

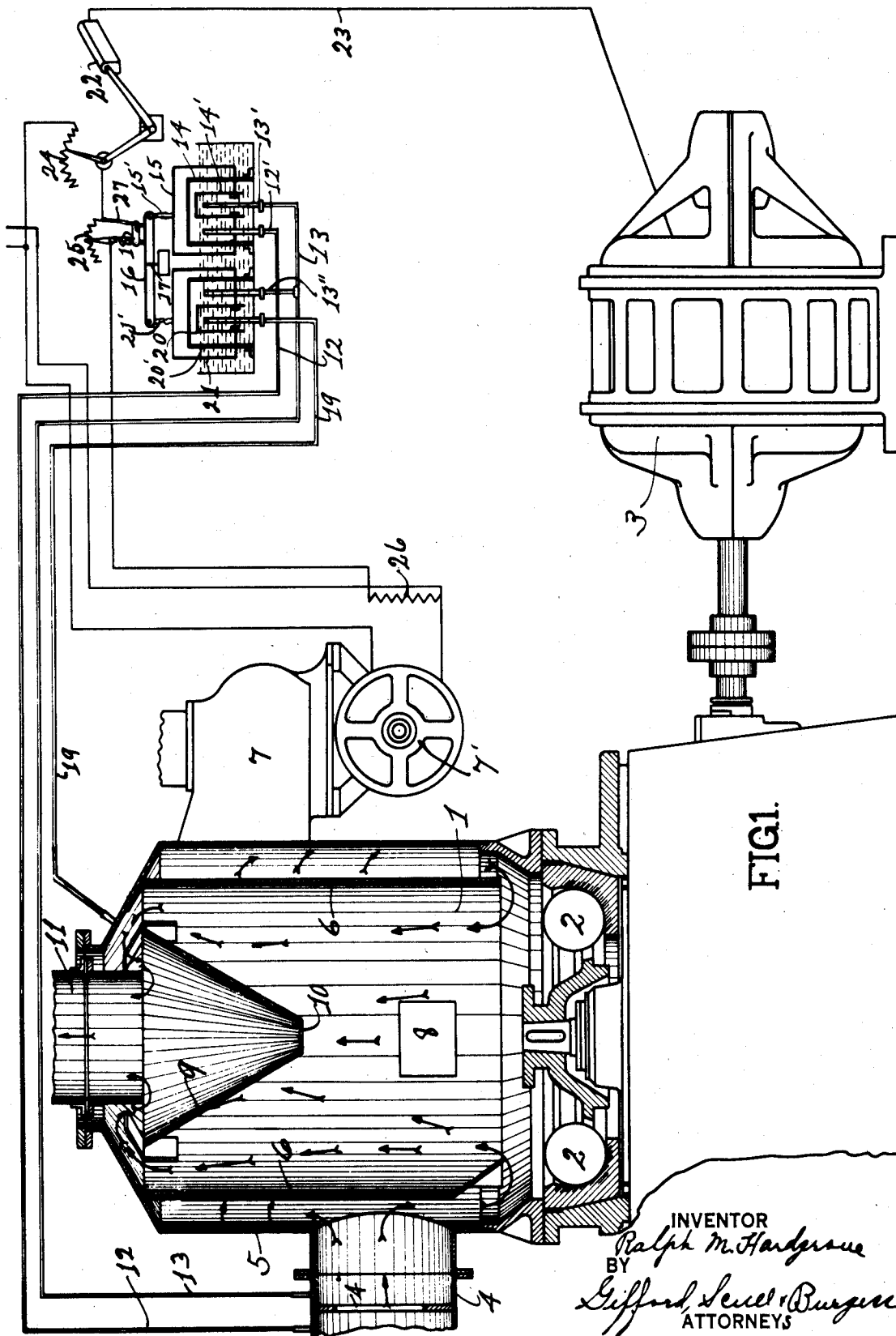
July 10, 1934.

