

April 13, 1926.

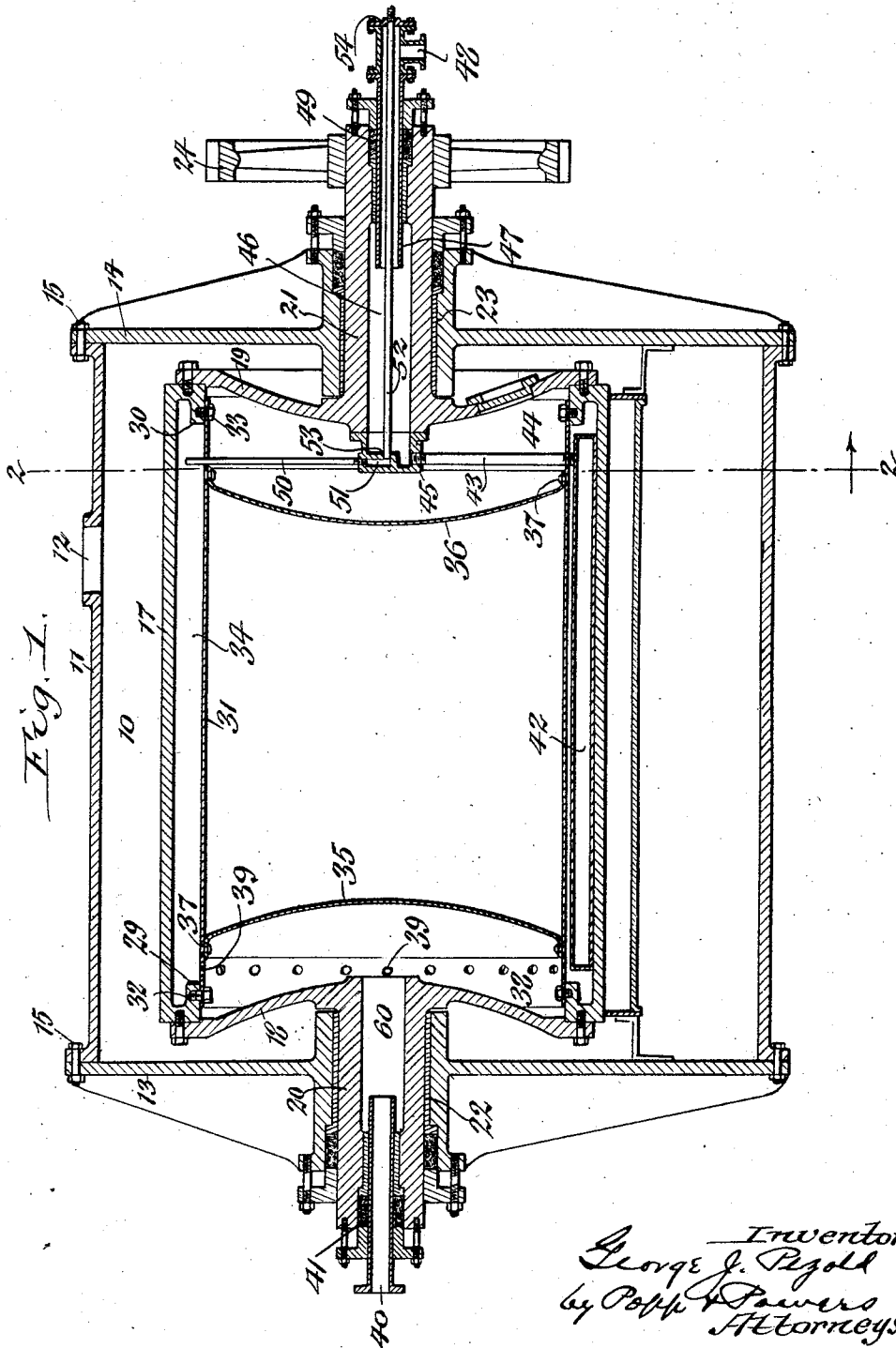
1,580,164

G. J. PEZOLD

DRYING APPARATUS

Filed Jan. 28, 1924

2 Sheets-Sheet 1



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