

Jan. 23, 1945.

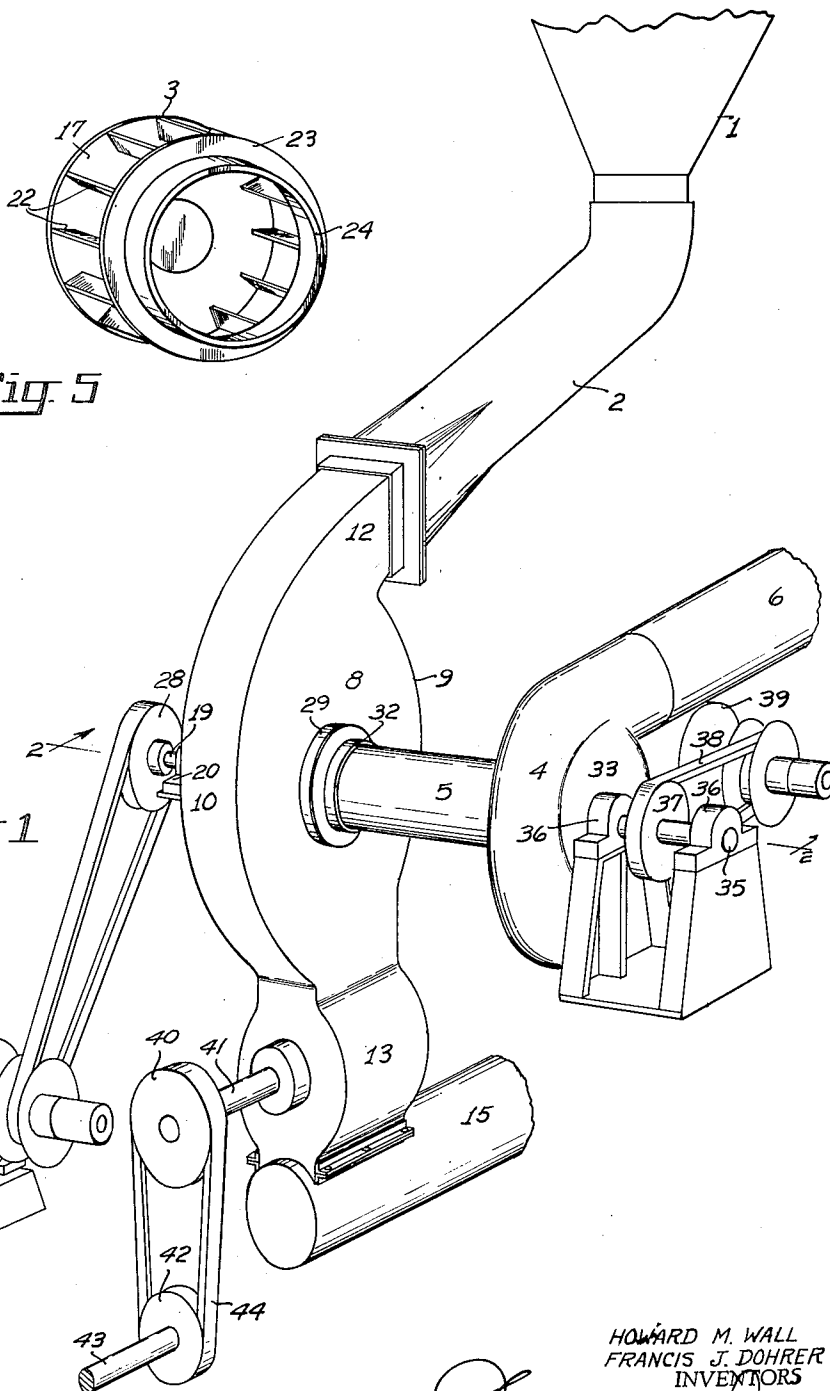
H. M. WALL ET AL

2,367,906

APPARATUS FOR SEPARATING WOOD FLOUR

Filed Jan. 9, 1942

2 Sheets-Sheet 1



HOWARD M. WALL
FRANCIS J. DOHRER
INVENTORS

BY *Harold L. Cook*
ATTORNEY

Jan. 23, 1945.