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GRINDING MILL AND PROCESS OF OPERATING IT

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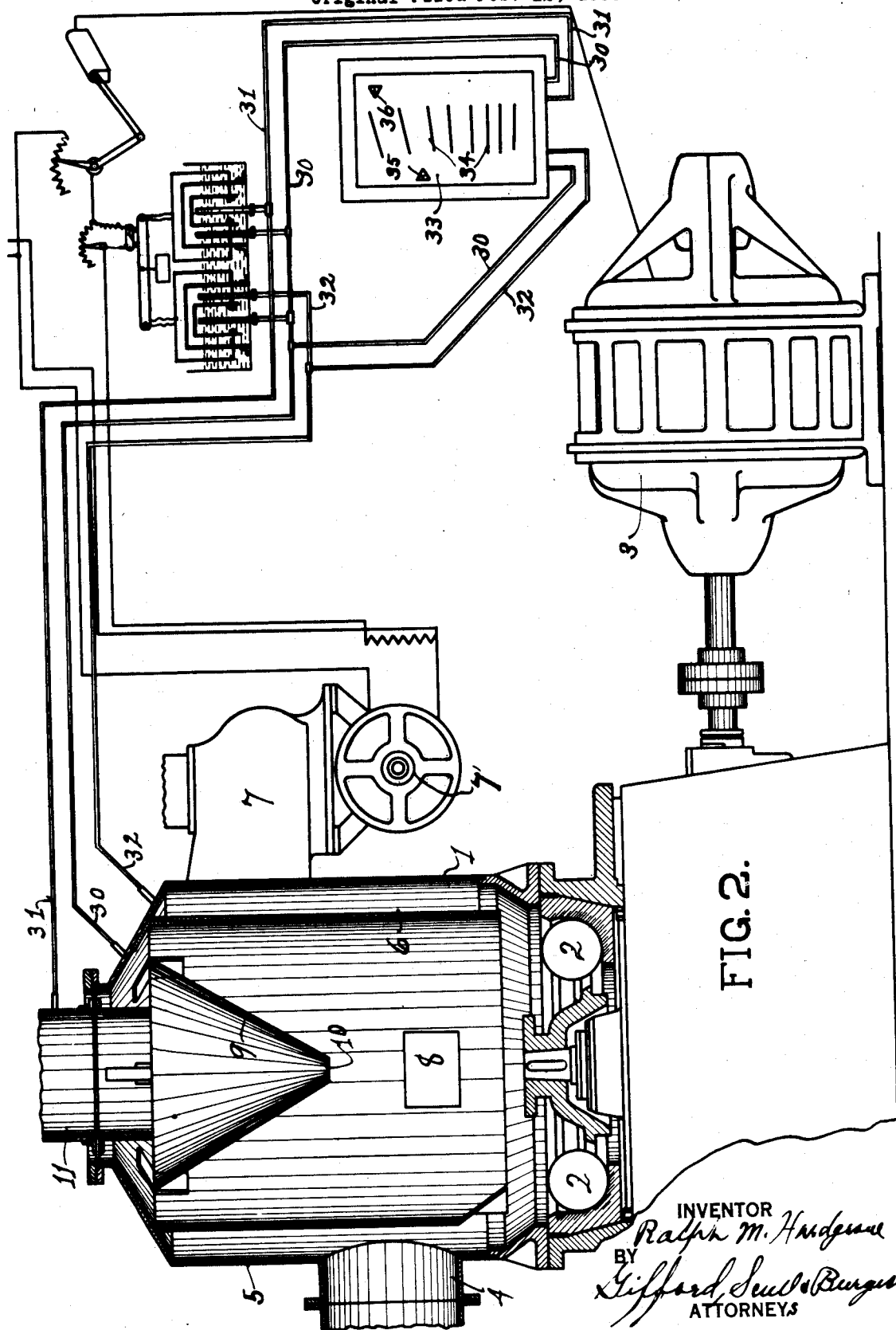
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GRINDING MILL AND PROCESS OF
OPERATING IT

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This invention relates to a grinding mill of the type in which solid material is finely ground or pulverized and the finely ground particles are removed from the mill by a current of air. The invention is especially useful in connection with grinding coal but is not restricted to this particular use.

Heretofore difficulties have been experienced in regulating the feed of material to a mill of this sort so as to have a proper amount of the material in the mill as it is undergoing the grinding operation. By the present invention the rate at which the material is introduced into the mill is automatically regulated to keep the proper amount of the material in the mill.

The invention will be understood from the description in connection with the accompanying drawings, in which Fig. 1 is a side view, partly in vertical section, showing an illustrated embodiment of the invention; and Fig. 2 is a similar view showing a modification.

