April 11, 1939. C. R. BUSS 2,153,739

APPARATUS FOR AND METHOD OF FORMING MINERAL WOOL FROM FUSIBLE SOLIDS

Filed Dec. 10, 1936

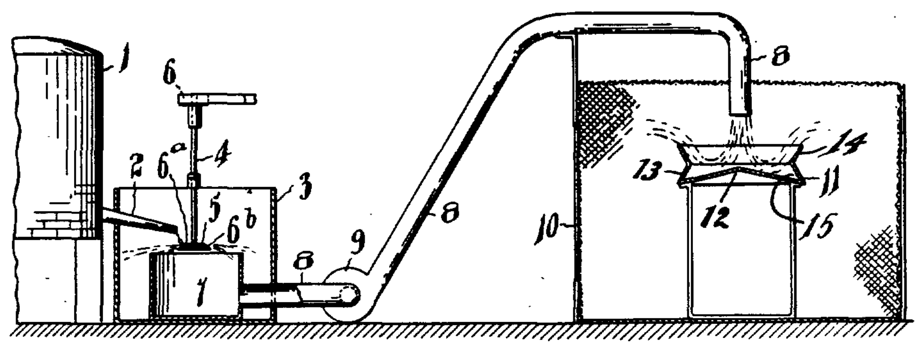

Fig. 1.

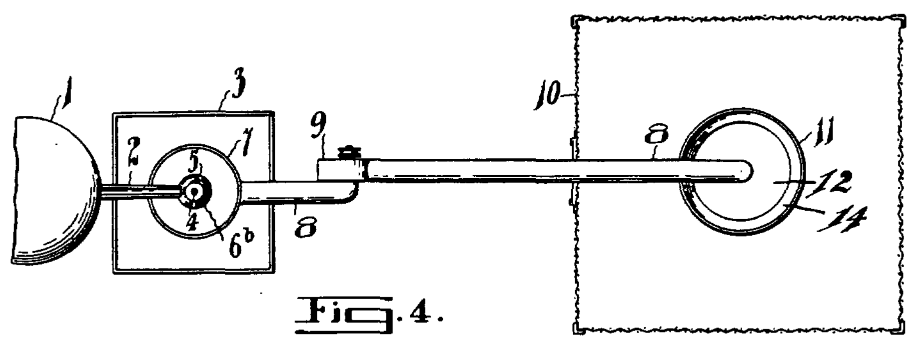

Fig. 4.

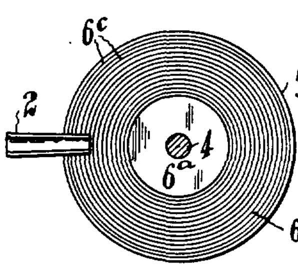

Fig. 2.

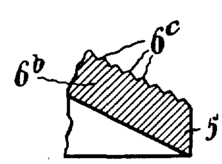

Fig. 5

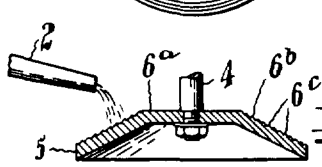

Fig. 3.

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2,153,739

APPARATUS FOR AND METHOD OF FORMING MINERAL WOOL FROM FUSIBLE SOLIDS

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Application December 10, 1936, Serial No. 115,169

12 Claims. (Cl. 83—91)

This invention relates to the disintegrating of rock, slag and other fusible solids into the fibrous state. The process and apparatus at present used for the manufacture of fibrous material of this kind is very unwieldly and requires the use of a large amount of building space.

The object of the present invention is to devise apparatus which is very compact in comparison with the present apparatus, and which at the same time will be very efficient in operation and economical in use.

The formation of fibers from molten rock, slag and the like is generally termed "blowing." The present process relates to that general type of spinning which involves the formation of drops or small masses of the viscous fluid which are projected away from their place of formation with the pulling of a thread or fiber from the drop or mass. The drop or head of the thread solidifies, due to loss of heat, and it produces so-called "shot." The production of the "shot" is unavoidable according to this method of producing the fibers. Also it appears that some of the shot are formed under circumstances resulting in little if any drawing of fiber from or by them. However, the presence of the shot in the finished fibers is undesirable because the shot add very greatly to the weight without any compensating utility.

According to the present invention the drops or small masses by and from which the threads are drawn are formed and projected by the engagement of a stream of the molten rock, slag and the like with the peripheral portion of a coned and grooved spinning disc running at a high velocity. The spinning disc breaks up the viscous fluid into the required drops or masses and projects them with sufficient kinetic energy to draw the desired thread. The head and thread continue to remain attached so long as the head is molten and viscous, but as soon as the head loses its molten condition, it should be broken off the thread. The problem then is first to assist in the breaking off the heads or shot when possible and separation of the heads or shot from the threads. According to the present invention I have provided a classifier which works on the combined action of suction and inertia to cause not only separation of the heads from the fibers but also classification and segregation of the same.

The way I do this is more fully described hereafter, but, in general, it consists in establishing a definite flow of air downward in a zone around the spinning disc. This zone is defined by a circular wall outside of which is a relatively quiet zone which provides a receptacle for the shot.

The flow of air in the first zone is in practice secured by drawing or sucking the air by means of a fan or blower.

