Oct. 19, 1948. H. C. SMITH 2,451,582

APPARATUS FOR PRODUCING MINERAL WOOL

Filed Sept. 9, 1941 2 Sheets-Sheet 1

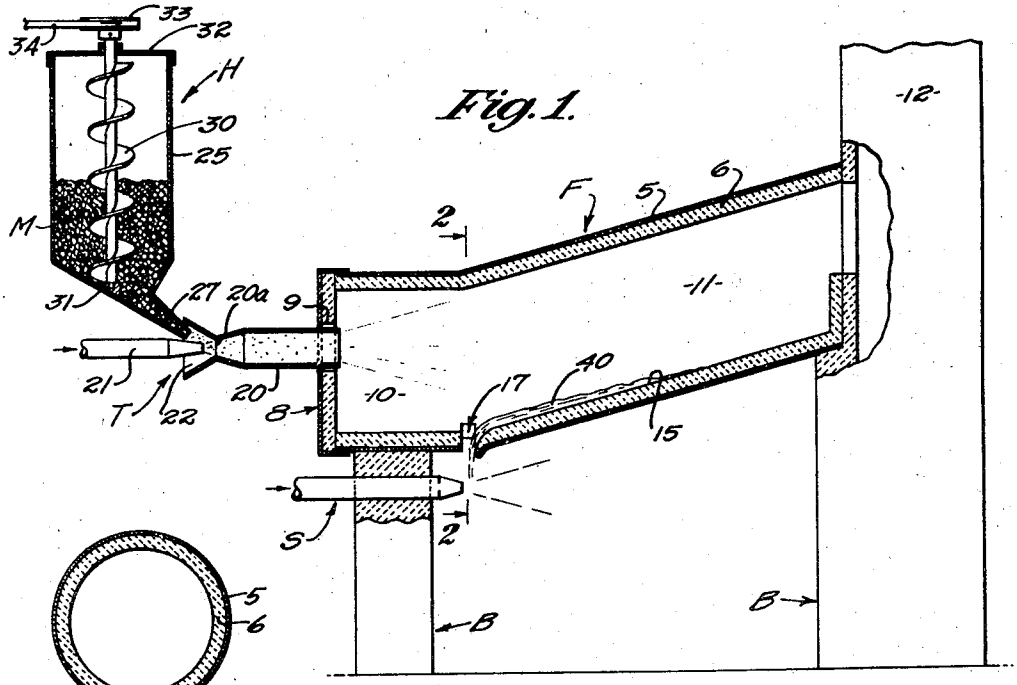

Fig. 1.

Fig. 2.

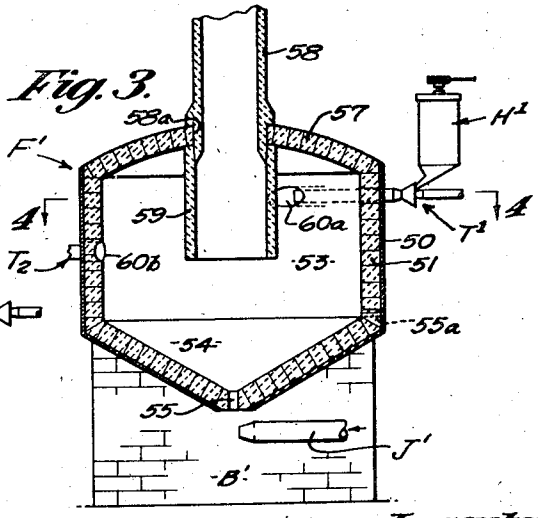

Fig. 3.

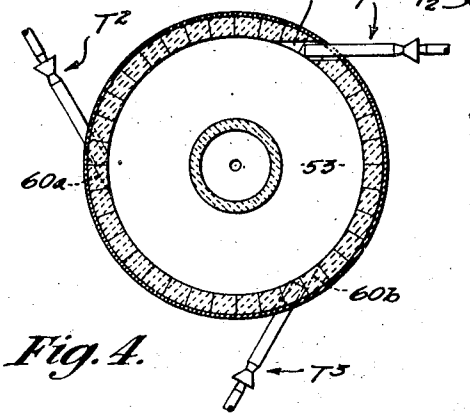

Fig. 4.

