Jan. 27, 1953 C. W. HAWTHORNE, JR 2,626,424

METHOD AND APPARATUS FOR PRODUCTION OF MINERAL WOOL

Filed July 8, 1950

FIG. 1.

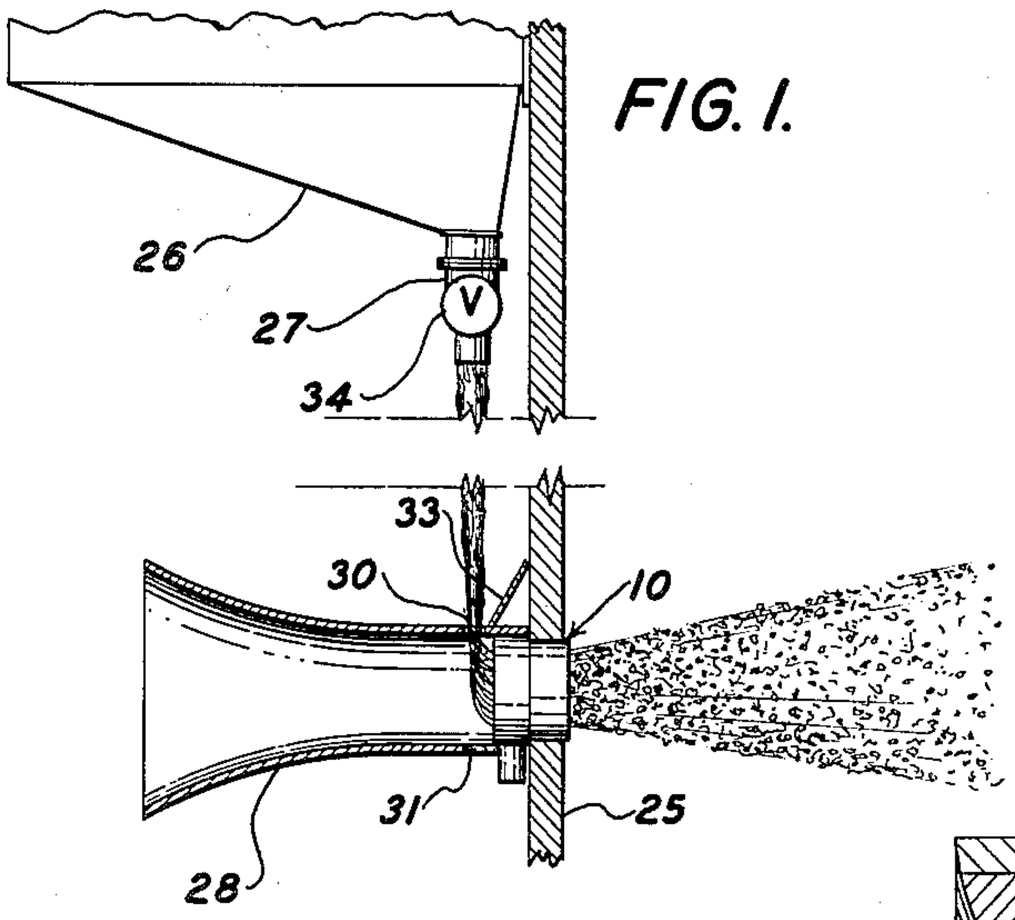


FIG. 2.