The action is as follows: The drops or small masses projected from the disc have sufficient kinetic energy or inertia of motion to carry themselves through the zone of flowing air without material deflection. But the thread or fiber which is being drawn presents so great a hold to the moving current of air that it is carried by the current of air and tends to be broken off of the shot. Thus whereas the shot succeed in passing through the zone of moving air into the receptacle for shot, the threads or fibers are drawn away by the current of air before they escape. These fibers as fast as they are formed are then conveyed by the current of air to a second classifier.

Some of the fibers are produced by drops or masses which are so small to begin with or are so much depleted by the drawing of the threads that they do not have the necessary inertia left to carry through the moving current of air and, therefore, are carried along with the fibers by the suction of the fan. As the fibers pass through the fan, the action tends to break off some of the heads or shot from threads. The fan delivers all the fibers, both those without heads and those having heads attached, under considerable velocity of movement in a moving current of air which is projected against a wall which is preferably the bottom wall of a pan or classifier. There the current of air is sharply deflected, but the heavier particles impinge upon the bottom wall of the pan. The light fibers tend to follow the flow of air and are likewise deflected, i. e., up and over the edge of the pan. The heads of the fibers or any adherent solid particles being more compact and heavy tend to strike against the wall and are thereby broken off of or loosened from the fibers, and much of the shot that escapes the first classification at the spinning cone is detached and trapped at this stage. The second classifier is preferably arranged to trap the detached heads and allow the fibers to escape into a suitable receptacle. This action of the separation of the solid particles is accomplished by deflecting the solid particles and by allowing them to gravitate into a pocket or trap where they are out of the line of impingement by incoming fibers and shot.

The wool or fiber so produced is so much freed of shot that it is greatly superior to any mineral wool heretofore produced in respect to fineness, weight, and insulating qualities.

I attain my object by means of the apparatus hereinafter described and illustrated in the accompanying drawing in which—

Fig. 1 is a diagrammatic view showing the improved apparatus;

Fig. 2 a plan view of the disintegrator;

Fig. 3 a cross section through the disintegrator; and

Fig. 4 a plan view of the apparatus, parts being shown in section;

Fig. 5 an enlarged detail illustrating the shape of the ribs on the disintegrator.

In the drawing like numerals of reference indicate corresponding parts in the different figures.

The apparatus comprises broadly three main parts, a furnace for melting the material, disintegrating means and collecting means.

1 indicates a reducing furnace, which may be of any ordinary type and heated in any suitable manner and provided with the discharge spout 2.

Adjacent the furnace is a spinner chamber 3 where the disintegration is effected. On a vertical shaft 4 is mounted the spinner 5. This shaft is provided with a drive pulley 6 by means of which it is driven from an electric motor, gasoline engine, or other means not shown. This spinner is formed with a flat central disk portion 6^a and an outwardly and downwardly inclined peripheral portion 6^b, and the upper surface of this inclined peripheral portion is provided with annular ribs 6^c, forming between them annular grooves. As will be seen from Fig. 5, these ribs are formed with a narrow inner wall and a wide outer wall, and the top of the rib is above the level of the groove at the inner side of the rib. The ribs therefore have a tendency to collect and carry the film of molten material around with the spinner before overflowing to the next groove. A considerably greater spread of the film is thus obtained before it is discharged from the spinner under centrifugal action. It will be noted from Figs. 1 and 3 that the spout 2 is arranged to discharge on to this ribbed inclined peripheral portion of the spinner.

The upper edges of the ribs which separate the grooves form definite edges from which the material is thrown off and the depth of the groove serves to define the mass of the drops or masses thrown off by centrifugal force. Thus, simultaneous spinning from the upper edges of a plurality of ribs is carried on, greatly increasing the yield of wool.

The material is disintegrated by discharging it in the molten condition from the furnace on to this inclined peripheral portion 6^b of the spinner, while the latter is being rapidly rotated.

With a spinner approximately twelve inches in diameter I find that best results are attained by driving the spinner at approximately 3600–4000 revolutions per minute, but it will be understood that the spinner may be larger or smaller and the speed of rotation may vary with the diameter of the spinner.

The molten material from the spout 2 is, as before stated, dropped on or directed against the upper part of the inclined peripheral portion 6^b of the spinner while the latter is rapidly rotated, and due to the centrifugal force, is discharged outwardly from the spinner. Due to the inclination of the molten material receiving surface, the deposited material has a tendency to also spread downwardly over said inclined surface thus "thinning" the film of molten material before the latter is thrown off, thus facilitating the disintegration or breaking up of the material. This "thinning" or "spreading" of the material is further helped by the corrugating or ribbing of the deposition surface.

The stream of molten material from the spout 2 in running upon the coned and grooved portion of the disc 5 tends to fill one or more of the grooves. That is to say each groove will accept only a certain flow or quantity of material and any excess tends to be received by the next succeeding groove or grooves. The edges of the ridges separating the grooves act like retaining flanges from the rims of which the material is flung in drops or masses. The size of the grooves which are emptied by centrifugal force tends to control the size of the drops thrown off.

These molten viscous drops in being projected by the disc tend to leave behind them a thread or fiber which is pulled, drawn, or spun from the body of the drop while it is sufficiently fluid. The drop forms a head from which the fiber or thread streams backward. When the head solidifies, the drawing of fiber ceases and the head tends to separate from the fiber because the fiber has much greater friction with the air than the head has. The heads freed from the threads or from which no threads were formed are like small pellets or shot and are generally termed "shot."

