May 24, 1932. H. HARDINGE 1,859,771

JOINT SEAL

Filed Jan. 4, 1930

FIG.1.

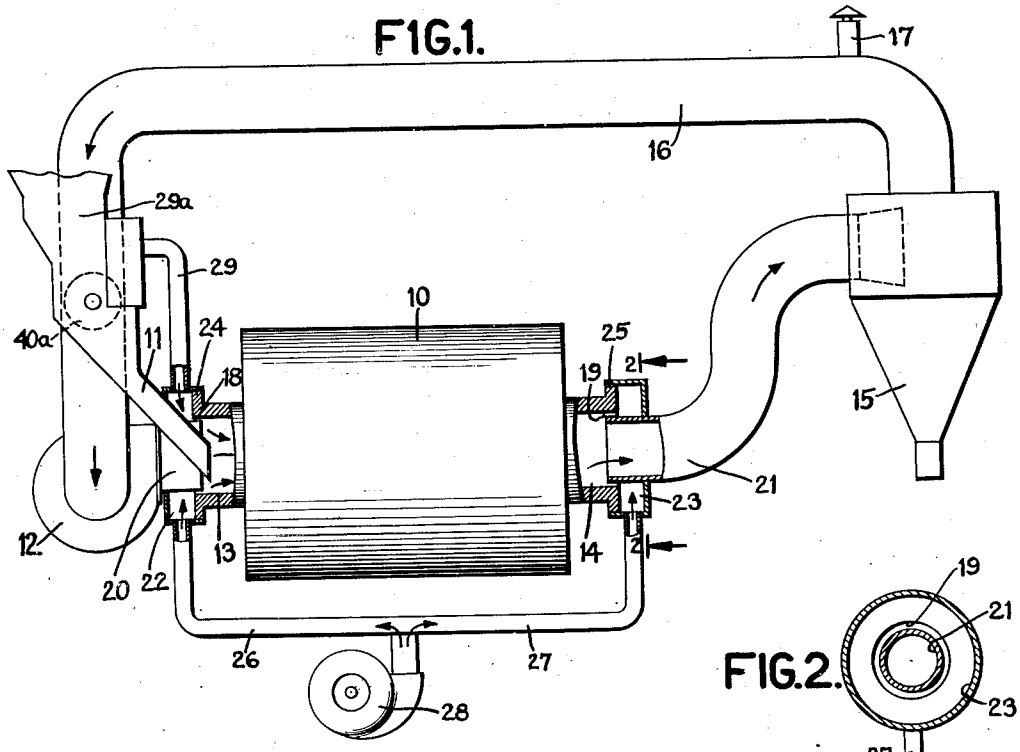
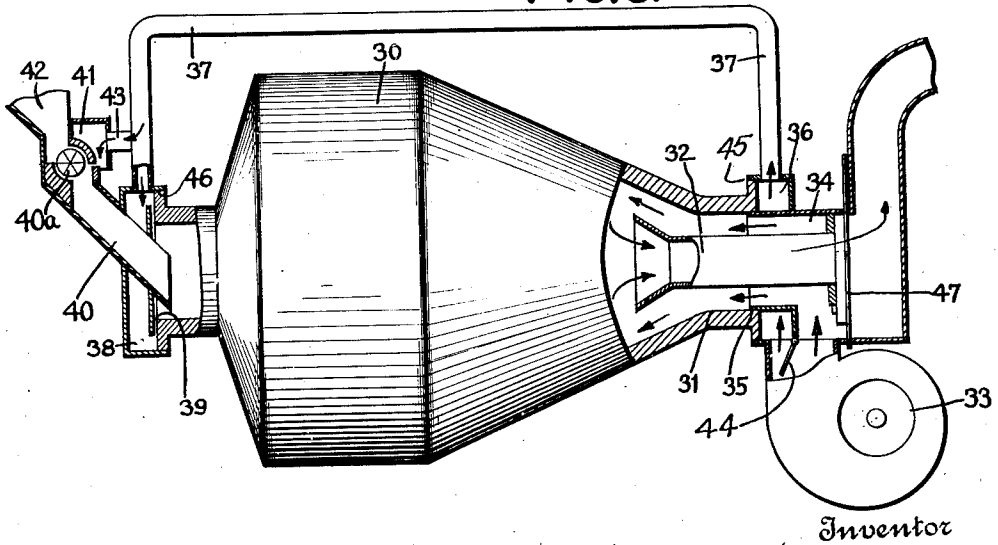


FIG.2.

FIG.3.



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UNITED STATES PATENT OFFICE

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JOINT SEAL

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This invention relates to joint seals for sealing joints between rotary and non-rotary connections through which elastic fluids pass. More particularly the invention is concerned with preventing the loss of fine material likely to escape with air or other elastic fluid at the joints between a rotary pulverizing mill and cooperatively connected stationary conduits through which the elastic fluid is passed as it enters and leaves the pulverizing mill.