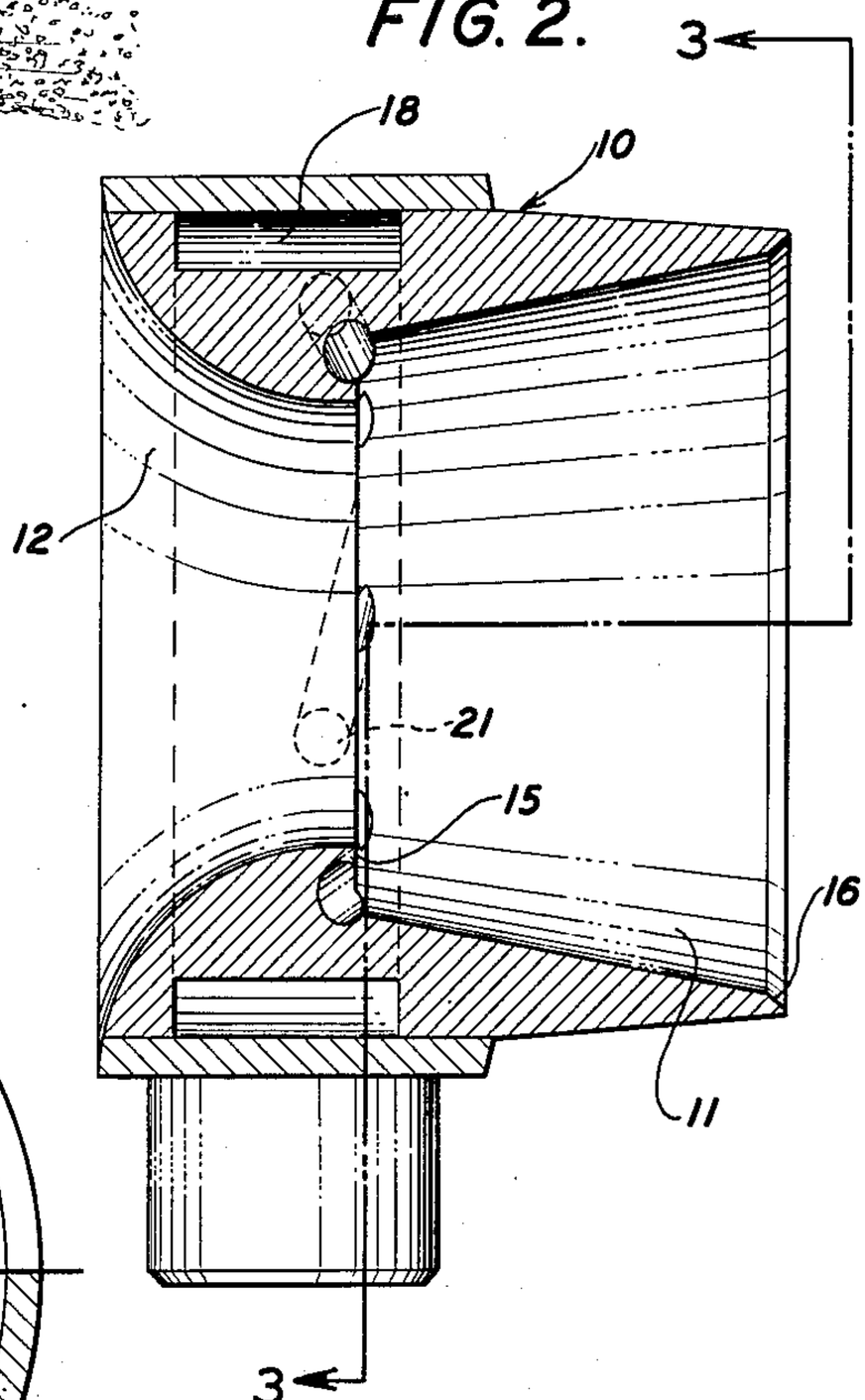