These pellets or shot particles, due to their greater weight, are thrown further from the spinner than the fibrous material and are thus naturally separated from the latter. I therefore provide means for taking advantage of this natural separation to retain the shot separate from the fibrous material.

Furthermore, the suction means which I provide facilitates the separation or breaking of the heads from the fibers to produce separate fibers and shot, by pulling the fibers downwardly as the heads thereof travel laterally. This tends to release the heads from the tails or thread-like fibers and allow them to travel on as shot. If the heads are not separated from the threads, they are pulled with the threads or fibers by the current of air and later subjected to a second separating action. Within the spinner chamber 3 is provided a deep pan or receptacle 7 having an open top. This receptacle 7 is of such a size that its wall is so placed that the fibrous material falls inside the receptacle, whereas the shot or heavier material is thrown outside the receptacle.

The fibrous material is drawn from the receptacle 7 through a conduit 8, a suction fan 9 being provided in the conduit for this purpose. The suction due to the operation of the fan 9 has a tendency to draw down any fibrous material which might tend to pass over the top of the wall of the receptacle 7.

This drawing down of the air in a zone surrounding the disc 5 and inside the walls of the chamber 7 presents a novel and effective action. The current of air tends to draw the fiber or thread downwardly much more than it does the head or shot because the head or shot presents much less surface for a given mass. A result, by the downward pull of the air upon the thread or fiber not only is the thread pulled down into the receptacle 7, but this action tends to pull or break the threads off of and away from the heads or shot and out of the path in which the heads or shot are projected.

Thus, by projecting the spun material heads or shot and the fibers transversely across the current of air, it is possible to secure a very good classifying action due to first that the heads or shot having a higher ratio of volume to surface to retain a greater inertia and are projected to a greater radial distance than the threads or fibers. Second, the transverse current of air draws the threads sidewise (i. e., down in Figure 1) relative to the path in which the material is projected. Hence, a large part of the heads or shot are removed in this operation, while the fibers largely freed of heads or shot are drawn off and discharged through conduit 8.

This conduit 8 leads to a receiver 10, preferably of woven wire or similar openwork construction to permit air to pass therethrough while collecting the fibrous material. A small percentage of heavy or shot material will cling to the fibrous material and drop into the reseptacle 7, and is drawn off through the conduit 8, which it is desired to separate as far as possible from the fibrous material.

This shot comprises some heads which are still integral with their fibers, which heads were not broken off by the air flow in the zone lying around the disc 5 and inside the receptacle 7. To some extent these heads may be freed as shot by the action of the fan and the travel of the material through the conduit 8—8. However, I provide a further action in the second stage of treatment where I provide means for breaking off and separating as shot those heads which still are attached to threads. This second stage of treatment also classifies and separates such loose shot as was not removed by the action in the first classifier 5—7—3 and such as has been freed from the threads or fibers in passing from the first classifier 5—7—3 to the second classifier. I therefore suitably support within the receiver 10 a pan 11, and the conduit 8 is arranged to discharge into this pan 11. The wall of this pan is inclined inwardly from the base of the pan, and then outwardly, thus forming a wide mouth to receive the material from the conduit, and a narrow neck portion which tends to trap any shot which has adhered to the fibres.

The bottom wall of the pan as shown is coned convexly in order to direct impinging heads or shot laterally to trap the same in the lower outer corner of the pan, both by their inertia and by gravity. The product carried by the current of air from the receptacle 7 through conduit 8 and fan 9 is discharged toward the coned bottom wall of the pan 11. Fibers with no appreciable weight of head or shot tends to be immediately wafted out of the pan, but heavy particles, such as shot or fibers with heads or shot adhering to them, have sufficient inertia to actually impinge against the bottom of the pan. This impingement tends to shake loose or break loose from the fibers any solid particles such as shot or heads. Thereby the breaking off and separation of the solid particles as shot is effected by an action different from that in the separator and classifier 5—7—3. The deflection and gravitation of the solid particles laterally and downwardly keeps them from getting in the way of the incoming current of air and air borne material.

The pan 11 forms a pocket with an inclined wall, i e., specifically, a flat cone 12 against the apex of which the discharge end of the tube 8 directs the air borne current of material. The bottom wall has an annular conical wall 13 of steeper inclination than the wall 12 joined to the outer end thereof so as to form an acute dihedral angle 15 with the bottom wall 12. The solid particles in the air borne current tend to impinge upon said conical bottom wall and by their inertia, bounce, and gravity are deflected into the annular pocket 15. The inwardly coned wall 13 tends to deflect any solid particles which strike it further into the corner or trap 15. The upwardly and outwardly flared wall 14 allows and directs an easy expansion of the reflex current of air carrying the light fibers so that they are wafted out of the pan 11 and tend to settle in the receptacle or bin 10. Obviously, the structural form of the pocket constituted by pan 11 may be widely varied giving, however, the above mode of impacting and separating. The fibrous stock under the action of the air is carried outwardly towards the wall of the receiver and drops to the bottom thereof. The fibrous material is removed from the receiver and bagged or baled as desired for convenient handling.

