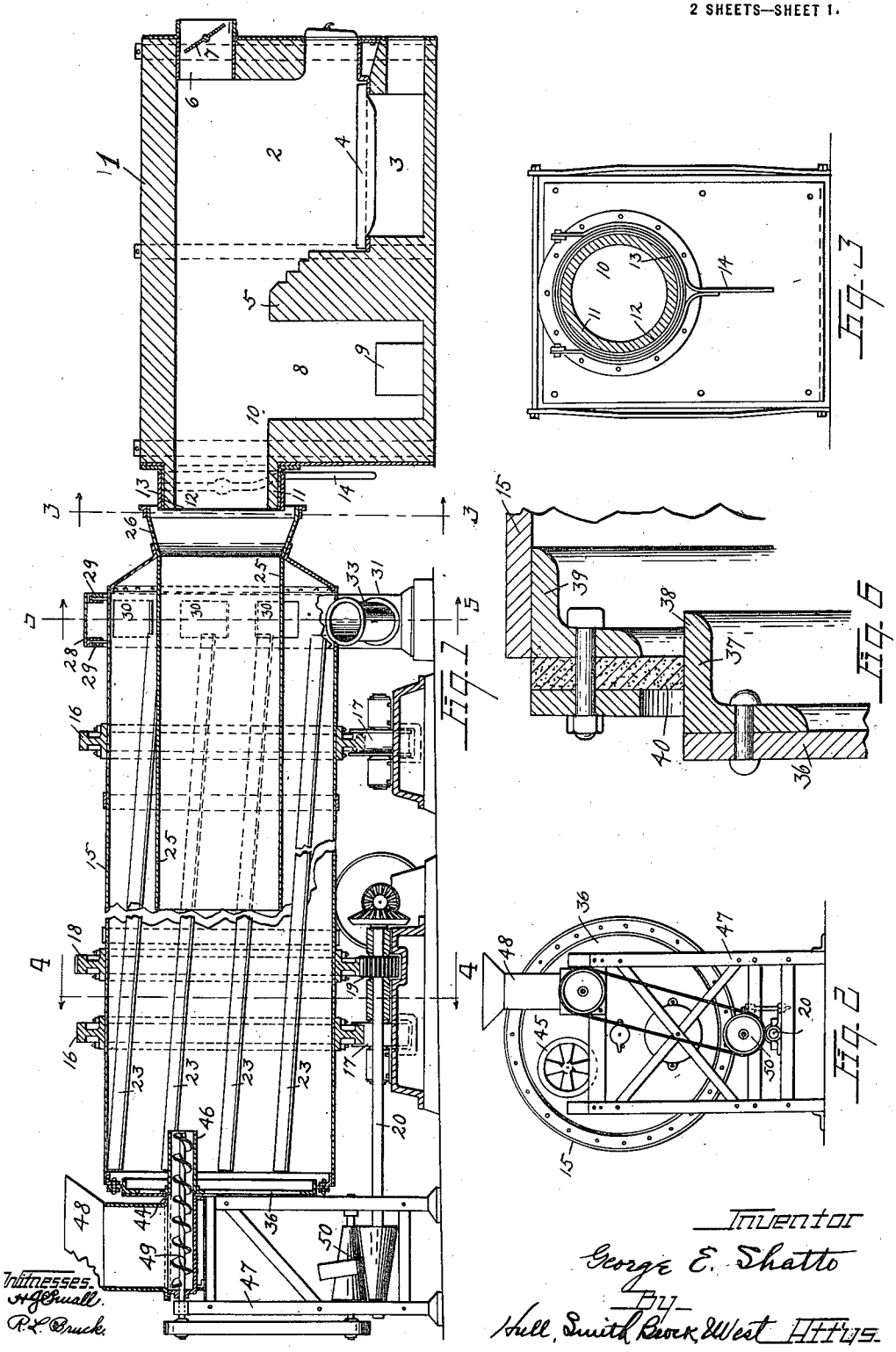
DRIER.

APPLICATION FILED AUG. 21, 1915.

1,297,409.

Patented Mar. 18, 1919.

2 SHEETS—SHEET 1.



Witnesses.
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2 SHEETS—SHEET 2.