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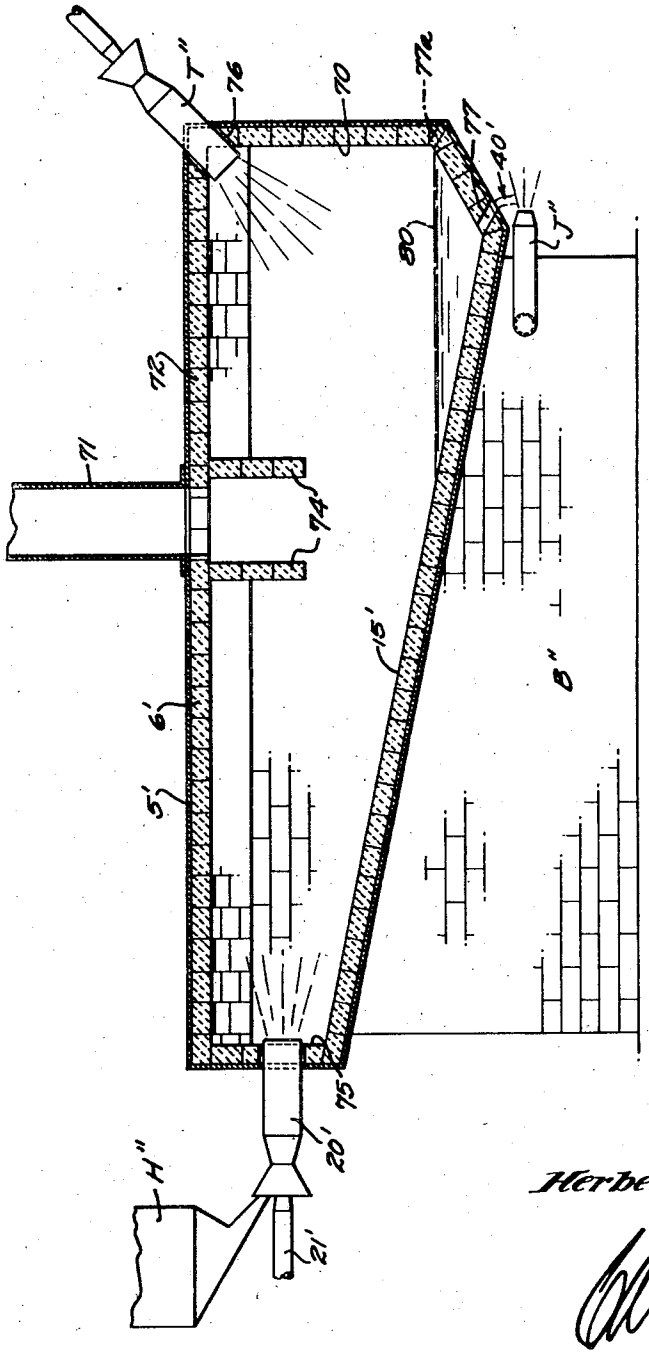

Fig. 4

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APPARATUS FOR PRODUCING MINERAL WOOL

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Application September 9, 1941, Serial No. 410,177

3 Claims. (Cl. 263—40)

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This invention relates to method and apparatus for producing mineral wool, commonly known as rock wool. I aim to provide a mineral wool furnace which requires a minimum of space and equipment; which may be made portable; which produces a high grade of product; which may be easily regulated as to rate of output; which has maximum economy of operation; which provides efficient combining and blending of raw materials; in which the operation may be started and stopped with maximum ease; and which is capable of producing a continuous stream of slag at uniform rate and temperature.

In another of its aspects, my invention contemplates a novel method of producing mineral wool, and particularly of feeding raw materials into a slag furnace.

Other major advantages are inherent in my invention and how those, as well as those specifically set forth hereinabove, are accomplished will become apparent from the following detailed description of presently preferred examples thereof, for which purpose I shall refer to the accompanying drawings, in which:

Fig. 1 is a view partly in elevation and partly in longitudinal section;

Fig. 2 is a cross-section on line 2—2 of Fig. 1;

Fig. 3 is a view partly in elevation and partly in vertical section showing a variational form;

Fig. 4 is a section on line 4—4 of Fig. 3; and

Fig. 5 is a longitudinal sectional view of a further variational form.

Referring now to Figs. 1 and 2 of the drawings, I show generally a furnace F, a fuel injecting unit T, a raw material feeder H and a steam jet S.