While the applicant does not desire to restrict himself to any particular dimensions, he has found that with a spinner 12" in diameter good results are obtained if the spinner chamber 3 is approximately seven feet square and six feet high, the receptacle 7 approximately four feet in diameter. It will be seen therefore that the main disintegration and separation of the fibrous material from the shot is conducted within the chamber 3, which is quite small in size. The receiver 10 may be of any suitable size. The chamber 3 and receiver 10 will, of course, be provided with suitable openings through which access may be had to their interiors for removing the shot material or other purposes.

The apparatus above described is intended particularly for the manufacture of rock wool. It is found that with the apparatus above described, the rock wool is formed with considerably longer fibres and contains less shot or heavy particles. The wool also possesses greater resiliency than rock wool as made by the older processes, and has a lesser tendency to break down under vibration. A given quantity of wool when subjected to a given pressure weighs lighter than wool made according to the old methods, and therefore a given quantity of the wool by weight, will go considerably further than the old type wool, and possesses a higher insulating value.

It is found that the thickness of the fibres may be regulated by varying the speed of rotation of the spinner.

What I claim as my invention is:

1. In apparatus for forming mineral wool from fusible solids, the combination with a furnace, of a rotary member having a downwardly and outwardly inclined peripheral portion; said peripheral portion having a plurality of closely spaced small V-shaped annular ribs formed in its upper surface, the inner sides of said ribs being narrow with a slight upward inclination, and the outer sides of said ribs wide with a slow downward inclination; means for rotating said member; and means for depositing molten material from said furnace in a small stream on to said inclined peripheral portion of the rotary member.

2. In apparatus for forming mineral wool from fusible solids, the combination with a furnace of a rotary member; means for depositing molten material from said furnace in a fine stream on to said rotary member; means for rotating said member to centrifugally discharge the deposited material from said member; and a chamber for receiving said discharged material, said chamber having a partition dividing said chamber into

inner and outer compartments; suction means for withdrawing the mineral wool deposited in the inner compartment, and a receptacle having openwork walls for receiving material from said suction means.

3. In apparatus for forming mineral wool from fusible solids, the combination with a furnace of a rotary member; means for depositing molten material from said furnace in a fine stream on to said rotary member; means for rotating said member to centrifugally discharge the deposited material from said member; and a chamber for receiving said discharged material, said chamber having a partition dividing said chamber into inner and outer compartments; suction means for withdrawing the mineral wool deposited in the inner chamber; a receptacle having openwork walls for receiving material from said suction means; and a pan positioned in said casing into which the discharge from the suction means is directed, said pan having a restricted neck portion adapted to trap heavier particles of material.

4. A method of forming mineral wool from fusible solids which consists in reducing the solids to a molten state; discharging the molten material in a fine stream, then bringing the molten stream into contact with downwardly and outwardly inclined annular surface while rotating the latter at high speed, drawing off, in a current of air, the fibres from the loose shot adjacent the point of formation as fast as they are formed, discharging in said current of air the withdrawn fibres downwardly against the wall of a pocket to break off any shot adhering to the fibres, and raising the fibers out of the pockets by the current of air to separate the broken-off shot from the fibres.

5. In combination, a spinning cone comprising a central body portion and a downwardly and outwardly tapered marginal portion, said tapered marginal portion having upon its upper face a series of closely spaced grooves separated by circular ribs forming circular spinning edges from which fibers are adapted to be spun, means for pouring upon the grooved surface of the cone adjacent its periphery a stream of molten viscous slag like material which supplies simultaneously a plurality of said grooves to produce multiple spinning from the corresponding spinning edges, a fiber receiving receptacle having its upper rim disposed below the cone and substantially surrounding the cone, said cone being mounted upon a vertical shaft extending solely from the upper end of the cone whereby the space below the cone and in the receptacle is unobstructed by the shaft, and a suction pipe having means for sucking a current of air downward around the periphery of the cone and through the receptacle and suction pipe to remove the fibers as fast as they are formed.

6. In the manufacture of mineral wool from a viscous molten material, the method of separating shot from fibers which consists in projecting the molten material transversely to a current of air which is ineffective to deflect the shot but which draws the fibers transversely from the path of the shot as fast as the fibers are formed, and by said current of air convey the fibers as fast as they are formed and discharging them so as to impact them against a wall disposed within a pocket, said impacting tending to knock shot or heavy particles loose from the fibers and the current of air flowing out of the pocket wafting the fibers back out of the pocket.

7. The process of freeing solid particles from rock wool which comprises conveying a stream of the material to be separated in a current of air, discharging said current of air and air borne material against an inclined bottom wall of a pocket whereby the denser portion of the current of air borne material impinges against said inclined wall and breaks the solid particles loose from the fibers of the wool, said solid particles being deflected laterally and downwardly by said inclined wall by inertia and by gravity and the fibers are wafted up and out of the pocket by the reflected current of air escaping out of the pocket.

8. The combination of a pan having a coned bottom wall and a rim, said rim consisting of an annular wall forming with the bottom wall an acute angle to provide an annular pocket for trapping said particles which impinge upon the coned portion wall, and means for discharging an air borne current of fibrous material with adherent solid particles against said coned bottom wall, said means comprising a discharge tube directed axially upon the point of the cone.

9. The combination of claim 8 with an outwardly and upwardly flared conical wall joining the upper margin of said annular wall and serving to form an expansion passageway for the reflex current of air which is discharged by said tube in the direction of said coned bottom wall.