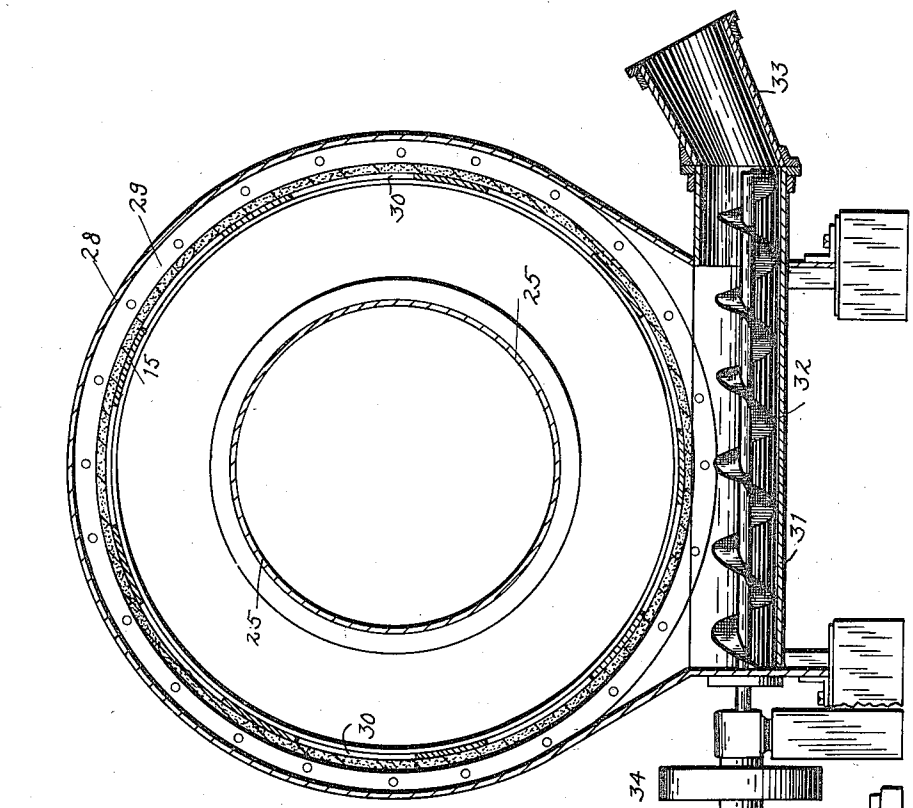

FIG. 5

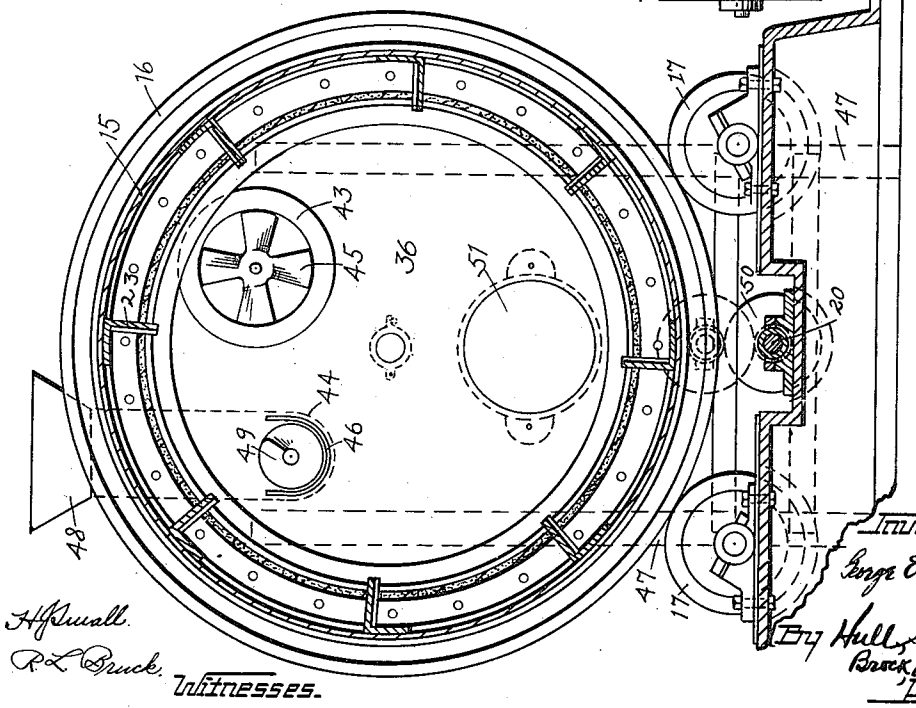

FIG. 4

Witnesses.