H. M. WALL ET AL

2,367,906

APPARATUS FOR SEPARATING WOOD FLOUR

Filed Jan. 9, 1942

2 Sheets-Sheet 2

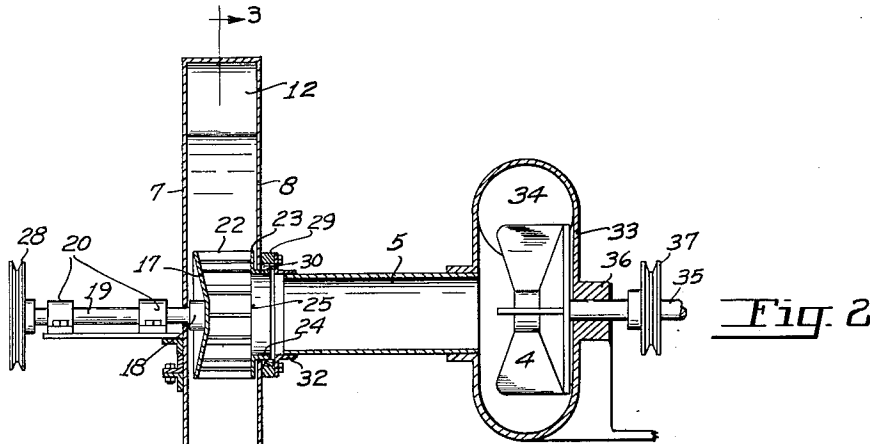


Fig. 2

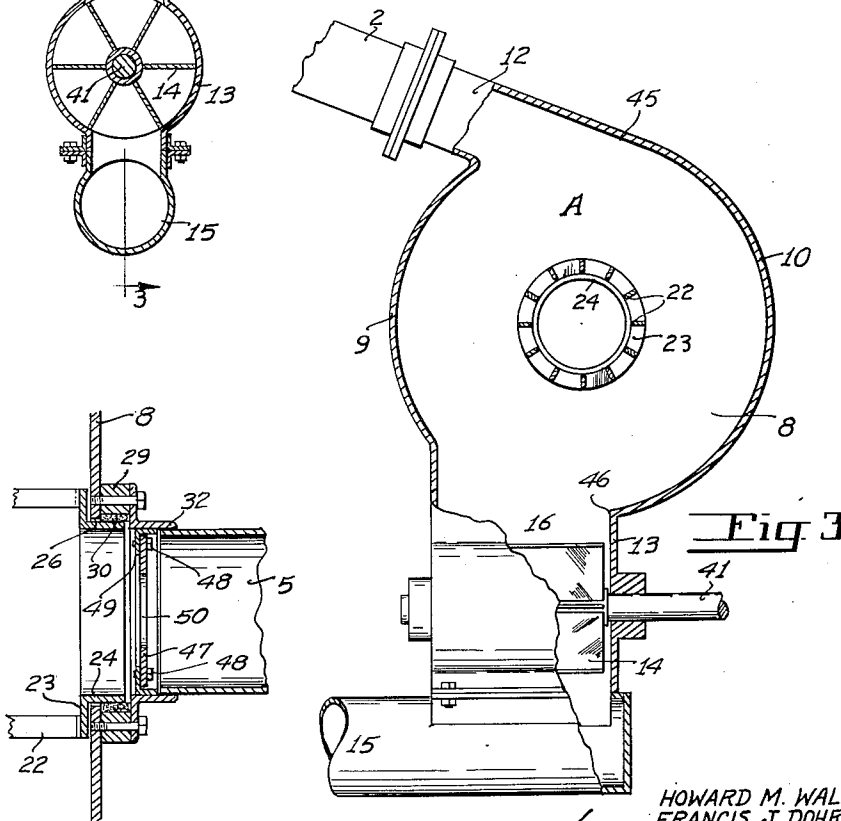


Fig 3

Fig 4

HOWARD M. WALL
FRANCIS J. DOHRER
INVENTORS

BY

ATTORNEY

UNITED STATES PATENT OFFICE

2,367,906

APPARATUS FOR SEPARATING WOOD FLOUR

Howard M. Wall, Portland, Oreg., and Francis J. Dohrer, Seattle, Wash.; said Dohrer assignor to said Wall

Application January 9, 1942, Serial No. 426,216

3 Claims. (Cl. 209—144)

This invention relates to the manufacture of wood flour, and has particular reference to a method of and apparatus for recovering wood flour from finely divided wood particles, such as sawdust or sander dust, which are commonly found as by-products of woodworking plants.

