June 3, 1930. D. D. PEEBLES 1,761,149

DRYING APPARATUS AND METHOD

Filed July 18, 1927

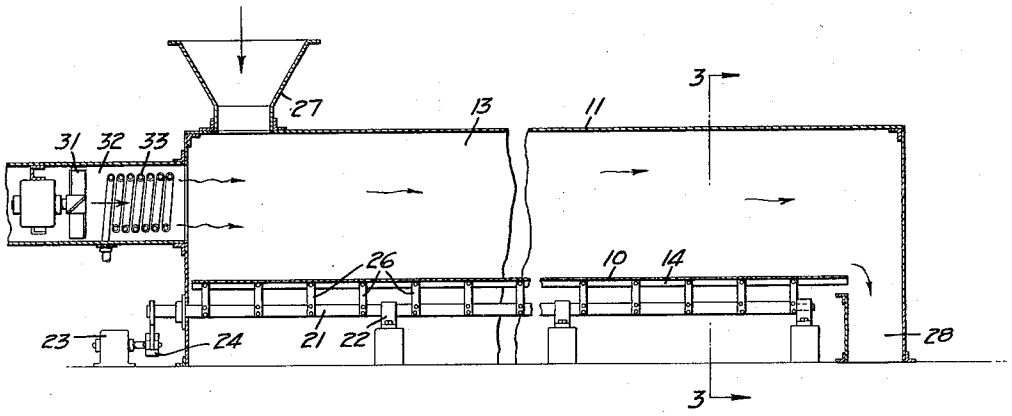



FIG. 1.

FIG. 2.

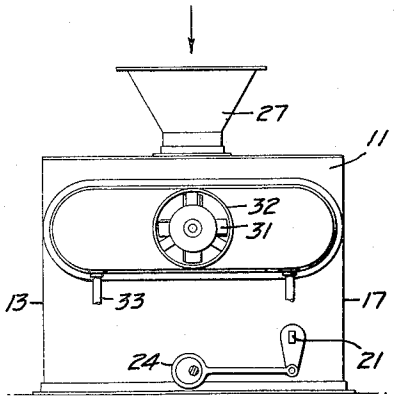
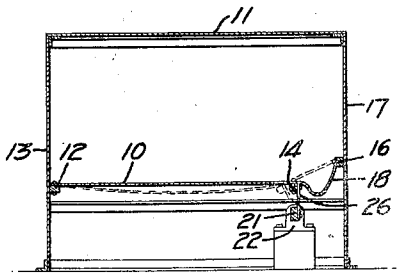



FIG. 3.




INVENTOR
David D. Peebles
BY
White, Frost & Fryer
his ATTORNEYS

Patented June 3, 1930 1,761,149

# UNITED STATES PATENT OFFICE

DAVID D. PEEBLES, OF EUREKA, CALIFORNIA

## DRYING APPARATUS AND METHOD

Application filed July 18, 1927. Serial No. 206,440.

This invention relates generally to apparatus for and method of effecting drying of substances in divided condition.

It is an object of this invention to devise a drying apparatus which will effect drying of a maximum amount of material in a minimum of time.

It is a further object of this invention to devise an effective drying apparatus which will be cheap to manufacture and will occupy a minimum of space.

It is a further object of this invention to devise an apparatus for drying divided material having adhesive properties, such as casein.

It is a further object of this invention to devise a novel method of drying which will effect the objects set forth above.

Further objects of this invention will appear from the following description in which I have set forth the preferred embodiment of my invention. It is to be understood that the appended claims are to be accorded a range of equivalents consistent with the state of the prior art.

Referring to the drawing:

Figure 1 is a cross sectional elevational view showing a drying apparatus constructed in accordance with this invention.

Fig. 2 is an end view of the apparatus shown in Fig. 1.

Fig. 3 is a cross sectional view taken along the line 3—3 of Fig. 1.

In the drying of substances in divided condition, it has become a common practice to employ a large number of trays within which the substance is placed, these trays being stacked in tiers and passed through tunnels heated to drying temperature. In apparatus of this kind, much labor is required for placing the material within the trays and arranging the trays upon the trucks which carry the same through the drying tunnel. Likewise when the tiers of trays are removed from the tunnel, the trays must be manually removed, emptied of their contents and cleaned before reusing. A considerable outlay of capital is required for apparatus of this kind, and a comparatively long time is necessary for drying a given amount of material. These disadvantages are especially marked when drying material which is naturally adhesive, such as casein. In order to prevent the particles of casein from adhering together to form a solid mass, this material must be spread into comparatively thin layers in the trays, thus necessitating a great number of trays for a given amount of material. In this invention I have provided a simple form of apparatus which may be operated continuously with practically no labor to dry substances in a minimum of time. Because of the inherent nature of its operation, it is particularly adapted for naturally adhesive substances such as casein.

The invention may be outlined briefly as comprising a flexible screen upon which the substance to be dried is placed. This screen is whipped repeatedly by mechanical means so that the divided material is thrown up in the form of a cloud above the screen. The top of the screen is enclosed and a draft of drying gas maintained to gradually move the material toward one end of the screen where it is removed in completely dried condition.