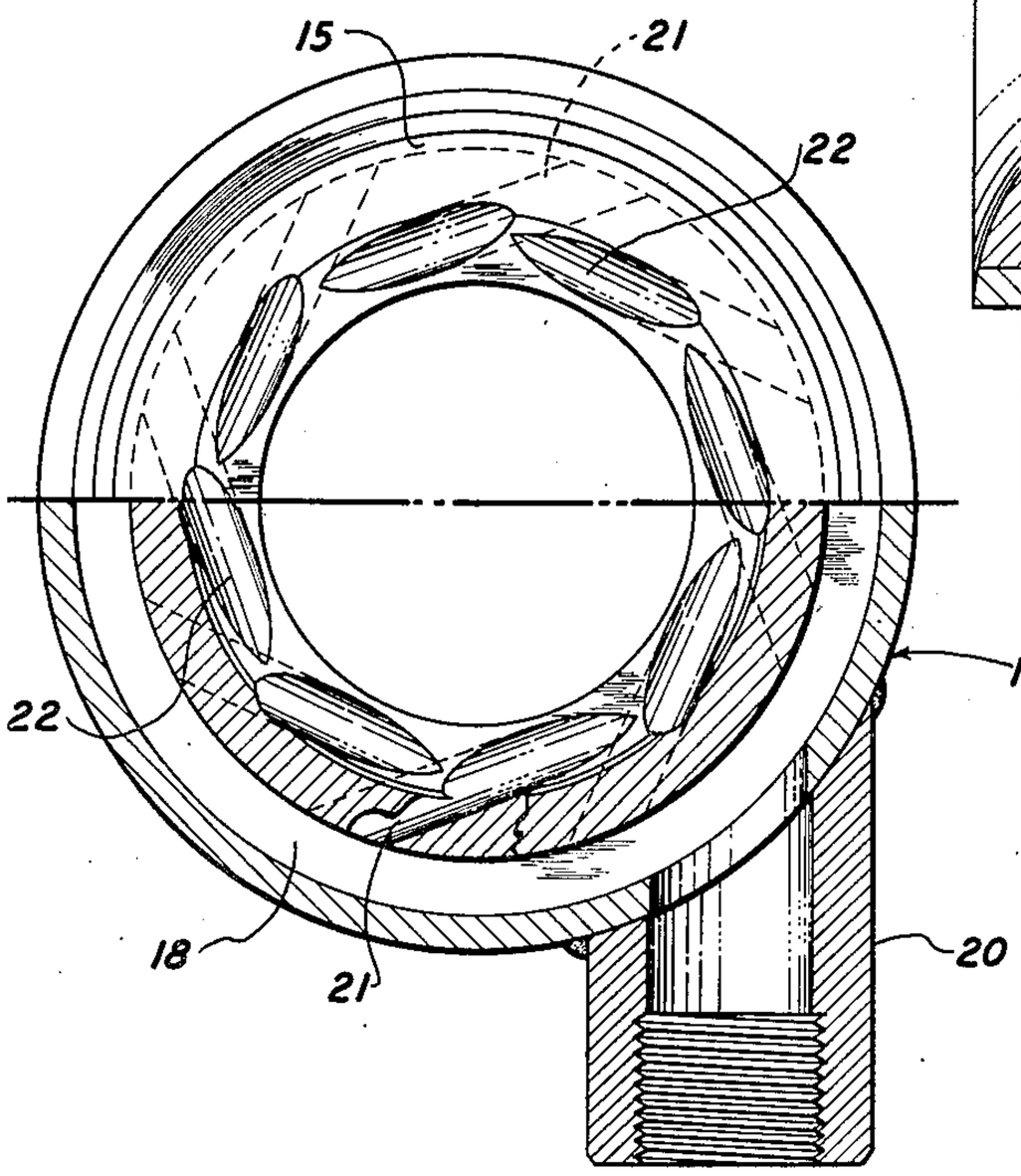