The finely divided wood products such as sander dust and sawdust which comprise the by-products of woodworking plants are commonly used as fuel, or are discarded and burned as refuse. Whatever disposal is made of these products, however, they are commonly withdrawn from the sanders or from adjacent the saws in a woodworking plant by blower fans and delivered under forced air draft to the usual cyclones for separating the air from the dust. From thence the conglomerate mixture of chips, wood flour, minerals from the sandpaper, and the like, is conveyed to the furnaces or to a refuse pile, according to what disposal is to be made thereof. So far as is known to applicants, no previous effort has been made to separate commercial products such as wood flour from these by-products of woodworking plants, and the present invention is predicated upon the concept of recovering wood flour therefrom by circulating the mixture by mechanical means to form a vortex, the velocity of rotation of the mixture in the vortex being such that at least substantially all of the particles of the mixture comprising wood flour is suspended in the vortex. Means is provided for creating movement of air toward the center of the vortex with a velocity sufficient to carry with it substantially all particles of the mixture having less than a predetermined mass, and for removing the air and the particles of the mixture carried thereby from the center of the vortex.

In the particular application of the method herein illustrated and described, sander dust from the sanding room of a woodworking plant is delivered to a separating chamber wherein a rotor is provided for circulating in a vortex at least substantially all of the wood flour contained in the sander dust. A first outlet communicates with said chamber adjacent the center of the vortex, and means is provided for applying a suction to said outlet for withdrawing from said chamber wood flour consisting of particles of a predetermined size and smaller. A second outlet is provided communicating with said chamber adjacent the outer periphery of the vortex for withdrawing the remainder of the sander dust from the chamber.

It is primary object of the invention to produce commercial grades of wood flour by providing for

the recovery thereof from mixtures of finely divided wood particles.

It is a further object of the invention to provide a method of and apparatus for recovering commercial grades of wood flour from a mixture of finely divided wood particles.

It is a further object of the invention to provide a method of and apparatus for the recovery of wood flour from the finely divided by-products of woodworking plants.

It is a further object of the invention to provide a new and novel method of classifying and sorting finely divided wood particles containing wood flour and of recovering therefrom wood flour of a predetermined size.

It is a further object of the invention to provide a method of separating wood flour of a predetermined size from a flow of finely divided wood particles containing wood flour of such size, and of conveying the wood flour to a receiving bin.

It is a further object of the invention to provide apparatus for separating wood flour of a predetermined size from discrete materials containing such flour and for delivering the several separated products to places of disposal and use.

The invention is herein disclosed in connection with the description of an equipment adapted to carry out the method, said description being taken in conjunction with the accompanying drawings, while features of novelty characterizing the invention are pointed out with greater particularity in the appended claims.

In the drawings, Figure 1 is a perspective view of an apparatus designed to separate wood flour from other finely divided wood products and to deliver the several products of the separation to places of disposal and use; Figure 2 is a sectional view of the apparatus illustrated in Figure 1, taken on the vertical axis of the separating chamber and suction fan as indicated by the line 2—2 of Figure 1; Figure 3 is a side elevation of the apparatus, partly in section, taken on the line 3—3 of Figure 2; Figure 4 is an enlarged sectional view illustrating a modification of the structure at the outlet orifice of the separating chamber; and Figure 5 is a perspective view of the rotor in the separating chamber.

The apparatus illustrated in the drawings comprises, generally, a cyclone usually mounted in an elevated position with respect to a woodworking plant, and to which is delivered the comminuted mixture of wood particles and abrasive materials which are the products of the saws and sanding rooms of the plant. Insofar as the present invention is concerned, the cyclone represents

a source of supply of such material, from whence the material is delivered through the supply pipe 2 to a separating chamber A, hereinafter more particularly described. During intervals of non-use of the wood flour recovery system a valve is opened, permitting the flow of material from the cyclone into a bypass pipe line for supplying dust to the furnaces, no part of this structure being shown. In the separating chamber A the material supplied thereto from the cyclone 1 is circulated with a vortical movement by means of a rotor 3, the velocity of rotation being such that substantially all of the mixture comprising wood flour is suspended in the atmosphere of the chamber. Air is exhausted from the separating chamber A by means of a suction fan 4 (see Figure 2) communicating with the separating chamber A by means of a pipe line 5 whereby air in the separating chamber A is moved toward the center of the vortex at a velocity sufficient to carry with it substantially all particles of the mixture having less than a predetermined mass. The fan 4 withdraws the air-borne particles from the center of the vortex and delivers these particles to a receiving bin, not shown, through a pipe line 6.