Among the objects of the invention is to provide means whereby the joints of a pulverizing mill may be sealed to prevent the loss of pulverized material from a pulverizing mill.

Another object of the invention is to render practical the operation of a pulverizing mill under pressure with the discharge side of a blower connected so as to deliver elastic fluid to the mill without an accompanying loss of elastic fluid at the joints of the mill.

Other objects and advantages will appear hereinafter in the description and claims.

In the drawings:

Fig. 1 is a view of a system for pulverizing and collecting materials which is provided with the means of my invention for preventing loss of material at the joints between the pulverizing mill and associated conduits.

Fig. 2 is a section on line 2—2 of Fig. 1.

Fig. 3 illustrates the embodiment of my invention in a different installation.

It is common practice to feed coarse material into a pulverizing mill and to remove comminuted material from a pulverizing mill through the trunnions which support the pulverizing mill for rotation. As between connecting a blower directly to the outlet or to the inlet of a pulverizing mill for removing pulverized material therefrom by air flotation, it is preferable to place the blower at the inlet of the mill, for in this position it is subjected to less wear because of the pulverized material in the air which is being driven through the mill. With the blower at the inlet of the mill, in many systems the mill is subjected to a pressure above atmospheric pressure with the result that leakage at the joints of the mill is likely to exist. In such cases, in order to benefit by the advantages to be gained by having the blower at the inlet of the pulverizer I provide means for preventing leakage at the joints between a pulverizing mill and cooperatively connected conduits.

The material pulverizing and collecting system illustrated in Fig. 1 may be characterized as a closed-circuit system in which fluid currents, such as air, are circulated throughout the system. It includes a pulverizer 10, which may be of any well-known construction, and a chute 11 is provided by which coarse material may be fed to the mill. The air is propelled by a blower 12 through hollow trunnion 13 and into the grinding chamber of the mill 10 where the air picks up pulverized material and carries the same with it as it leaves the mill. The air leaves the mill through trunnion 14 and is caused to enter a cyclone dust collector 15 which separates the material from the air. The material-free air leaving the dust collector 15 is drawn through conduit 16 to blower 12 and recirculated through the system. Vent 17 affords means by which counteracting effects against changes in volume of the air being circulated may be accomplished as, for example, the removal of excessive air which has filtered into the system.

With a mill under pressure, loss of air would be likely to occur at joints 18 and 19 between the mill and conduits 20 and 21 respectively if no provision were made to prevent such occurrence. By utilizing the principle of my invention the balance of pressure about these joints is against permitting air to escape from the system at these joints and, for accomplishing this result, I place boxes 22, 23, enclosing chambers outside of the joints. These boxes form joints with the flanges or outer ends 24, 25 of trunnions 13, 14, respectively, and these latter joints may be made to fit as closely as is practicable by methods ordinarily used.

In order to create pressure in the chambers formed by these boxes greater than the pressure of the elastic fluid within the mill in the vicinity of joints 18, 19, I connect boxes 22, 23 by two conduits 26, 27 with a blower 28. A

certain amount of pressure will be lost from the boxes because of leakage at the joints, but the flow of air from boxes 22 and 23 at joints 18 and 19 will be toward the interior of the mill and no pulverized material may escape into the atmosphere. Blower 28 may be controlled so as to create the desired pressure head which is suitable for preventing pulverized material from escaping into the surrounding atmosphere without the use of excess power. If desired, a conduit 29 may be provided for causing pressure to be impressed within hopper 29*a* for preventing loss of air and pulverized material from the mill through chute 11. This arrangement will be explained in more detail in the description of the invention as illustrated in Fig. 3.

In Fig. 3 I have illustrated my invention as associated with another type of grinding mill. It is not intended to limit the application of my invention to any particular type of material pulverizing system and I have shown in Fig. 3 only sufficient elements of a system to illustrate the adaptability of my invention with different types of mills irrespective of the character of the system. That is to say, the mill and equipment illustrated in Fig. 3 may be used in conjunction with a closed circuit type of material pulverizing and collecting system similar to that illustrated in Fig. 1 or it may be used in other manners such as for example in systems adapted to convey fuel by fluid currents from a mill directly to a furnace or to a bin from which the pulverized material may be removed when wanted. The mill 30 illustrated in Fig. 3 is the well known Hardinge Conical Mill and is so connected as to receive fluid currents through hollow trunnion 31 and to permit fluid currents carrying pulverized material to flow from the mill through a conduit 32 disposed within trunnion 31. So far as the present invention is concerned, conduit 32, trough which material is removed from the mill, may have connection with a classifier similar to that illustrated in Fig. 1, or it may be connected with a dust collector which has no return connections with a blower, or it may be connected directly with a furnace.