10. Apparatus for forming mineral wool comprising the combination of a shaft journaled for rotation on a vertical axis, a rotary spinning member mounted on the lower end of the shaft, the space around and under the member being unobstructed so as to permit the free passage of fibers spun by the member downward and laterally, said member having its upper marginal portion disposed in the form of a cone sloping downwardly and outwardly, said marginal conical portion having a series of closely spaced circumferential grooves the radially outermost sides of the grooves being defined by ribs having edges standing above the bottoms of the grooves, means for supplying a stream of viscous molten wool-forming material to be spun and depositing the same upon said marginal conical portion at a point remote from the center of the member and in sufficient volume to cause the molten material to spread upon the inclined surface simultaneously over a series of said grooves, said grooves and ribs tending to assist in the spreading of said material on the member, and means for rotating the member at high speed, whereby the molten material is spun into fine fibers from a plurality of said edges in multiple at the same time and under substantially the same temperature conditions by the operation of said spinning member.

11. Apparatus for spinning molten viscous material into fine fibers comprising a rotating spinner consisting of a central body having a downwardly sloping conical margin, said body having a series of closely spaced circumferential grooves formed on said margin, said grooves being spaced apart by sharp ridges from the tops of which fibers are spun, a shaft journaled for rotation on a vertical axis, said spinner being disposed on the lower end of the shaft leaving the space around the sides and under the spinner clear of obstructions whereby fibers spun from the periphery of the spinner may be removed, as fast as formed, by a current of air, means for providing molten viscous material to be spun, and means for depositing a stream of said molten material upon the conical margin remote from the center of the spinner in sufficient volume to supply directly a plurality of said grooves simultaneously with ma-

terial for spinning, and suction means for continuously drawing the fibers downwardly and away to remove them as fast as formed.

12. Apparatus for producing mineral wool comprising means providing a supply of molten viscous mineral for spinning, a rotary spinner having on its upper surface a conical margin on which are formed a series of closely spaced circumferential grooves separated by narrow ridges from the tops of which fibers are spun, a shaft journaled for rotation, the spinner being mounted on the end of the shaft leaving the space about and beyond the spinner clear of obstructions, means for depositing a stream of said molten material upon the grooved surface of the spinner at a point remote from its axis simultaneously into a plurality of said grooves whereby fibers are spun in multiple at the same time and under substantially the same temperature conditions from a plurality of said spinning ridges, means for driving the shaft and said spinner at high rotative speed to cause the aforesaid spinning of fibers by the rotation of the disc, a fiber receiving receptacle having a wall, particles of the material not drawn into fibers being adapted to be discharged beyond the edge of the wall, said receptacle being disposed adjacent the spinner in position to receive the fibers, and suction producing means for drawing a current of air through the space in which the fibers are spun and through the receptacle to carry the fibers into the receptacle and to remove the fibers from the receptacle in a continuous operation, the space in which the fibers are spun and the interior of the receptacle being free of obstructions whereby the fibers may be continuously removed as fast as they are formed.

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MTC 017002

Oct. 22, 1935. C. C. WHITTIER 2,018,478

MACHINE FOR MAKING CHEMICAL ASBESTOS

Filed Jan. 16, 1933

Fig. 1.

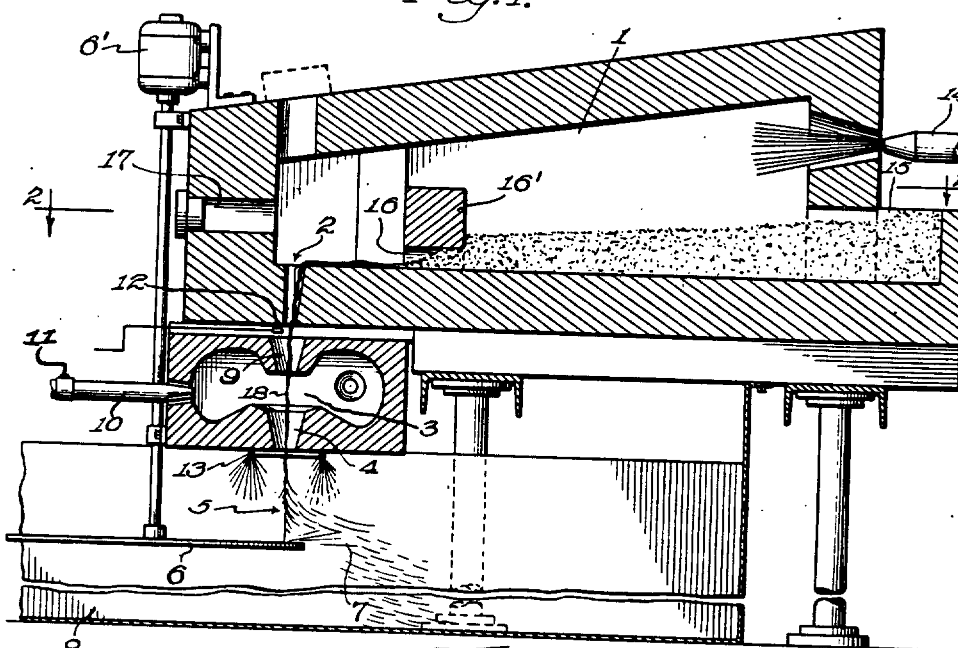


Fig. 2.