The separating chamber A comprises an outer casing made up of end walls 7 and 8, respectively, and curved wall portions 9 and 10 connecting the end walls. A downwardly directed inlet 12 receives material from the supply pipe 2 and introduces said material tangentially of the separating chamber. The curved wall portion 10 is substantially semi-cylindrical and extends from the inlet 12 to a point of conjunction with an end wall of the casing 13 of an outfeed valve 14, through which materials of greater mass than those recovered through the pipe line 5 are delivered into a pipe line 15 communicating with the furnace supply line, not shown. The curved wall portion 9 is curved on the same radius as is the wall portion 10 and extends from the inlet 12 to a point of conjunction with the end wall of the casing 13, the respective end walls of the casing 13, together with end walls 7 and 8, defining an outlet orifice 16 for the discharge of materials of greater than a predetermined mass from the separating chamber A. It will be noted that the discharge orifice 16 extends tangentially of the separating chamber A, the discharge orifice being rotated from the intake orifice through an angle of slightly more than 180 degrees, the inlet edge of the outlet orifice 16, indicated by the numeral 46, being removed from the outlet edge of the intake orifice 12, indicated by the numeral 45, by a distance corresponding to substantially one-half the circumference of the separating chamber. The curved wall portions 9 and 10 define a substantially cylindrical casing having a horizontal axis, the cylinder being interrupted at the inlet and discharge orifices.

Mounted axially of the chamber A is a rotor 3, the center of rotation thereof being coincident with the horizontal axis of the chamber. The rotor 3 comprises an end plate 17 mounted closely adjacent the end wall 7 and having formed therewith a hub portion 18 for supporting the rotor on a shaft 19 mounted in bearings 20. Radially disposed rotor blades 22 mounted peripherally of the plate 17 extend axially therefrom to a point closely adjacent the end wall 8 where they are secured to a ring disc 23. The ring disc 23 is provided with an axially extending flange 24 defining an orifice 25 in the ring disc, which flange 24 extends through an orifice 26 in the wall 8 of the chamber A. Power to drive the

rotor 3 is supplied from the variable speed drive mechanism 27 through a V belt drive trained around a pulley 28 keyed to the shaft 19.

It will be noted that the edges of the wall 8 defining the orifice 26 closely approach the peripheral surface of the flange 24, and to insure a seal at this point a retaining ring 29 is mounted exteriorly of the wall 8 around the orifice 26 and a packing member 30 is mounted between the retaining ring 29 and the flange 24. This structure seals the orifice 26 and prevents the flow of material from the chamber A, except as it is carried into the center of the vortex created by the rotor 3 and is caused to flow therefrom through the orifice 25. A collar 32 fastened to the retaining ring 29 is provided with an outwardly projecting flange portion for cooperatively receiving the end of the pipe 5 which provides communication between the suction fan 4 and the center of the rotor 3.

The suction fan 4 is mounted in a casing 33 forming a volute having a discharge orifice 34. Material withdrawn by the fan 4 from the center of the rotor 3 in the chamber A is discharged from the casing 33 through the discharge orifice 34 into the pipe line 6 through which it is conveyed to a receiving bin, not shown. The fan 4 is mounted on a shaft 35 mounted in bearings 36 and to which is keyed a pulley 37. A V belt 38, driven by a variable speed drive mechanism 39 and trained around the pulley 37, supplies motive power to the fan 4.

In the modification illustrated in Figure 4 is illustrated means for varying the diameter of the orifice 25 in the outlet end of the rotor 3. This mechanism comprises a disc 47 adapted to be secured as by bolts 48 to the intumed flange of a collar 49 secured within the collar 32 and positioned between the end of the flange 24 on the rotor 3 and the adjacent end of the pipe 5. The disc 47 is provided with an orifice 50 of a selected diameter, thus reducing the diameter of the orifice 25 to the diameter of the orifice 50, the purpose for which will hereinafter be set forth. It will be appreciated that other discs having orifices of greater or lesser diameter may be substituted for the disc 47.

