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APPARATUS FOR DRYING MATERIALS.

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1,415,160. Patented May 9, 1922.

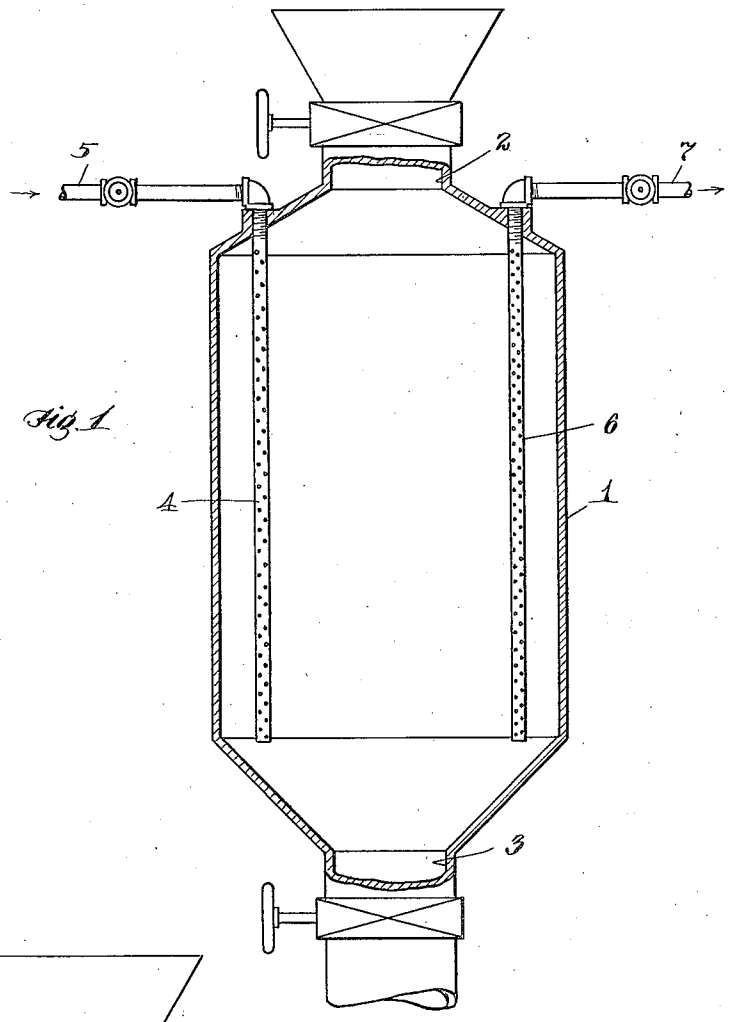


Fig. 1

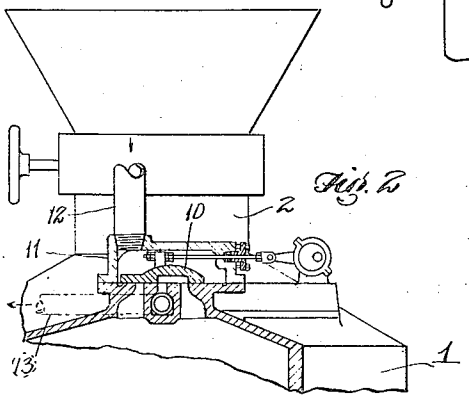


Fig. 2

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APPARATUS FOR DRYING MATERIALS.

1,415,160. Specification of Letters Patent. Patented May 9, 1922.

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To all whom it may concern:

Be it known that I, HERBERT H. DOW, a citizen of the United States, and a resident of Midland, county of Midland, and State of Michigan, have invented a new and useful Improvement in Apparatus for Drying Materials, of which the following is a specification, the principle of the invention being herein explained and the best mode in which I have contemplated applying that principle, so as to distinguish it from other inventions.

In drying materials, such as the products of various chemical manufacturing processes, the ordinary shelf dryer is objectionable in that there are no means for communicating heat from the steam jacketed surface to the material resting on the shelves except the more or less rarified air within the drying chamber, and the convection currents of such rarified air are either too slow or lack heat absorbing capacity. The drying action principally results from the conduction of heat from the steam heated surface to the layer of material that is in immediate contact therewith, but in the case of a finely powdered material, even this is a very slow and ineffective way of heating. The purpose of the present invention is to provide an apparatus for use in connection with a drying process of this sort, whereby it will not be necessary, first of all, to subdivide the material into thin layers with attendant labor, expense and the need of expensive apparatus. A further object is to apply the heating medium in such a manner as to insure its dissemination more or less uniformly throughout the mass of material so as to not only expedite the drying operation, but secure uniform results.