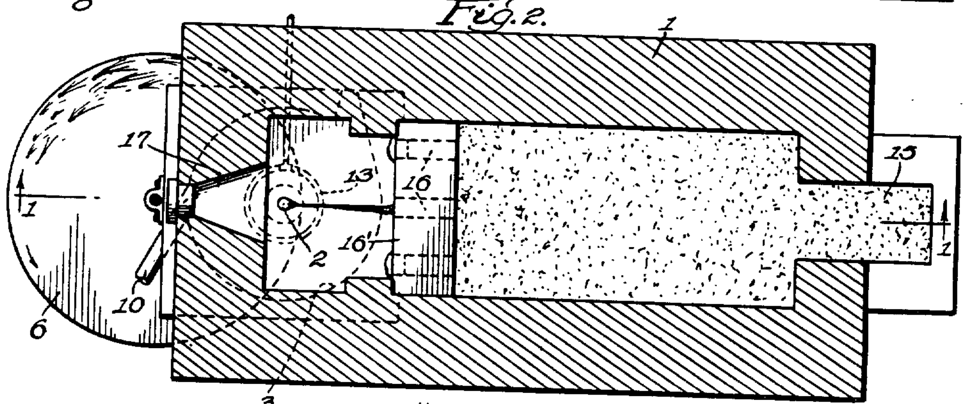
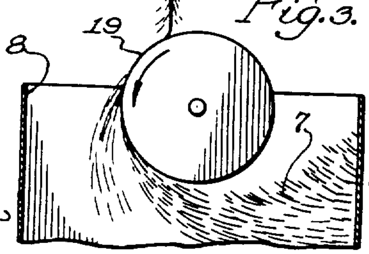


Fig. 3.



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MACHINE FOR MAKING CHEMICAL ASBESTOS

Charles C. Whittier, Chicago, Ill.

Application January 16, 1933, Serial No. 652,093

2 Claims. (Cl. 49—1)

This invention relates to a new and useful filamentary material and to methods and means for producing same, and more especially to artificial asbestos or chemically new asbestos-like fibers and to efficient continuous-process methods and mechanisms or means for manufacturing such material or product.

The main objects of the invention are to artificially product a fibrous mineral product or material having substantially all of the desirable attributes of natural asbestos fiber in its various forms, and to provide such a product of superior quality and better adapted for various purposes for which natural asbestos is used, and also for many other purposes for which natural asbestos is not adapted; including especially insulating and textile commodities; to produce a tempered and more flexible fiber of greater strength and toughness; to combine synthetically, in suitable proportions, appropriate materials mainly of natural source and to so treat the same as to accomplish the foregoing purposes and thus produce a product having the desired qualities herein set forth; and to provide means adapted for continuous-process operation whereby the product herein described may be produced or manufactured commercially and of satisfactory quality and in sufficient volume to meet practical industrial and commercial needs.

Means adapted for carrying out the purposes and for manufacturing the product herein described are illustrated by the accompanying drawing, in which:

Figure 1 is a vertical sectional view of a mineral fusing furnace having combined therewith appropriate heat regulating means and suitable mechanism to cause and effect drawing of filaments from the molten material treated.

Fig. 2 is a plan substantially on the line 2—2 of Fig. 1.

Fig. 3 is a side view of a modified form of filament drawing rotor.

Referring to said drawing, the process as a whole may be briefly described by stating that raw material, comprising the several necessary elements or minerals, is fed into the fusing furnace chamber 1 from which it flows by gravity through the outlet 2 and falls in a stream through a temperature controlling chamber 3, and thence downward through the opening 4 into an open space or chamber 5 where it is submitted to the frictional attack of a rapidly moving gaseous atmosphere as for instance air, certain parts of the material being immediately drawn off in filamentary form into the atmosphere, and the remainder falling upon a rapidly moving carrier 6, preferably of rotor design, whereby the material carried thereon is further submitted to the frictional attack of the atmosphere and further drawn off in filamentary form; said carrier as shown in Figs. 1 and 2 being in discoidal form and rotated horizontally, whereby the material deposited thereon or part of it is hurled centrifugally outward in liquid form whereby it is still further acted upon frictionally and parts or substantially all of the remaining material is drawn off by the atmosphere in filamentary form. All of the filaments 7, upon passing into the atmosphere, congeal and become set in permanent filament or fiber form and thereupon settle by gravity and collect feltwise in the chamber 8 which surrounds and extends below the carrier. The rotor 6 is driven by a motor 6'.

The fibrous or filamentary material 7 thus collected is removed in any convenient way and may be packaged or baled in any desired manner ready for storage or shipment, as will be understood, or it may be conveyed directly to any point whereon wanted, as for utilization in the industrial arts or for other purposes.

The said chamber 3 is annuloidal in shape and is positioned horizontally with the inlet and outlet openings 9 and 4 in vertical coaxial alinement therewith. Fuel is admitted in a somewhat tangential direction through a burner jet 10 having a delicately responsive control valve 11. This valve is regulated automatically by a pyrometric thermostat 12 or the like positioned adjacent to the path of the molten mineral as it passes from chamber 1 to chamber 3, the said thermostat and valve being responsively connected, as understood in the temperature control art, as for instance by electrical means not fully shown.