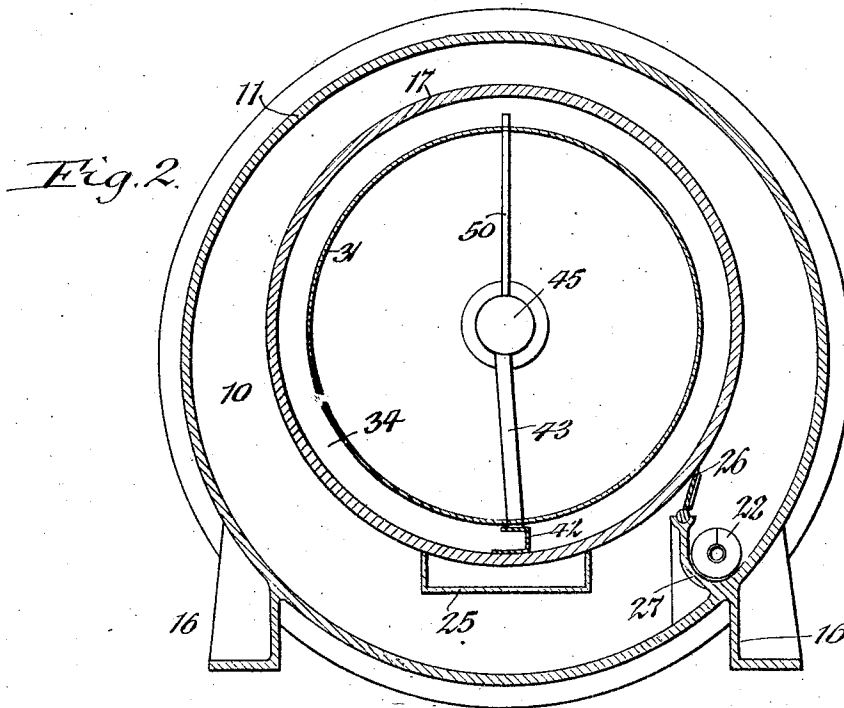
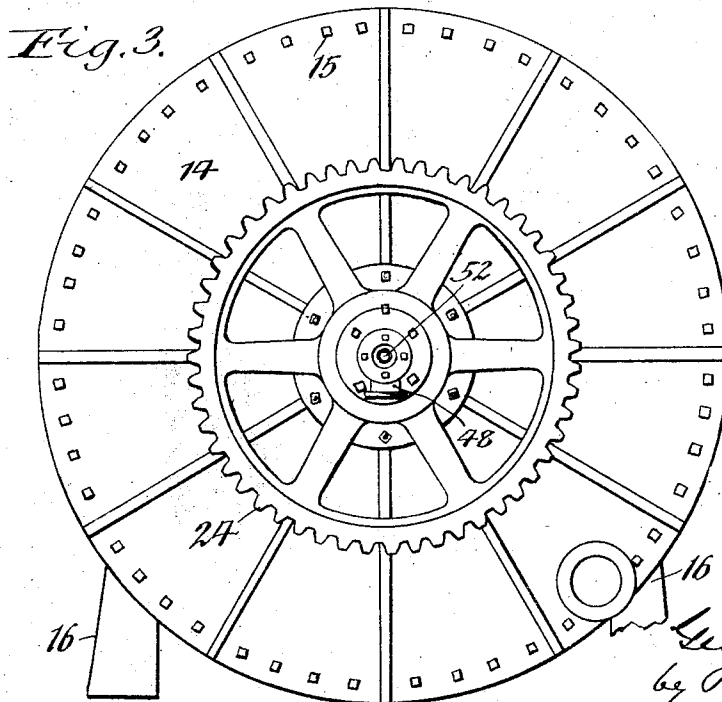
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE.

GEORGE J. PEZOLD, OF BUFFALO, NEW YORK.