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UNITED STATES PATENT OFFICE.

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DRIER.

1,297,409. Specification of Letters Patent. Patented Mar. 18, 1919.

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To all whom it may concern:

Be it known that I, GEORGE E. SHATTO, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Driers, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention relates to driers and especially to that class of driers whereby the moisture may be separated from plastic or sticky substances such as the residue of garbage or town refuse after cooking, or brewers' grains, flax or cotton seed products, and the like, although it is susceptible of use in other connections as will be well understood. In the drying of substances of this nature it is necessary to avoid carefully any frying or roasting of the material by prolonged contact with hot metal since this would lead to sticking, charring and decomposition. Also as soon as the moisture has been somewhat reduced the material is very easily ignited, particularly at the temperatures necessarily employed for the most efficient treatment. The object of this invention is the provision of a drying device which may be operated for this purpose in a rapid continuous manner and with a minimum of expense for attendance, labor, repairs, and operation, and with a minimum of danger of sticking, charring, or ignition.

Generally speaking my invention may be defined as consisting of the combinations and constructions recited in the claims hereto annexed and illustrated in one embodiment in the drawings accompanying and forming a part of this application, wherein: Figure 1 is a longitudinal, vertical, sectional view through a drier constructed in accordance with my invention; Fig. 2 is a left hand end elevation of the same; Fig. 3 is a view of the furnace taken upon the line 3—3 of Fig. 1 and looking in the direction of the arrows; Figs. 4 and 5 are vertical, transverse, cross-sectional views taken upon the lines 4—4 and 5—5 of Fig. 1 and looking in the direction of the arrows; and Fig. 6 is a detail view of the joint between the drier cylinder and one of its end closures, drawn to enlarged scale.

Describing the parts by reference characters, my improved drier consists essentially of a heating part and an evaporating part, the two being preferably made entirely separate. Preferably I employ direct furnace heat, passing the entire combustion products through the evaporating part in case they be not too smoky, suitable means being provided for reducing the temperature and increasing the volume of the gases. The heat employed may theoretically be that of the flue gases of a steam or other boiler, and my invention contemplates such an arrangement. However the fact that the drier and steam boiler may be wanted at different times, causes me to prefer a wholly separate heat source. The heating part here shown consists of a casing 1 having therein a fire box 2, and an ash pit 3 separated by a grate 4. In the rear of the fire box is formed a bridge wall 5 and to the upper part of the fire box is connected the flue 6 provided with a damper 7. Upon the opposite side of the bridge 5 from the fire box I provide a settling chamber 8 preferably formed with a cleanout door 9, and having a large aperture 10 for the hot gases. This aperture is preferably surrounded by a horizontal flange 11 incased by a metal band 12 about which is slidably mounted a movable collar 13. This collar is pivoted to a lever 14 suitably fulcrumed to the furnace casing in such wise as to be protracted or retracted at will.

The drier portion consists of an elongated cylindrical shell 15 mounted in nearly horizontal position and arranged to be rotated about its longitudinal axis. Preferably this shell is encircled at two or more points by hoops or tires 16 arranged to run upon suitable rollers 17, and may also be provided with an additional toothed hoop 18 meshing with a pinion 19 carried by the drive shaft 20, whereby it may be rotated. The shell interior is provided with a plurality of inwardly projecting shelves 23—23 here shown as secured in a spiral manner to the shell and serving upon the rotation of the same not only to tumble the material over and over and to lift it up and shower it through the hot gases, but also to cause a steady progression of the same from one end of the device to the other. The angularity of these shelves will vary with the speed of progression desired and with the inclination of the shell body. Another advantage of the spiral arrangement is that the operation is more uniform and the material is cascaded so as to be brought more thoroughly in contact with the hot gases.

This shell is preferably mounted in aline-

ment with the furnace 1 and is provided with a central, axial tube 25 arranged in alinement with the aperture 10 and arranged to be brought into more or less close communication therewith depending upon the adjustment of the sleeve 13. The outer end of the tube 25 may be enlarged as at 26 for the reception of this sleeve, and the inner end of this tube extends a considerable distance into the shell, but generally less than half its length. This tube is preferably arranged to rotate with the shell. Surrounding the end of the shell is a hood 28 terminating at each side in a skirt 29 which embraces closely the shell exterior. The portion of the shell inside the space defined by this hood is formed with a plurality of apertures 30—30, and beneath these apertures there is formed a horizontal, substantially semi-circular trough 31 having therein a screw conveyer 32 and ending in an upwardly deflected discharge chute. The screw is driven by any suitable means such as a pulley 34.