FIG. 3.



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METHOD AND APPARATUS FOR PRODUCTION OF MINERAL WOOL

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5 Claims. (Cl. 18—2.5)

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This invention relates to mineral wool manufacture and provides improved apparatus and methods for the production of mineral wool.

Conventional apparatus for producing mineral wool includes a high pressure steam or air nozzle. Another conventional apparatus, known as a spinning wheel, produces a superior mineral wool, having a longer, more resilient and stronger fiber than mineral wood produced with steam or air nozzles. However, the spinning wheel has moving parts which tend to wear excessively at the required speeds of operation and also has a motor. The nozzle type equipment has advantages of simplicity and durability due to the lack of the moving parts and the motor, and is still used even though it produces a less satisfactory product.

In the instant invention, I provide improved apparatus and methods which have the advantage of simplicity, as with the conventional nozzle, but result in the superior product of the spinning wheel. Mineral wood produced in accordance with the invention is at least equal in quality to that of the spinning wheel and the apparatus of the invention, which lacks moving parts, is simple in construction and relatively trouble free.

The method of the invention comprises introducing a molten mineral into a gaseous stream having high rotational and linear velocities. In one operation, the method comprises imparting to a gaseous stream a high linear and rotational velocity, employing the resulting spiralling gaseous stream to create a low pressure area, and utilizing the low pressure area to aspirate a molten mineral into the gaseous stream.

The word "mineral" is used broadly to cover any material suitable for mineral wool production, including slags and rocks. Either steam or high pressure air or other gases may be used.

The apparatus of the invention includes a chamber, and a throat opening into the chamber with the cross section of the throat at the opening being smaller than the cross section of the chamber. A plurality of relatively small passages open into the chamber at an angle to the inside periphery of the chamber wall. Steam or other high pressure gas is admitted through the passages into the chamber, forming the spiralling gaseous stream which creates the low pressure area in the throat.

Preferably, the throat and the chamber have circular cross sections, with the throat curving inwardly and opening forwardly and abruptly into the chamber, which has an outwardly tapering inner wall. In the preferred embodiment, the small passages open into the chamber in a forward direction and substantially tangential to the inside circumference of the chamber wall. The magnitude of the rotational and linear velocity is a function of the angle at which the passages open into the chamber and, generally speaking, the nearer this angle approaches a tangent of the circle the greater is the rotational and linear velocity.

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As indicated at the outset, the mineral wool produced by my apparatus is superior to wool from the conventional nozzle and at least equal in quality to the wool of the spinning wheel. Moreover, through the use of my apparatus and the practice of the methods of the invention, throughput (i. e. the amount of mineral handled per unit of time) may be materially increased, lessening the cost of manufacture.

The apparatus and methods of the invention will be more clearly understood in the light of the following detailed description and drawings, wherein:

Fig. 1 is a fragmentary side elevation, partly in section, of an installation for the production of mineral wool, showing the relative positions of a nozzle of the invention and an overlying cupola;

Fig. 2 is a longitudinal section of the nozzle of Fig. 1; and

Fig. 3 is a front elevation, partially in section and partially cut away, of the nozzle of Figs. 1 and 2, taken along the line 3—3 of Fig. 2.

The nozzle 10, as shown in Figs. 2 and 3, includes a chamber 11 and a coaxial throat 12. Both chamber and throat are circular in cross section. The chamber has an open end and at its other end, an annular wall 15. The inside wall of the chamber tapers (preferably at an angle of approximately 15° to the longitudinal axis of the chamber) outward and forward from the outer circumference of the annular wall to a beveled front edge 16. The inner wall of the throat curves inward from the rear of the nozzle and opens abruptly through the hole of the annular wall into the chamber. At the intersection of the chamber and the wall the diameter of the chamber is greater than the diameter of the throat 12.

An annular steam compartment 18 is formed in the wall of the nozzle and spaced outward of the chamber and throat toward the rear of the nozzle. The compartment is connected by an inlet 20 to a source of high pressure steam (not shown).

Eight cylindrical steam passages 21 connect

the annular compartment to the chamber. As shown in Figs. 2 and 3, each of these passages slants uniformly forward and inward from the compartment and opens into the chamber through the annular wall and through the wall of the chamber adjacent the annular wall at an angle to the inside circumference of the chamber, so that the axes of the passages lie in and define a hyperboloid of revolution. The passages are each substantially parallel to a line tangential to the hole in the annular wall (i. e. the front of the throat) and terminate in grooves **22** in this wall, the depth of which decreases to zero at their forward ends. The outlines of the grooves as shown in Fig. 3, are each defined by a plane cutting obliquely through a cylinder, i. e. elliptical. Actually, the outlines of grooves are not true ellipses because a portion of each passage opens through the wall.