In the drawings reference character 1 indicates a grinding mill with a series of grinding balls 2 in the lower portion thereof, these balls being driven in a well-known way by means of a motor 3.

An inlet 4 for air extends into one side of a casing 5 of the mill, so that air passes from the inlet 4 into the annular space between the inside wall of the casing 5 and the outside wall of the annular baffle 6. Air may be forced to pass through the mill from the inlet 4, as indicated by arrows, to pick up fine particles of the material that is being ground by a blower, not shown. Or the air may be drawn through the mill by means of a suction fan, not shown. Arrangements for causing a current of air to pass through such mills are old and well known and it is not thought necessary to describe them in detail.

Material such as lumps of coal, for example, is fed into the mill by means of a feeder 7. The rate of feed of material into the mill depends upon the speed of the feeder motor 7'. The material enters the mill through an opening 8 and since feeders of this type are well known in this art, it is not thought necessary to describe one of them in detail.

The upper portion of the mill 1 is provided with a separating cone 9 with an open bottom 10. The dust-laden air passes over the upper edge of the cone 9 and out through the outlet 11, the large particles passing back through the outlet 10 for further grinding. The mechanism for regulating the rate of feed of material to the mill in accordance with the amount of the material in the mill, will now be described. A restricted

orifice 4' is provided in the inlet 4 to cause an appreciable drop in pressure of the air as it passes through this orifice. Pipes 12 and 13 lead from opposite sides of the orifice 4' to a well-known type of pressure differential device. This device comprises an inverted stationary hood or bell 14, the lower edge of which extends below the level of liquid in a container. The extension 12' of the pipe 12 extends into the hood 14. A floating hood or cup 14' of small size is placed inside of the hood 14 and the extension 13' of the pipe 13 extends into this hood. The hood 14' is connected by a rigid framework 15 and flexible connection 15' to one end of a lever 16 which is pivoted at 17 and carries a mercoid switch 18. 60

The other end of the lever 16 is connected to a similar floating hood or bell. The hood or bell connected to this end of the lever 16 is operated by a drop in air pressure in the mill 1 between the inner side of the orifice 4' and a point beyond the lower edge of the annular baffle 6. A pipe 19 extends from such a point in the mill 1 into a floating hood or bell 20 that is located in a larger stationary hood 20', into which a branch 13' of the pipe 13 extends. The floating hood 20 is connected by a rigid framework 21 and flexible connection 21' to the lefthand end of the lever 16. 70

Reference character 22 indicates diagrammatically a device of a well-known type which varies the speed of the motors 3 and 7' in accordance with the demand for the ground material. It is connected to the motor 3 by means of a connection 23 and regulates the speed of this motor. It is also connected to the motor 7' through a resistance 24 which it varies in accordance with the speed desired. A resistance 25 is connected in series with the field 26 of the motor 7' and wires 27 are connected from the mercoid switch 18 to one side of the resistance 25 and the resistance arm that passes over this resistance, respectively, and serve to short-circuit this resistance when the mercoid switch 18 is closed. The resistance 25 is preferably set so that the speed of the feeder motor 7' will be slightly greater than is necessary to feed the proper amount of material into the mill 1 under normal conditions, so that when the resistance 25 is cut out by the closure of the mercoid switch 18 the speed of the feed motor will be decreased. 80

The pressure differential mechanism can be adjusted so that the lever 16 will be in the horizontal position when the level of the material being ground in the mill 1 is at the desired point. The drop in pressure across the orifice 4' and the drop in pressure of the air passing through the 110

orifice between the lower edge of the baffle 6 and the upper surface of the material that is being ground, balance each other under this condition. When too much material accumulates in the mill 1 the resistance to the passage of air below the baffle 6 is increased so that an increased drop in pressure takes place through this orifice with the result that the righthand end of the lever 16 rises and the mercooid switch 18 is closed, this short-circuits the resistance 25 in the field 26 of the motor 7', thereby decreasing the speed of the feeder mechanism, thus decreasing the rate at which the material is fed to the mill 1, without decreasing the speed of the motor 3 that drives the grinding balls 2.

An increase in the amount of air passing through the mill also increases the drop in pressure between the pipes 13 and 19. In order to prevent the change in the amount of air passing through the mill from changing the speed of the feeding mechanism, the orifice 4' is provided so that the corresponding change will take place in the drop of pressure through this orifice 4', thereby compensating for corresponding changes in the differential pressure mechanism.