In order to temper the resultant fibers and so enhance their toughness and flexibility and corresponding fitness for fabrication and textile purposes and the like, an oil spray pressure jet or series of jets 13 are mounted to discharge oil vapor into the filament drawing air and against the hot filaments as they are formed.

The component elements in this new filamentary product are substantially those found in natural asbestos but may be varied considerably in their relative proportions, and other elements may be added to impart particular or special characteristics, as for instance coloring oxides, etc. Fusing together appropriate natural minerals is sufficient for the main purposes. It has been found, for instance, that a very good quality of asbestos fiber may be obtained by com-

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bining and treating certain materials as follows: alumina 27%; lime 22%; magnesia 17%; and silica 34%. This results in a light colored product consisting of fine flexible fibers or filaments. Appropriate metallic oxides may be added in small proportions to produce desired colors, as for instance iron oxide.

A very good asbestos may be obtained by chemically combining by heat ordinary natural dolomite and clay in appropriate proportions, the clay containing 25% or more of alumina. See Bulletin 95 (1920) of the Department of the Interior, Bureau of Mines, page 225, regarding dolomite.

In case the necessary materials are readily available, a good asbestos may be made advantageously by combining magnesium limestone, bauxite and silica, or by combining silica, magnesite and hematite.

Whenever the device herein described is to be operated, fuel is supplied to the fusing chamber 1 through the burner nozzle 14, and raw materials, usually containing the necessary elements, as for instance clay and dolomite, or other suitable materials, are fed in at 15.

When the material begins to fuse sufficiently, one or more clay plugs are removed from the openings 16 of the gate or dam 16', by access through the rear opening 17 so as to permit the molten mineral to trickle down at 2. The burner 10 having been started, the temperature of the stream 18 will be held constant at a predetermined value by thermostat 12. Then as the stream enters the space 5 it is acted upon by the draft of air generated frictionally by the rotor 6 and the impinging air overcomes the surface tension of the liquid stream and pulls particles, which it draws out, into long strings or filaments which are instantly congealed by the relatively cool but substantially hot air. The rotor 6 is maintained at proper speed corresponding with the temperature and fluidity of the molten mineral stream and may range in peripheral speed from almost three to six thousand feet per minute.

Whatever liquid falls upon the rotor is further subject to the filament drawing action of the air as it is carried along more or less on the rotor; but whatever of the liquid on the rotor is not drawn into filaments is thrown off centrifugally and further exposed to air drawing, usually sufficient to exhaust the mass and leave little or no residue or solid remnants; but any such remnants as may occur are reprocessed, or they may be used for other purposes, as for instance ground for use as an abrasive, so there is no waste of material.

Referring to the modified construction shown in Figure 3, the rotor 19 here shown is mounted on a horizontal axis and the molten mineral falls upon the broad cylindriform face thereof; the operative effect on the mineral being substantially the same as results from using the form shown in Figures 1 and 2.

The specific quality and size of the asbestos fibers may be varied somewhat according to the purpose for which they are to be used by varying the temperature and fluidity of the molten stream as it passes through the temperature adjustment chamber.

It is to be understood that some of the details set forth may be altered or omitted without departing from the spirit of the invention as defined by the following claims:

I claim:

1. An asbestos making apparatus comprising a fusing furnace having a discharge cascade outlet, a horizontally disposed temperature regulating combustion chamber substantially annuloidal in shape arranged coaxial with, and surrounding, an intermediate portion of said outlet in open communication therewith, a burner entering, and arranged tangential to, the outer periphery of said chamber to cause rotation of the atmosphere in the chamber about the slag in the course of its discharge through said outlet, and means to promote the drawing of filaments from said slag below the discharge end of the outlet.

2. An asbestos making apparatus comprising a fusing furnace having a discharge cascade outlet, a horizontal disposed temperature regulating combustion chamber annuloidal in shape, arranged coaxial with and around an intermediate portion of said outlet, said chamber being substantially kidney-shape in cross-section and in open communication at its center with that portion of the outlet surrounded by the chamber, a burner entering, and arranged tangential to, the outer periphery of the chamber to cause rotation of the atmosphere in said chamber about the slag in the course of its passage through the outlet, and means to promote the drawing of filaments from the slag below the discharge end of the outlet.

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APPARATUS AND METHOD FOR PRODUCTION OF FIBERS FROM GLASS, SLAG, AND THE LIKE MELTABLE MATERIALS

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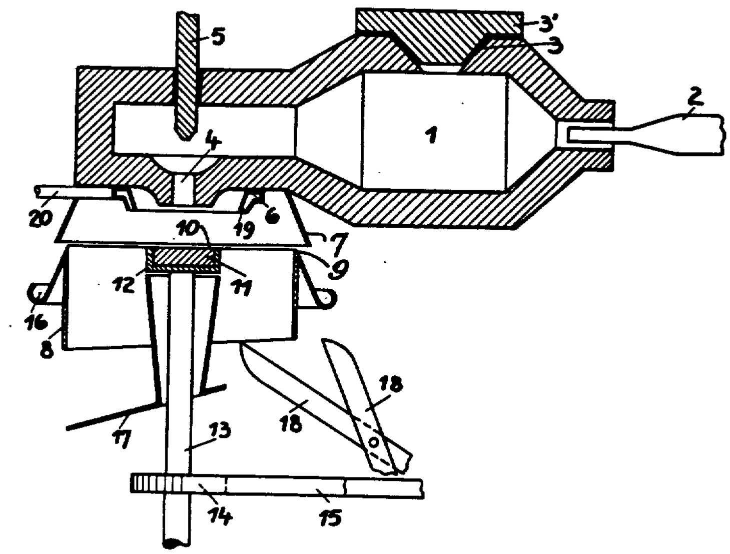