DRYING APPARATUS.

Application filed January 28, 1924. Serial No. 688,902.

To all whom it may concern:

Be it known that I, GEORGE J. PEZOLD, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented new and useful Improvements in Drying Apparatus, of which the following is a specification.

This invention relates to a drying apparatus which is more particularly designed for either drying or reducing the liquid content of fluid matter containing solids.

It is the object of this invention to produce a drying apparatus for this purpose in which the steam space is reduced, the velocity of the steam and the transference of heat is increased and thereby enable the drying operation to be effected more economically, expeditiously and efficiently.

In the accompanying drawings:

Figure 1 is a vertical longitudinal section showing my invention embodied in a drying apparatus which works under a vacuum.

Figure 2 is a vertical cross section of the same, taken on line 2-2, Figure 1.

Figure 3 is an end elevation thereof.

Similar characters of reference refer to like parts in the several figures.

Although my invention is capable of use in a drying apparatus which operates either under atmospheric pressure or under a vacuum, the same, for example, is shown in the drawings for operation under a vacuum. In this particular instance the apparatus is constructed as follows:

The numeral 10 represents a vacuum chamber which may be of any suitable construction, but as shown in the drawings the same comprises a cylindrical wall 11 which has its axis arranged horizontally and provided with a vapor outlet 12 which is adapted to be connected with an exhausting device of any suitable construction whereby the vapors are withdrawn from the vacuum chamber and a vacuum is produced therein so as to expedite the drying operation. This wall 11 is provided at its opposite ends with transverse heads 13, 14 which may be detachably secured thereto in any suitable manner, but preferably by means of bolts 15 arranged on the peripheral parts of these members. The body or wall 11 of the vacuum chamber may be supported in an approved manner, for example, by means of legs 16 arranged on the underside thereof and adapted to rest on the floor of the building or other available support. Arranged

within the vacuum chamber is the drying drum which is constructed in accordance with my improvements. As there shown, this drum comprises an outer cylindrical wall or shell 17 which has its axis arranged horizontally, transverse heads 18, 19 secured to opposite ends of the outer wall 17, and tubular trunnions 20, 21 arranged horizontally and projecting outwardly from the outer ends of the heads 18 and 19, and journaled in suitable bearings 22, 23 in the heads 13 and 14 of the vacuum chamber. The body and heads of this drum together with the parts mounted thereon may be turned in various ways from the exterior of the machine, for instance, by means of a gear wheel 24 applied to the outer end of the hollow trunnion 21 and receiving power from any available source.

The outer wall of this drum is adapted to be heated internally for the purpose of drying the material which is applied upon the periphery thereof. The liquid which is to be dried may be supplied to the periphery of the outer wall of this drum in any suitable manner, for instance, by supporting a body or stream of this liquid by means of a pan or trough 25 in the lower part of the vacuum chamber and in such a position that the lower side of the drum wall upon rotating will bring the several parts of its periphery successively in contact with the top of the liquid in the pan 25 and pick up a continuous film of this liquid which adheres to the wall of the drum. As the drum turns this liquid is carried upwardly on one side of the drum and then downwardly on the opposite side thereof during which time the moisture in the liquid is evaporated or driven off by the heat within the drum and the solid content thereof remains adhering to the periphery of the outer wall. Before that part of the drum bearing the dried material again reaches the liquid supply pan or tray 25, this dried material is removed from the periphery of the drum by means of a knife or blade 26 which is arranged in rear of the trough 25 and engages the periphery of the drum so as to remove the dried material therefrom. The material thus removed may be discharged from the vacuum chamber in any suitable manner, but in the construction shown in the drawings this is accomplished by a conveyer mechanism which comprises a trough 27 which receives the dried material from the

knife 26 and a screw conveyer 28 which moves the material lengthwise through the trough 27 and discharges the same to the exterior of the machine in a manner well-known in this type of machine. When, however, the drying is to be accomplished under atmospheric pressure the cylindrical wall 11 of the vacuum chamber may be omitted by means equivalent to the trough 25 or retained for supplying the periphery of the drum wall with liquid and means corresponding to the knife 26 and conveyer 28 are also employed for removing the dried product from the drum and carrying the same away.