In the modification shown in Fig. 2, instead of using a fixed orifice in the air inlet, pipes 30 and 31 are connected to points on opposite sides of the separator 9 so that the drop in pressure between these pipes will depend upon the amount of air passing through the machine. The drop in pressure of the air passing under the baffle 6 or through the orifice between the lower edge of this baffle and the upper surface of the material that is being ground, can be indicated by the difference in pressure between the pipes 30 and 32. The pipes 30, 31 and 32 are connected to a pressure differential mechanism similar to that described in connection with Fig. 1 and it is not believed that it is necessary to repeat the description. In this modification the pipes 30 and 31 are connected to one side of a visual pressure indicating mechanism 33 and the pipes 30 and 32 are connected to the other side thereof. This mechanism 33 is provided with lines 34 along the ends of which pointers 35 and 36 actuated by the differentials in pressure between the pipes 30 and 31 and pipes 30 and 32, move. This device is also old and well known and it is not believed that it is necessary to describe the same.

I claim:

1. The process of controlling the feed of material to an air-swept grinding mill, which comprises passing air through the mill and utilizing variations in drop in the air pressure through an opening through which the air passes in the mill, that varies in size in accordance with the amount of material in the mill, to vary the rate of feed of material to the mill.

2. The process of controlling the feed of material to an air-swept grinding mill, which comprises passing air through the mill and utilizing variations in drop in the air pressure through an opening through which the air passes in the mill, that varies in size in accordance with the amount of material in the mill, to vary the rate of feed of material to the mill, and regulating said control by the drop in pressure of the air as it passes through an opening of constant size.

3. The process of controlling the feed of material to an air-swept grinding mill, which comprises passing air through the mill to remove fine particles of ground material, causing the air to pass through an opening of constant size and an opening whose size varies with the

amount of material in the mill, and utilizing the drops in pressures through said openings to vary the rate of feeding material to the mill.

4. The process of controlling the feed of material to an air-swept grinding mill, which comprises passing air through the mill and creating a drop in pressure at one place, creating a drop in pressure at another place in accordance with the amount of material in said mill that is being ground, and utilizing the difference in said drops in pressure to control the rate of feed of material to said mill.

5. The process which comprises passing air through a grinding mill to pick up fine particles of ground material and controlling the rate of feed of material to the mill by a drop in pressure which depends upon the amount of air entering the mill and another drop in pressure which depends upon the amount of material in the mill.

6. The process which comprises introducing coal into a grinding mill, passing a current of air across the surface of the coal in the mill and controlling the rate of introducing the coal by the resistance to the passage of the air over the surface of the coal.

7. The process which comprises introducing coal into a grinding mill, passing a current of air across the surface of the coal in the mill and varying the rate of introducing the coal by variations in the resistance to the passage of the air over the surface of the coal in accordance with the level of coal in the mill.

8. In combination, a grinding mill, means for feeding material to said mill to be ground, means for passing a current of air through said mill to pick up fine particles of material, means for creating a drop in pressure at one point, means for creating a drop in pressure at another point in said mill in accordance with the amount of material in said mill that is being ground, and means for controlling said feeding means by difference in said drops in pressure.

9. In combination, a grinding mill, means for feeding material to said mill to be ground, means for passing a current of air through said mill to pick up fine particles of material, means providing a fixed orifice through which the air passes, means providing an orifice, that varies in size with variations in the amount of material being ground in said mill, through which the air passes and means operated by pressure drops through said orifices for regulating said feeding means.

10. In combination, a grinding mill, means for feeding material to said mill to be ground, means for passing a current of air through said mill to pick up fine particles of material, means providing two orifices through which the air passes, one of said orifices being of fixed size and the other varying in size in accordance with the amount of material in said mill, and means operated by pressure drops through said orifices for regulating said feeding means.

11. In combination, a grinding mill, means for feeding material to said mill to be ground, means for passing a current of air through said mill to pick up fine particles of material, means providing two orifices through which the air passes, one of said orifices being of fixed size and the other varying in size in accordance with the amount of material in said mill, and means connected to opposite sides of said orifices to regulate the rate of feed of material to said mill.