As illustrated blower 33 delivers fluid currents into conduit 34 connected with hollow trunnion 31. In a manner similar to that described in connection with use of the invention illustrated in Fig. 1, the joint 35 existing between conduit 34 and trunnion 31 is sealed by a box 36 describing a chamber in which pressure is maintained.

The interior of box 36 is connected by means of conduit 37 with the interior of box 38 surrounding the joint 39 at the feed end of the mill. So as to prevent the escape of air from the mill upward through feed chute 40 an enclosed type of feeder is employed which, in this case, consists of a rotating pocket drum 40*a*. Only a very small amount of air can leak past this feeder into the hopper 42. A box 41 near the lower end of hopper 42 may be connected with conduit 37 by a conduit 43. Pressure may be maintained in boxes 36, 38 and in conduit 37 by means of an independent blower in a manner similar to that illustrated in Fig. 1, or pressure created by blower 33, Fig. 3, may be availed of. For using the main blower 33 for this purpose a deflector 44 may be provided for apportioning the pressure between joint seal boxes 36, 38 and conduit 34. It will be appreciated that the velocity of the air in box 36, conduit 37 and box 38 is nearly nil since the leakage occurring therefrom is slight, and that the velocity of the air delivered to the mill is of a substantial magnitude and will therefore have static pressure lower than that of the air delivered to boxes 36, 38 and conduit 37. Therefore, one blower may be used in the dual capacity of providing pressure in the boxes greater than within the mill, and of providing a moving current of air within the mill. As is apparent, the pressure maintained in boxes 36, 38, causes air to enter the mill through joints 35, 39 and thereby prevents the escape of fine material at these locations. The air escaping at joints 45, 46 between the trunnions and boxes 36, 38, respectively, will be free of dust since the inlet of blower 33 is connected with the atmosphere, a source of relatively clean air supply.

Damper 47 may be provided for controlling the operation of the mill by controlling the quantity of air blown through the mill. When less material is to be carried from the mill, damper 47 is in a high position and when more material is to be carried from the mill, damper 47 is in a lower position.

While I have described my invention in connection with pulverizing mills for various uses, I wish it to be understood that it has utility for use in apparatus where rotary and non-rotary elements are connected together and in which gases under pressure are caused to enter rotary elements such as rotary kilns, driers and rotating pipe conveyors.

I claim:

1. The combination with a rotary unit having a chamber, a relative non-rotatable conduit opening in the said chamber and blower means controlling pressure within said chamber through said conduit, of means including a chamber surrounding the joint of said rotary unit with said conduit, and means to maintain pressure within the last named chamber above that within the conduit.

2. In combination, a rotary unit, relatively stationary blower means having connection with said rotary unit for causing fluid currents in said rotary unit, means enclosing the joint of said rotary unit and blower means, and means for creating pressure within said enclosing means.

3. In combination, a rotary unit, relatively

stationary blower means having connection with said rotary unit for creating fluid movement in said rotary unit, means enclosing a joint of said rotary unit and blower means, and means connecting said enclosing means with the pressure side of said blower means.

4. In combination, a rotary pulverizing mill having an air inlet conduit and outlet conduit at one end, said outlet conduit being within said inlet conduit, blower means causing motion of fluid currents within said mill through said inlet conduit, means having a chamber disposed about the joint of the mill and the inlet conduit, and means maintaining said chamber at a pressure above that within the mill.

5. In combination, a rotary pulverizing mill having inlet and outlet openings at one end of the mill, means for introducing elastic fluid into the mill through said inlet opening, said means including a blower with its pressure end having connection with said inlet through a conduit opening into the inlet of the mill and forming a joint therewith, means forming a chamber about said joint, and means for creating pressure within said chamber.

6. In combination, a rotary pulverizing mill having an inlet through which elastic fluid is introduced to the mill under pressure, a relatively fixed conduit cooperatively connected with said inlet, means having a chamber separating the joint of the inlet and said fixed conduit from the atmosphere, and pressure means for creating pressure within said chamber.

7. In combination, a rotary pulverizing mill having an inlet through which elastic fluid is introduced to the mill and an outlet through which elastic fluid is removed from the mill, a relatively fixed conduit connected with said inlet, a relatively fixed conduit connected with said outlet, and means for creating pressure outside of the joints of said conduits with the inlet and outlet of the mill.

8. In combination, a rotary element having an inlet and outlet, a relatively fixed conduit connected with said inlet, a box surrounding the joint between said conduit and the inlet of the rotary element, a blower discharging into said conduit and into said box, and means for controlling the pressure effect of said blower on said box.

9. In combination, a rotary element through which fluid currents are passed, said rotary element having a feed end and an inlet for fluid currents, stationary feeder means for feeding material into said rotary element, a stationary conduit connected to said inlet for introducing fluid currents to the rotary element, and means for maintaining pressure about the joints between said feeder means and rotary element and between said conduit and rotary element, greater than the pressure within the rotary element.