My invention which is embodied in the drying drum for the purpose of reducing the steam space therein, increasing the velocity of the steam and the heat transference and thus permit of effecting the drying of the material more economically, efficiently and rapidly may be variously constructed, but the example which is shown in the drawings as one form suitable for accomplishing this purpose is constructed as follows:

At opposite ends the outer wall 17 of the drying drum is provided with inwardly projecting annular flanges 29 and 30 which are preferably formed integrally with this wall. Arranged concentrically within the outer wall 17 is an inner cylindrical shell 31 which is secured at its opposite ends to the flanges 29, 30 by means of bolts 32, 33 or by other suitable means. This shell or inner wall is preferably constructed of sheet metal and the same is spaced apart from the outer wall 17 of the drum so as to form an intervening space or heating chamber 34 therebetween. Within the inner shell 31 and adjacent to opposite ends thereof are arranged two transverse partitions or diaphragms 35, 36, each of which is preferably constructed of sheet metal and dished inwardly and secured at its outer edge to the adjacent part of the cylindrical shell 31 by means of rivets 37. The front partition 35 is spaced apart from the front head 18 so as to form a communicating chamber or conduit 38 therebetween and that portion of the shell 31 between the partition 35 and the head 18 is provided with an annular row of perforations 39 whereby communication is established through the medium of the chamber 38 between the inlet passage 39 in the hollow front trunnion 20 and the front end of the heating chamber 34. Any suitable heating medium may be conducted through the hollow front trunnion 20 and to the heating chamber 34 for the purpose of drying the material which is deposited upon the periphery of the drum. Steam is generally used for this purpose and this may be supplied to the inlet 60 of the front hollow trunnion 20 by means of a supply pipe having a stationary inlet nozzle

40 projecting axially into the outer end of the hollow trunnion 20 and forming a leak-tight joint therewith by means of a stuffing box 41 interposed between these parts, as shown in Figure 1. The steam or other heating medium passes from the delivery nozzle 40 through the passage 39 in the front trunnion 20, thence laterally in all directions through the communicating chamber 38 and thence through the openings 39 into the heating chamber 34 in which latter the steam or other heating medium is presented to the inner side of the drum wall in the form of a body which is considerably reduced in volume or thickness and confined to the outer wall of the drum instead of filling a considerable part thereof including the center, as has been the custom heretofore. By this means a considerable reduction on the steam space is effected, consequently increasing the velocity of steam and in turn increasing the transference of heat from the steam to the material lying in contact with the outer side of the main wall 17 of the drum and expediting the drying operation.

The water of condensation may be carried away from the heating chamber 34 in various ways, the means for this purpose shown in the drawings being suitable and constructed as follows:

The numeral 42 represents a scoop arranged in the heating chamber 34 close to the inner side wall 17 and on one side of the axis of the rotation of the drum so that during each turn of the latter the scoop 42 picks up the water of condensation lying on the inner side of the lower part of the drum. This water is carried away from the rear end of the scoop by means of a drain pipe 43 which is arranged radially within the clearance chamber 44 formed between the rear head 19 of the drum and the adjacent partition 36 of the inner shell, the outer end of this radial drain pipe 43 being in communication with the inner side of this scoop and its inner end communicating with the interior of a hollow coupling head 45 which is secured to the inner end of the outlet passage 46 formed in the rear trunnion 21 so that this water of condensation is carried from the scoop 42 to this outlet or drain passage 46 during the operation of the machine. This water of condensation is carried to the exterior of the machine by means of a stationary drain pipe having a stationary discharge nozzle 47 arranged axially within the outer end of the hollow trunnion 21 and provided with a lateral discharge branch 48, a leak tight joint being formed between this discharge 47 and the hollow trunnion 21 means of a stuffing box 49, as shown in Figure 1. Due to this construction the water of condensation is carried away much more rapidly and

thoroughly than has been possible heretofore and it also decreases the thickness of the water film lying against the lower side of the drum and thereby increases the transference of heat to the material under treatment and thereby increases the output of the machine and effects a corresponding reduction in the cost of drying the material.