The furnace F is of the reverberatory type supported on a base B and is shown as comprising a metal casing 5 having an inner lining 6 of a suitable refractory material such, for instance, as fire brick, fire clay, ganister, carborundum fire sand or chromite block. The forward end 10 of the furnace—that is, the end through which the fuel and raw material are introduced—is capped by a similarly lined end wall 8, having an opening 9 and said forward end is substantially horizontally disposed. The adjoining melting zone portion 11 is disposed upwardly at an angle and communicates with a stack 12. The hearth 15 has a tap hole 17 at the junction between end 10 and the melting zone 11. The fuel injection unit comprises a mixing tube 20 projecting into opening 9 and a fuel jet 21 by which fuel under pressure is injected into the venturi 20a of the mixing tube 20, air being drawn in at the opening 22.

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For feeding the raw material M to the furnace, I provide a hopper 25 which has a discharge spout 27 discharging material into tube 20 through air inlet 22. A conveyor screw 30 is rotatably mounted in the hopper on brackets 31, 32 carried by the hopper and is driven by a wheel 33, the wheel being driven by a belt 34 leading from a power element, not shown. The raw materials are placed in the hopper in a finely ground state and as they are discharged into the mixing tube 20 they are picked up and propelled well up into the furnace along with the combustion mixture. Thus when the materials reach the furnace they are in intimately admixed and blended state. When the raw material is thus propelled far up into the melting zone 11 it becomes molten slag and slowly gravitates towards the tap hole 17, a continuous stream of slag 40 pouring out of the tap hole 17 in the path of the steam discharged from jet S, which acts to blast the molten slag into the mineral wool product in the well known manner. Other suitable types of feeders may be substituted for feeder H.

From the foregoing it will be observed that the rate of production may be easily controlled by regulating the rate of introduction of the raw material, and since the slag, after being melted, travels continuously towards the heat source it leaves the furnace at maximum and uniform fluidity, which results in a high and uniform grade of mineral wool.

When beginning operations, it is desirable to thoroughly heat the furnace before beginning the feeding of raw materials and when stopping operation, it is desirable to stop the feed of material somewhat before the fuel is stopped in order to clear the furnace.

While my device is particularly adapted for the use of gas or oil fuels, it will be readily apparent to those skilled in this art that other fuels, such as powdered coke, may be fed under pressure to the furnace instead of gas or oil and thus the fuel injecting unit T may be considered as intended for any suitable type of fuel.

In Figs. 3 and 4, I show a variational form of unit employing my invention. There I show a reverberatory furnace F' comprising a casing 50 lined with fire brick 51 or other suitable refractory. The combustion chamber 53 is circular in cross-section and the lower portion 54 is conical, having a tap hole 55. The cover 57 is arched and a stack 58 communicates with the furnace through a hole 58a. A tubular baffle 59 depends into the combustion chamber 53 to prevent raw material injected into the fur ace from passing

out through the stack. In this form of device the fuel and raw material are injected into the furnace by burners T^1, T^2 and T^3 and feeders H^1, which are constructed as before described, in a direction tangentially of the combustion chamber. There are three injection points provided by circumferentially spaced holes **60**, **60***a* and **60***b* through the side wall of the furnace, said holes being disposed preferably in different horizontal planes. In operation, the raw material enters the furnace tangentially in the fuel stream and, as is the case in operation of the device of Figs. 1 and 2, being subjected directly to the flame as well as heat from the walls, rapidly melts and gravitates along the side walls to the tap hole **55** where it passes out into the path of the steam blast from jet J' which converts the molten slag into mineral wool. The furnace is supported on a suitable base B'.

In some cases it may be desirable, instead of utilizing tap hole **55**, to maintain a lake of molten slag in the lower portion **54** of the furnace. In such event, instead of placing the tap hole at the bottom, a tap hole as shown by dotted line **55***a* may be provided through the side wall at the desired slag level denoted by dotted line **80**. In that case the steam jet J' would be positioned to discharge into the slag stream which would pour from hole **55***a*.