The other end of the shell is closed by a stationary plate 36, the connection between the two being preferably arranged so as to be substantially tight and at the same time to permit the requisite expansion movement. A convenient method of effecting this result is to secure to one face of the plate 36 an angle iron 37 rolled to circular form so as to exhibit a cylindrical outer face 38. A similar but larger angle iron 39 is also secured to the inner end of the shell 15, and to the outer flat face of this second angle is secured an annular packing member 40 arranged to engage the cylindrical surface 38 of the ring 37. This arrangement effects the tight joint required while permitting free expansion and contraction of the shell. A similar arrangement is preferably employed at each side of the hood 28.

The plate 36 is preferably formed in its upper part with a couple of openings 43 and 44, in one of which is mounted the exhaust fan 45 and in the other the semi-cylindrical elongated trough 46. The outer part of this trough is supported by the frame work 47 which also supports the plate 36, and communicating with this trough is a hopper 48 for the reception of the material to be treated. Suitable means such as a spiral conveyer 49 is employed in this trough to force the material from the hopper into the drier, such means being driven from the main shaft 20 through suitable speed change gearing such as the cones 50.

The plate 36 may also conveniently be provided with a man-hole 51 to permit inspection or cleaning.

The operation of this device is as follows: Fuel is fed to the fire chamber 2 and the material to be treated at the hopper 48. When the fire is first started the products of combustion are discharged through the flue 6, but during the normal operation of the device the combustion gases are all drawn through the opening 10 by the suction of the fan 45, the damper 7 being closed. The sleeve 13 is so adjusted relatively to the tube 25 that enough outside air is drawn in to reduce the gases to the proper temperature, this air and gas becoming thoroughly mixed together during their passage through the tube 25. Any desired drying temperature may be employed that preferred by me being about 300° F, which permits the introduction of a very large amount of air since the furnace gases will frequently be as hot as 1000° F., although this temperature varies largely which renders an adjustable inlet advisable. The moist material, by being showered through the hot gases, gives up its moisture directly and without scorching. The shell 15 is never hotter and usually cooler than the material inside, wherefore no frying can take place. The length of the pipe 25 is so chosen as to cause it to extend substantially to the point where evaporation has been largely completed and the danger of ignition first appears. With oily or grease containing material such as reduced garbage, seed products, corn products, etc., the material would take fire if exposed freely to air and heat when dried unless the temperature were kept so low as to render the process very inefficient. With this drier the material at this point passes into the closed annular space outside of the tube 25 where it is still subjected to the radiant heat from this tube but is not exposed directly. The last portion of the water comes away much more slowly and requires a more gentle steady heat. Also the vapor given off by the material in this space renders ignition all the more difficult. The fact that the tube 25 is constantly rotating prevents material from lodging thereon and taking fire. The fact that the feeding device 49 is connected directly to the kiln rotating devices 19 permits the rate of speed to be so adjusted that the material may be brought exactly to the right condition at the time of its discharge. Arrived at the discharge end of the shell the material drops through the openings 30—30 into the trough 31 whence it is ejected by the screw 32 into the chute 33, the inclination of this chute causing the material to become heaped up over the opening thus closing the discharge opening against any material admission of air which otherwise would interfere with the operation of the drier.

While I have described my invention thus in detail and pointed out at some length the particular constructions which my experience has indicated as most desirable, together with some of the reasons therefor, it will be understood that these details and

constructions could be departed from or modified in some instances, wherefore I do not limit myself in these matters except as recited in the claims hereto annexed or as rendered necessary by the prior state of the art.

Having thus described my invention, what I claim is:—

1. In a drier, in combination, an elongated cylindrical shell mounted for rotation about a nearly horizontal axis, means for introducing material to be dried into one end of said shell, a plurality of shelves projecting inwardly from the wall of said shell and extending substantially from end to end thereof, the inclination of said shell and shelves being so arranged that the material will progress therealong as the shell is rotated, means for discharging the dried material from the opposite end of said shell, a hollow imperforate axial tube projecting into said shell from its discharge end, means for withdrawing gases from the end of said shell opposite said tube, and means for delivering heated drying gases to said tube.