It is desirable to remove the non-condensable gases from the heating chamber for the purpose of enabling the steam or other heating medium to operate more efficiently and increase the heat transference which ordinarily is interfered with by the presence of non-condensable gases. In the preferred form for accomplishing this a non-condensable gas discharge pipe 50 is arranged radially within the clearance chamber 44 and extended with its outer end through the adjacent part of the shell 31 so that the outer extremity of this pipe terminates near the inner side of the outer wall 17 at a point which is arranged on that side of the axis of the drum diametrically opposite to where the scoop 42 is located, as shown in Figures 1 and 2. The inner end of this uncondensable gas discharge pipe 50 communicates with the gas discharge chamber 51 formed on the inner part of the cap 45 and from this gas chamber the gas is discharged to the exterior of the machine by a stationary gas outlet pipe 52 arranged axially within the water outlet passage 46 and the discharge pipe 47 and fitted loosely at its inner end in an opening 53 formed in the outer side of the chamber 51 while the outer end of the pipe 52 is mounted on a head 54 which is arranged on the outer part of the water discharge pipe 47, as shown in Figure 1. As the drum turns the cap 45 mounted thereon, it also turns about the inner end of the pipe 52 thereby maintaining communication between the gas exhaust pipe 50 and the delivery pipe 52 without interfering in any way with the relative rotation of these parts. The non-condensable gases are withdrawn from the inner side of the wall 17 while the same is not covered by water, these gases passing outwardly through the pipe 50, gas chamber 51 and discharge pipe 52 to the exterior of the machine. The passage of the gas in this manner may be facilitated by connecting the discharge pipe 52 with an exhausting device of any suitable character such as an ordinary pump, or providing this pipe with a valve and allowing the gas to escape to the atmosphere by the difference in pressure. By thus removing the non-condensable gases this results in an increased velocity in the steam and it also aids in

increasing the heat transference from the steam to the material under treatment and thereby effects a more rapid drying of the same.

As previously stated this improved drying apparatus is capable of being embodied in an apparatus which operates either under atmospheric or vacuum conditions and may be utilized for drying all materials that are ordinarily dried on drum or roll driers.

I claim as my invention:

1. A drying apparatus comprising a rotary drum having a cylindrical outer wall, inwardly projecting flanges arranged on opposite ends of said wall, heads secured to said flanges, hollow trunnions arranged on said heads, an inner shell secured at its opposite ends to said flanges and spaced apart from the inner side of said wall and forming a heating chamber therebetween, and partitions arranged transversely within the shell and secured thereto and spaced apart from said heads, the space between one of said partitions and the adjacent head forming a conduit for a heating medium and the adjacent part of the shell between said last mentioned partition and the adjacent head being provided with perforations for the passage of a heating medium into said heating chamber.
2. A drying apparatus comprising a rotary drum having a cylindrical wall, inwardly projecting flanges arranged at opposite ends of said wall, heads arranged at opposite ends of the wall, hollow trunnions arranged on said heads, and forming a heating medium inlet and a condensation outlet, respectively, an inner shell secured at its opposite ends to said flanges and spaced apart from the inner side of the wall and forming a heating chamber therebetween, partitions arranged transversely within the shell and secured thereto and spaced apart from said heads, the space between one partition and the adjacent head forming a conduit for a heating medium which communicates with said heating medium inlet and said heating chamber, condensation removing means extending from the interior of said heating chamber on one side of the axis of the drum and along the outer side of said other partition to said condensation outlet, and means extending from said heating chamber on the opposite side of said axis through said outlet to the exterior of the apparatus for the purpose of carrying away any gas which may be present in the heating chamber.

GEORGE J. PEZOLD.