In operation, finely divided material such as sander dust, which contains an appreciable amount of wood flour, is delivered to a cyclone 1 from which it will flow under the impetus of the suction induced by the fan 4 through supply pipe 2 to the inlet 12 of separating chamber A. In chamber A rotation of the rotor 3 creates a vortical movement of the air and the air-borne materials therein, the velocity of rotation being such that at least substantially all of the materials of less than a predetermined size are suspended in the vortex. The wood particles having the greater mass, and the mineral particles removed from the sandpaper during the sanding operation, being heavier than the particles constituting wood flour, experience the greater force and a separation takes place. The action of the centrifugal and centripetal forces on the particles effects the separation of the material in accordance with the differences in size and corresponding mass velocities of the various moving particles in the mixture. The finer particles, being less affected by the centrifugal forces set up by the vortex action, form a strata within or adjacent the periphery of the rotor. The larger particles are projected outwardly toward the outer periphery of the vortex and are dropped into the outfeed valve 14 which, upon

being rotated, delivers these larger particles to the pipe line 15. The outfeed valve 14 is mounted on a shaft 41, rotation thereof being effected by means of a V belt 44 trained around pulleys 40 and 42 whereby driving power is transmitted from a shaft 43.

The suction induced by the fan 4 causes the lighter materials contained in the strata adjacent the periphery of the rotor to approach the center of the rotor, from which they are withdrawn through the orifice 25 and pipe 5 to be thereupon delivered through the pipe 6 to the receiving bin. Several factors determine the size of the particles recovered by the apparatus, these being, respectively, the speed of rotation of the rotor, the diameter of the rotor as compared with the diameter of the separating chamber, the amount of suction induced by operation of the fan 4, and the diameter of the orifice 25. In a wood flour recovery system constructed and operated in accordance with the teachings of the invention, the curved wall portions 9 and 10 define a substantially cylindrical chamber having a radius of two feet two inches. The rotor 3, sixteen inches in diameter, is provided with twenty-four blades 22 and is rotated at a speed of between 800 and 900 revolutions per minute. The suction induced by operation of the fan 4, as measured by a standard U tube, measures minus 4 inches of water, and, by the use of a disc 47, the diameter of the orifice 25 measures approximately six and one-half inches. The apparatus constructed and operated as herein described recovers wood flour of a size that will pass through an 80-mesh screen, substantially all of the material of this size being recovered from the material entering the separating chamber. Other factors being constant, wood flour comprising larger or smaller particles of wood dust may be recovered by varying the diameter of the orifice 25, or by reducing or increasing the suction created by the fan 4, or by varying the speed of the rotor 3. It will be appreciated, therefore, that various changes in form, proportion, size and details of construction within the scope of the claims may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

Having now described our invention and in what manner the same may be used, what we claim as new and desire to protect by Letters Patent is:

1. Apparatus for separating fine dustlike particles of wood from a mixture of comminuted wood, said apparatus comprising a housing defining a generally cylindrical chamber supported with its axis extending horizontally, an inlet for said mixture communicating with said chamber adjacent the upper part thereof, means arranged

within said chamber for whirling the mixture introduced therein whereby at least substantially all of the lighter component of the mixture is caused to be suspended in the atmosphere of the chamber and carried thereby in a vortex, a first outlet communicating with said chamber axially of said vortex, means for applying a suction to said first outlet for withdrawing fine particles from said vortex, a disc insertable in said outlet and provided with an orifice of a selected diameter for determining the size of particles withdrawn by said suction from said outlet, a second outlet communicating with said chamber adjacent the outer periphery of said vortex, the inlet edge of the outlet being substantially one half the circumference of the chamber from the inlet.

2. Apparatus for separating wood flour from finely divided wood particles comprising end walls and an outer curved wall portion connecting the end walls forming a substantially cylindrical chamber having a horizontal axis, a rotor in said chamber comprising a plurality of peripherally spaced radial blades and having a substantially unobstructed open center, means for driving said rotor, means to supply materials to said chamber tangentially thereof, means defining an orifice through one of said end walls and communicating with the center of said rotor, means for withdrawing air-borne materials through said orifice, means for varying the diameter of said orifice for determining the size of particles withdrawn therethrough, and means defining an orifice through said curved wall through which materials not acted upon by said rotor are discharged from said chamber.

3. Apparatus for separating wood flour from finely divided wood particles comprising end walls and an outer curved wall portion connecting the end walls forming a substantially cylindrical chamber having a horizontal axis, a rotor in said chamber comprising a plurality of peripherally spaced radial blades and having a substantially unobstructed open center, means for driving said rotor, means for supplying materials to said chamber tangentially thereof, means defining an orifice through one of said end walls and communicating with the center of said rotor, means providing a seal between the end of said rotor and said end wall about said opening, means for withdrawing air borne materials through said orifice from said rotor, means for varying the diameter of said orifice for determining the size of particles withdrawn therethrough, and means defining an orifice through said curved wall through which materials not acted upon by said rotor are discharged from said chamber.

HOWARD M. WALL.
FRANCIS J. DOHRER.