In Fig. 5, I show another form which my invention may take. Here I show a furnace comprising a casing **5'** lined with a suitable refractory such as fire brick **6'** and having a hearth **15'** sloping towards the rear end **70** of the furnace. A stack **71** is provided through the arched top wall **72** and communicates with the furnace between spaced transverse baffles **74**. Front end **75** has an opening to receive the fuel mixing tube **20'** through which fuel from jet **21'** and raw material from feeder H'' enter the furnace in the manner before described. An auxiliary fuel injecting unit T'' discharges combustion mixture into the furnace through opening **76** in a direction diagonally downwardly onto the outflowing slag stream **40'**. Preferably, no raw material is fed through the auxiliary fuel injecting unit to insure that no unmelted particles or beads will pass out in the slag stream. Steam jet J'' plays on the outpouring slag to blast it into mineral wool. In this form of device I make provision for maintaining a lake of molten slag in the furnace by plugging the bottom tap hole **77** and using the upper tap hole **77***a*, in which event a lake of slag, as defined by dotted line **80**, would be maintained in the furnace with the auxiliary fuel injecting unit playing directly upon it to maintain the lake of slag in a state of high fluidity. Baffles **74** prevent light, unmelted particles of raw material from escaping through the stack. A suitable base B'' supports the furnace.

While I have resorted to considerable detail for the purpose of making my invention understood, I wish it understood that within the broader scope of my invention, as defined by the appended claims, various modifications and adaptations may be made without departing from the spirit of the invention.

I claim:

1. In a furnace of the class described, refractory walls defining an elongated combustion chamber having a hearth inclining from adjacent its front end towards its rear end whereby to induce gravity flow of molten material towards the front end, said hearth having a discharge opening adjacent the front end, and means for spraying a combined stream of fuel and pulverulent raw material into the front end of the furnace in a direction so angularly disposed with relation to the plane of the hearth as to be directed angularly into the flowing stream of molten material, said discharge opening communicating with the chamber in a plane with the inner surface of the hearth whereby to prevent formation of a pool of molten material on the hearth.

2. A furnace for continuously converting raw material into molten material, comprising refractory walls defining an elongated combustion chamber having a hearth disposed in a declining plane from one end towards the other, a stack communicating with the chamber, means for supplying raw material to the chamber, a discharge outlet in the lower end of the hearth, said discharge opening communicating with the chamber in a plane with the inner surface of the hearth whereby to prevent formation of a pool of molten material on the hearth, and means for directing a heating flame into the chamber angularly against the hearth adjacent said discharge outlet.

3. In a furnace of the class described, stationary refractory walls defining an elongated combustion chamber having a hearth inclining from adjacent its front end towards its rear end, a stack communicating with the chamber, nozzle means for directing a heating flame and pulverulent raw material into the chamber from the front end thereof, and a discharge opening through the hearth adjacent the front end thereof, said discharge opening communicating with the chamber in a plane with the inner surface of the hearth whereby to prevent formation of a pool of molten material on the hearth, the angle of incline of the hearth and the plane of the nozzle being so related that the fuel is sprayed from the nozzle in a direction longitudinally of the chamber and angularly against the hearth adjacent said discharge opening.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
241,108	Wiesebrock	May 3, 1881
729,009	Sutton	May 26, 1903
1,073,462	Banes	Sept. 16, 1913
1,160,621	Klepinger (b)	Nov. 16, 1915
1,164,653	Klepinger (a)	Dec. 21, 1915
1,206,771	Barr	Nov. 28, 1916
1,490,012	Kapteyn	Apr. 8, 1924
1,500,651	Smith	July 8, 1924
1,656,828	Powell	Jan. 17, 1928
1,863,708	Zotos	June 21, 1932
1,893,913	Saint Jacques	Jan. 10, 1933
1,904,781	Crawford	Apr. 18, 1933
1,929,308	Clark	Oct. 3, 1933
1,932,355	Scheidt	Oct. 24, 1933
1,953,034	Willetts	Mar. 27, 1934
1,964,915	Haswell et al.	July 3, 1934
2,057,393	Powell	Oct. 13, 1936
2,126,411	Powell	Aug. 9, 1938
2,131,599	Shrum	Sept. 27, 1938
2,242,089	Ramseyer	May 13, 1941
2,249,410	Wilson	July 15, 1941
2,358,903	Zotos	Sept. 26, 1944

FOREIGN PATENTS

Number	Country	Date
552,123	Germany	May 5, 1931
356,611	Great Britain	Sept. 10, 1931
780,140	France	Jan. 24, 1935