2. In a drier, in combination, an elongated cylindrical shell mounted for rotation about an axis slightly inclined from horizontal, means for introducing material to be dried into the higher end of said shell, a plurality of shelves projecting inwardly from the wall of said shell and extending from the receiving end substantially to the discharge end thereof, means for discharging the dried material from the opposite end of said shell, a hollow imperforate axial tube projecting into said shell from its discharge end and rotatable therewith means for withdrawing gases from the end of said shell opposite said tube, and means for delivering heated drying gases to said tube.

3. In a drier, in combination, an elongated cylindrical shell mounted for rotation about a nearly horizontal axis, means for introducing material to be dried into one end of said shell, a plurality of shelves projecting inwardly from the wall of said shell, the inclination of said shell and shelves being so arranged that the material will progress therealong as the shell is rotated, means for discharging the dried material from the opposite end of said shell, a hollow axial tube projecting into said shell from its discharge end, means for withdrawing gases from the end of said shell opposite said tube, a source of heated gases located in alinement with and spaced from the end of said tube,—and means for varying the width of the space between said tube and source.

4. In a drier, in combination, an elongated cylindrical shell mounted for rotation about an axis slightly inclined from horizontal, means for introducing material to be dried into the higher end of said shell, a plurality of shelves projecting inwardly from the wall of said shell, means for discharging the dried material from the opposite end of said shell, a hollow axial tube projecting into said shell from its discharge end, means for withdrawing gases from the end of said shell opposite said tube, a pipe for furnace gases located in alinement with and spaced from the end of said tube, and a movable sleeve connected with said pipe and arranged to adjust the space between said pipe and tube.

5. In a drier, the combination, with an elongated cylindrical shell mounted for rotation about a nearly horizontal axis and means for introducing the material to be dried into one end of said shell, said shell being adapted and arranged upon rotation to cause such material to progress to the opposite end thereof, of a closed chamber surrounding the discharge end of said shell, a trough disposed beneath and in communication with said chamber, said trough having an upwardly deflected discharge end, and conveying means in said trough.

6. In a drier, the combination, with an elongated cylindrical shell mounted for rotation about an axis slightly inclined to the horizontal and means for introducing the material to be dried into the upper end of said shell, of shelves in said shell arranged to lift and cascade the material therein, means for exhausting gases and vapors from the upper end of said shell, an axial tube projecting into the lower end of said shell and spaced from said shelves, means for delivering heated drying gases to said tube, a closed chamber surrounding the discharge end of said shell and having at its lower part a laterally extending trough, and conveying means in said trough, the wall of said shell being formed at a point above said trough with an aperture for the discharge of the dried material, and said trough having an upward inclined discharge portion whereby the material may be piled up by the operation of said conveyer and the admission of air into said shell impeded.

7. In a drier, the combination, with an elongated cylindrical shell mounted for rotation about a nearly horizontal axis and means for introducing the material to be dried into one end of said shell, said shell being adapted and arranged upon rotation to cause such material to progress to the opposite end thereof, of a closed chamber surrounding the discharge end of said shell, a trough disposed beneath and in communication with said chamber, said trough having an upwardly deflected discharge end, and a screw conveyer located in said trough.

8. In a drier, the combination, with an elongated cylindrical shell mounted for rotation about a nearly horizontal axis and means for introducing the material to be dried into one end of said shell, said shell

being adapted and arranged upon rotation to cause such material to progress to the opposite end thereof, of a closed chamber surrounding the discharge end of said shell, a trough disposed beneath and in communication with said chamber, and a screw conveyer located in said trough, the discharge end of said trough being upwardly inclined and flared.

9. In a drier, the combination, with an elongated cylindrical shell and a fixed closure for one end of the same, of an angle iron rolled to circular form and secured to one face of said closure, said angle iron presenting a cylindrical outer surface, a second angle iron rolled to circular form and secured to the inner surface of said shell, said last angle iron presenting a plain radial surface, and a packing ring clamped against the flat face of the last angle iron and embracing the circular face of said first angle iron whereby relative rotational and longitudinal movement of said shell and closure is permitted.

In testimony whereof I hereunto affix my signature.

GEORGE E. SHATTO.