10. The combination set forth in claim 9 in which the last named means comprises a blower which also provides fluid currents within the rotary element.

11. In combination, a rotary pulverizing mill having inlet and outlet connections through which elastic fluid is circulated, means including conduits and a blower for circulating elastic fluid through said mill, a feeder including a chute for delivering material to said mill, a chamber surrounding the discharge end of said chute at its entrance to the mill, connections from said chamber to the upper end of said chute which is outside of said chamber and means for maintaining pressure within said connections.

12. The combination with a rotary pulverizing mill and connections including a blower for circulating elastic fluid through the mill under pressure, of a chute for delivering material to the mill, and means including a conduit opening into said chute above the material therein for maintaining pressure to prevent the flow of elastic fluid and particles of material into the chute from the mill.

13. The combination with a rotary pulverizing mill and connections including a blower for circulating elastic fluid through the mill under pressure, of a chute for delivering material to the mill, a chamber surrounding the chute at its place of introduction to said mill, a conduit connected with said chute above the material therein, and blower means for maintaining pressure within said conduit and chamber.

14. The combination with a rotary pulverizing mill having an inlet through which elastic fluid is introduced to the mill and an outlet through which elastic fluid is removed from the mill, relatively fixed conduits having connection with said inlet and outlet, means for forcing elastic fluid through said mill, and a chute for feeding material to said mill, of chambers enclosing the joints which said fixed conduits and chute make with the mill, blower means for maintaining pressure in said chambers, and a conduit having connection with the pressure side of blower and the chute.

15. The combination set forth in claim 14 in which the means for forcing elastic fluid through the mill and the blower means for maintaining pressure in the chamber is the same mechanical unit.

16. In combination, a rotary receptacle, conduits having connection with the interior of said receptacle at one end thereof, one of said conduits being a fluid current inlet and the other being a fluid current outlet, stationary means closing the other end of said receptacle, a chamber enclosing the joint of said stationary means and said receptacle, and means for increasing the pressure in said chamber above that within said receptacle, to prevent leakage of dust laden fluid.

17. In combination, a rotary receptacle, conduits having connection with the interior of said receptacle at one end thereof, one of said conduits being a fluid current inlet and the other being a fluid current outlet, stationary means closing the other end of said receptacle, a hopper having a chute extending through said stationary means, means maintaining the pressure within said receptacle exceeding the pressure outside of said receptacle, and means for producing elastic fluid under pressure at the said end of said chute at a rate to maintain the pressure in excess of the pressure within said receptacle.

18. In combination, a pulverizing mill, conduits having connection with the interior of said mill, means coursing elastic fluid through said conduits and mill, stationary means closing one end of said mill, a feeder including a chute passing through said stationary means, and means comprising a blower and connections therefrom to said feeder for maintaining the pressure in said feeder in excess of that within said mill and chute.

19. In combination, a pulverizing mill, conduits having connection with the interior of said mill, means coursing elastic fluid through said conduits and mill, stationary means closing one end of the said mill, a feeder including a chute passing through said stationary means, a chamber surrounding the joint of said stationary means and mill, a conduit connecting the feeder with said chamber, and means for maintaining the pressure within said chamber above that outside of the mill.

20. In combination, a rotary pulverizing mill having one end open, means having connection with the open end of said mill, including conduits for conducting fluid currents to and from the interior of said mill, means enclosing the joint of the mill and the conduit conducting fluid currents to the mill and means having connection with said last named means for maintaining an increased pressure about the said joint to prevent dust from escaping through said joint.

21. In combination, a rotary pulverizing mill, conduits having connection with the interior of said mill, means for coursing fluid currents through said mill and said conduits, a relatively fixed chamber surrounding at least one of said conduits opposite its joint with the rotary mill, and pneumatic means maintaining the pressure in said chamber above atmospheric pressure.

22. In combination, a rotary pulverizing mill, conduits having connection with the interior of said mill, said conduits including an inlet conduit surrounding an outlet conduit, means for introducing fluid currents into said inlet conduit at a pressure exceeding the pressure outside of the mill, a chamber enclosing the joint between said mill and said inlet conduit, and means for maintaining the pressure in said chamber above the pressure outside of said mill.

23. In combination, a system comprising a rotary pulverizing mill, a relatively stationary classifier, connections therebetween, means for maintaining the elastic fluid entering the mill at a pressure greater than that surrounding the mill, means adjacent to the joint between the mill and connections, whereby elastic fluid is forced into the joint between the mill and connections, said elastic fluid being obtained from a point in the system where the pressure exceeds that within the drum.

In testimony whereof I hereto affix my signature.

HARLOWE HARDINGE.