Referring to the drawing I have shown an elongated flexible screen 10, constructed of suitable flexible material such as canvas. This canvas screen is supported in a general horizontal position and has its upper surface suitably enclosed. By "general horizontal direction" I have reference to such a positioning of the screen that material placed upon the same will not be quickly precipitated towards one end of the screen to defeat the objects of the invention. For example I have shown screen 10 disposed within a housing 11, the housing being in the form of an elongated tunnel. One edge of the screen is secured to a member 12 which is fastened along one side wall 13 while the other edge is secured to a member 14 which is adapted to be mechanically oscillated. Another member 16 is secured to the other side wall 17 of housing 11, and a piece of flexible material, such as a canvas strip 18 loosely connects between the members 16 and 14. Extending longitudinally of the housing, there is a shaft 21 provided with suitable journals 22. This

shaft is adapted to be rocked at a relatively high rate of speed by the motor or other power means 23, an excentric connection 24 serving to connect the motor 23 and shaft 21. Connected between the shaft 21 and the strip 14, are the spring members 26 which form resilient means for tensioning the screen 10.

The material to be dried is introduced upon one end of screen 10, as by means of the hopper 27, and is adapted to gradually progress toward the other end of the screen where it is discharged by suitable means such as the conduit 28. In order to cause the material to gradually progress along the screen, the screen may be tilted slightly from the horizontal, but I prefer to cause a draft of air or other drying gas to move along the screen to carry with it the material being dried. For example I have shown means for maintaining a draft in the form of a motor driven fan 31 which is adapted to induce a draft of air thru the conduit 32, this conduit communicating with the housing 11 adjacent the point of introduction of the material. For heating the air or other drying gas, suitable means may be provided such as the steam pipes 33 which have been shown as disposed within the conduit 32.

In operation the motor 23 functions to rapidly oscillate the shaft 31. This motion is transmitted to the springs 26 to alternately loosen and tension the screen 10. This causes what may be termed a "whipping" action and serves to throw the material on the screen upwardly. When divided material is introduced through hopper 27 and subjected to the action of the rapidly whipping screen, it is kept in a continual state of agitation, and is maintained in suspension above the screen. An observer looking into the housing would see no material disposed upon the surface of the screen, but would only note a cloud of rapidly moving material in which the particles are always in a state of motion. Because of the suspended state of the material, a draft of air induced through the housing causes the material to gradually progress toward the discharge end, the draft being of correct value and temperature so that when the material reaches the discharge conduit, the desired amount of moisture has been removed. The apparatus is adapted for continuous as well as intermittent operation.

Because of the peculiar method employed by this apparatus, it is particularly effective in the drying of substances normally adhesive, such as casein. The particles are prevented from adhering together since they are kept in a constant state of motion and are in suspension within the drying gas. In practice it is found that a single machine of the type described herein, having two superposed canvas screens, will dry an amount of casein equal to a relatively large dryer of the tray type.

I claim:

1. In a drying apparatus, a flexible sheet arranged in a general horizontal direction, and means for repeatedly tensioning said sheet to cause a whipping effect.

2. In a drying apparatus, a flexible sheet arranged in a general horizontal direction, means for repeatedly tensioning said sheet to cause a whipping effect, and means for maintaining a draft of gas above said sheet.

3. In a drying apparatus, an enclosure, means for maintaining a draft thru said enclosure in one direction, and a flexible sheet forming the lower wall of said enclosure on which material to be dried is adapted to be disposed, and means for repeatedly tensioning said sheet to cause a whipping effect.

4. In a drying apparatus, a flexible sheet disposed in a general horizontal direction, a closure over said sheet, and means for repeatedly tensioning said sheet to cause a whipping action.

5. In a drying apparatus, a flexible sheet disposed in a general horizontal direction, a closure over said sheet, and means including a resilient connection to one edge of said sheet for repeatedly tensioning the same to cause a whipping effect.

6. In an apparatus for drying divided material, a flexible sheet arranged in a general horizontal position, and means for imparting rapid vertical vibratory movements to said sheet, said means serving to repeatedly tension said sheet.

7. In an apparatus for drying divided material, a sheet arranged in a general horizontal position above which said material is disposed, means forming an enclosure over said sheet, means imparting vertical vibratory movements to said sheet whereby divided material in the enclosure is thrown upwardly upon contact with the sheet, and means comprising a draft of gas above said sheet for effecting drying of said material and for conveying said material out of said enclosure.

8. In a drying apparatus, a flexible sheet arranged in a general horizontal position, means forming an enclosure over said sheet, means for imparting vertical vibratory movements to the sheet, said means serving to repeatedly tension said sheet, and means for maintaining a draft of drying gas thru said enclosure.

9. In a drying apparatus for effecting drying of divided material, a sheet, an enclosure over said sheet containing a drying atmosphere, and means for effecting vertical vibratory movements of said sheet at a rate sufficient to keep divided material in the enclosure in suspension above said sheet.

10. In a drying apparatus for effecting drying of divided material, a sheet substantially imperforate to said material, an enclo-

sure over said sheet containing a drying atmosphere, and means for effecting vertical vibrating movements of said sheet at a rate sufficient to keep divided material in the enclosure in suspension above said sheet.

11. In a drying apparatus, a sheet arranged in a general horizontal direction, said sheet being substantially impervious to the material being dried, an enclosure over said sheet containing a drying atmosphere, and means for effecting substantially vertical vibratory movements of said sheet at a relatively high rate of speed.

In testimony whereof, I have hereunto set my hand.

DAVID D. PEEBLES.