In operation, steam is introduced into the annular compartment through the inlet. From the annular compartment, the steam escapes through the several passages at an angle into the chamber. The steam of the several passages combine into a spiralling stream having high linear and rotational velocity. Superheated steam having a temperature of 425° F. and a pressure of 125 lbs. per square inch (gauge) gives a desirable velocity. The spiralling stream which escapes through the forward end of the nozzle creates a low pressure area in the throat. A stream of molten slag (preferably having a temperature within the range of 2350°–2500° F.) falling to the rear of the nozzle adjacent the throat (as shown in Fig. 1) is diverted by atmospheric pressure into the low pressure area of the throat, and from there the slag is sucked into the spiralling steam. From the rear of the nozzle, the molten slag appears to explode upon entering the chamber from the throat. The slag is ejected from the chamber in the spiralling steam as fibrous mineral wool.

In Fig. 1, the nozzle **10** is shown placed in a wall **25** of an enclosed chamber (not shown) with the nozzle opening into the chamber. A cupola **26** containing molten blast furnace slag or a molten rock of a type suitable for mineral wool manufacture is disposed above the nozzle, with its outlet **27** spaced a short distance back of the rear of the nozzle. The molten slag escaping from the cupola and falling, in the configuration of an icicle, directly behind the nozzle is sucked into the throat.

In the installation illustrated, a duct **28** having a rearwardly flaring wall is fastened concentrically around the rear portion of the nozzle for the purpose of channelling air into the throat, thereby lessening turbulence.

The duct adjacent the nozzle has two holes, one directly above the other. The upper hole **30** allows the passage of the molten slag into the duct. The lower hole **31** is only used during the starting-up period, at which time, frequently a portion of the molten slag is not drawn into the throat. A directional baffle **33** at the forward end of the first hole aids in channelling the falling slag into this hole. Even in the absence of the duct, the baffle is conveniently used to protect the outside of the nozzle from the molten slag. In shutting down, a valve **34** of the cupola is closed before the steam to the nozzle is shut off.

In summary, I impart to a gas stream a high rotational and forward velocity so as to produce a zone of low pressure in the central portion of the stream adjacent the point at which the rotational velocity is imparted. A stream of molten mineral is sucked into this low pressure zone from the rear and molten mineral stream thus sucked in congeals in the gas stream, forming the fibrous mineral wool.

I claim:

1. In apparatus for producing mineral wool, the combination which comprises a chamber in which the wool is formed by blasting molten mineral with high velocity gas, a throat opening into the chamber for sucking the molten mineral into the chamber, and a plurality of gas passages disposed around the throat and opening forward into the chamber, the passages being slanted transverse to the axis of and in the same direction around the throat so that gas which is injected into the chamber through the passages describes a spiral path in the chamber.

2. Apparatus according to claim 1 in which the chamber is of frusto-conical form flaring outward from the throat.

3. Apparatus according to claim 1 provided with an annular manifold around the throat and connected to all of the passages for supplying gas thereto.

4. Apparatus according to claim 1 in which the throat is progressively smaller in cross section as its junction with the chamber is approached.

5. In the manufacture of mineral wool, the improvement which comprises creating a zone of low pressure in a chamber by simultaneously directing thereinto a plurality of jets of gas, the axes of the several jets being substantially tangential to a circle and slanted forward uniformly in the same direction from the plane of the circle by an angle other than a right angle, thereby producing a swirling current of gas which describes a spiral path around the zone, and permitting molten mineral to be sucked into the zone from the rear thereof.

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