To the accomplishment of the foregoing and related ends, the invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims, the annexed drawing and the following description setting forth in detail certain means for carrying out the invention, such disclosed means illustrating, however, but one of various ways in which the principle of the invention may be used.

In said annexed drawing:—

Fig. 1 is a diagrammatic representation of an apparatus adapted for carrying out the method or process in question; and Fig. 2 is a sectional detail of a modified form of such apparatus.

The steps of the process include alternately heating the material or product to be dried with hot dry air, and then cooling the same by evaporation and vacuum. To this end, in carrying out the process the material is conveniently placed in a large cylindrical container or drum 1, preferably disposed with its axis vertical as shown in the drawing, and having a valve-controlled inlet opening 2 at its upper end and a similar valve-controlled outlet opening 3 at its lower end. Projecting within the container, in the form of apparatus shown in Fig. 1, is a perforated pipe 4 having a valve-controlled exterior connection 5 with a hot air supply (not shown). Similarly projecting within such container is a second perforated pipe 6 having an exterior valve-controlled connection 7 with a vacuum-producing apparatus (not shown). The pipes 4 and 6 preferably extend parallel with the axis of the container where the latter is of cylindrical form as shown, and lie adjacent diametrically opposite portions of the cylindrical wall, so that, in other words, the bulk of the material being treated when the container is filled will lie between said pipes. It will be understood that a larger number of pipes may be utilized on each side than the single one shown, depending upon the size of the apparatus and the rapidity of operation desired.

In using the above described apparatus, after the desired quantity of material has been placed in the container 1, the valves in the inlet and outlet openings 2 and 3 respectively are both closed and hot dry air passed into and through the material, entering by way of pipe 4 and escaping by way of pipe 6. The air before it is thus admitted to the chamber may be dried and heated in any suitable manner; for example, by passing it through a tower containing calcium chloride, lime, sulphuric chloride, or other suitable desiccating agent, then passing it through an apparatus similar to a surface condenser in which air on one side is heated by steam on the other side of a tube. Preliminarily to supplying any hot air, or after it has been thus passed for a time through the material, the valve in connection 5 is closed and a vacuum applied

through connection 7 and pipe 6 until the pressure within the container is reduced to any desired degree. Thereupon the valve in said connection 7 is closed and the valve in connection 5 opened to admit more hot air until normal, or, if desired, supernormal, pressure is restored within the container. The valves 7 and 5 are thus alternately heated by hot air and cooled by evaporation and vacuum. The effect of the vacuum is of course to withdraw the previously admitted air, and to the extent that evaporation takes place, the air and the material being dried will both be cooled. The cycle of operation just described is repeated as often as necessary to bring the material to the requisite state of dryness, whereupon both valves 5 and 7 are closed, and the outlet 3 of the container is opened to discharge such dried material.

It is not essential that perforated pipes, such as pipes 4 and 6, should be used, but the hot dry air may be directly admitted to the chamber and the vacuum similarly applied, as shown in Fig. 2. In such figure, I further show a power actuated slide valve 10 in a suitable casing 11 connected with an air line 12 and vacuum line 13, whereby it is possible to introduce dry air and evacuate the apparatus with great frequency if desired.

The operation of the apparatus, it will be seen, is entirely simple and convenient, and is well adapted to the handling of fluffy masses which would be extremely difficult to place properly in a shelf dryer. Furthermore, such a mass can be dried quickly and uniformly throughout, even though it be a perfect non-conductor of heat, since the air admitted through pipe 5 will tend to penetrate the mass after the latter has been subjected to the vacuum, while the effect of the vacuum will be to withdraw such air and with it the moisture that it has absorbed.

It will be understood, of course, that other gaseous media than air may be employed, if inert so far as the particular material being treated is concerned. The term air, as herein used, is accordingly to be understood to connote any such medium suitable to the purpose.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the mechanism herein disclosed, provided the means stated by any of the following claims or the equivalent of such stated means be employed.

I therefore particularly point out and distinctly claim as my invention.

1. In drying apparatus, the combination of a chamber capable of being sealed, and having material supply and discharge openings, air-supply and vacuum lines connected with said chamber and unitary valve-means adapted to control said lines, respectively.

2. In drying apparatus, the combination of a chamber capable of being sealed, and having material supply and discharge openings, air-supply and vacuum lines connected with said chamber, and a single power-operated valve adapted to alternately open one such line and close the other.

Signed by me, this 2nd day of May, 1919.

HERBERT H. DOW.