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APPARATUS AND METHOD FOR PRODUCTION OF FIBERS FROM GLASS, SLAG, AND THE LIKE MELTABLE MATERIALS

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8 Claims. (Cl. 49—1)

The production of fibers or threads from molten glass, so-called glass silk, is hitherto performed by means of spinning machines on which the threads are drawn from prepared glass rods or from the molten mass through nozzles, while in the manufacture of slag wool the threads are produced by the aid of steam or air blowers.

It is the object of the invention to provide a novel method and device for making fibers or threads of the kind stated. According to this invention, the hot liquid glass or slag mass is flown in a continuous and uniform thin stream onto a rapidly rotating body, such as a disc of suitable material. The liquid mass is thrown off the periphery of the disc by the centrifugal force and simultaneously formed into thin threads which sink down in the space around the rotating disc and can be collected as a uniform fibrous web.

Owing to the higher momentum imparted to heavier particles, such as thicker drops and threads, these are thrown off the disc to a greater distance and thus can be easily separated from the threads of the normal or desired thickness.

For facilitating the production of the fibers and aiding them in sinking down after their formation, a circular current of air under pressure is blown around the disc toward the discharge end of the device, this air current exerting a downward pressure on the fibers thrown off the disc so that they can be readily carried off.

In order to allow of the invention to be more clearly understood, an embodiment of a device for carrying the invention into effect is shown on the accompanying drawing in a sectional elevation.

1 designates a furnace for melting the working material, such as glass or slag, the furnace being heated by burners 2. 3 is an opening for filling in fresh material and 3' is a cover for the said opening. 4 designates the outlet of the furnace with which cooperates a plug 5 which is adapted to be raised and lowered for regulating the quantity of material discharged through the outlet. The outlet mouth 4 is surrounded by a rim 6. The annular space between the mouth 4 and rim 6 is designed to be heated by gas flames or the like for regulating the temperature of the glass or slag discharged through the mouth. The space below the outlet 4 is enclosed by annular guard walls 7 and 8 which reduce the outward radiation and avoid premature cooling of the down flowing mass. A narrow gap 9 is left between the two walls 7 and 8. Arranged below the outlet 4 at a predetermined distance therefrom is a centrifuging disc 10. This disc consists of a circular plate 11 of a suitable, preferably refractory material and of a metal ring or casing 12 holding and encircling the plate 11 in such a manner as to prevent breaking of the latter due to the high number of revolutions. The disc 10 is mounted on a shaft 13 which has the required high speed imparted to it from an electromotor or other source of power through a pulley 14 and belt 15 or any other suitable drive. The upper edge of the wall 8 lies substantially on the same level as the top surface of the centrifuging disc 10, so that the glass or slag particles which are too heavy will be thrown over and beyond the said edge into the gap 9. They are thus separated from the fibers or threads which have the prescribed weight. The particles entering the gap 9 fall into a collecting gutter 16 from which they can be returned to the melting furnace 1.

The liquid mass flowing out of the mouth 4 is thrown off the disc in horizontal direction forming a kind of cloud of thin threads which sinks down between the disc 10 and the guard wall 8. This sinking mass constantly increased by the succeeding fresh threads surrounds the shaft 13 as a jacket-like envelope which deposits on an inclined bottom plate 17. The material is projected from the disc at points angularly spaced around the axis of rotation of the disc and during the formation of the fibers one end of each fiber is anchored to the disc.

The fibrous envelope is continuously or intermittently severed by means of cutting shears 18, which may be operated mechanically, and then glides down over the inclined bottom 17 to a winding device, not shown. The fibrous web produced by the cutting corresponds in width to the circumference of the fibrous jacket formed about the disc 10 and shaft 13.

Owing to their low weight, the fine fibers thrown off the disc have a comparatively low velocity of fall. Moreover, the high temperature prevailing near the disc gives the light fibers the tendency of flying upwards. This slow sinking of the fibers or their tendency to rise may become a hindrance to the proper carrying off of the fibers and may even affect more or less the operation of production and the quality of the product. To avoid this evil, a circular current of air is blown about the disc towards the discharge end of the device. According to the embodiment illustrated in the drawing, this air current is produced by an annular nozzle 19 which is formed by the rim 6 or separately therefrom and to which air under pressure is supplied through a pipe 20. The air current emitted by the nozzle 19 urges the fibers thrown off the disc 10 continuously downwards so as to make the path free for the succeeding fresh fibers. In this way, the continuous production of fibers can take place unhinderedly and the carrying off of the resulting product is greatly aided. Instead of air there may also be used any other suitable gaseous medium.

The thickness of the fibers can be regulated in various ways, such as by working with more or less high temperatures of the liquid mass, by changing the distance between the disc 10 and the mouth 4 or by controlling the quantity of liquid mass discharged through the outlet 4.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent, is:

1. A device for producing fibers from molten glass, slag and the like meltable material, comprising a receptacle for molten material, an outlet in the receptacle wherethrough to discharge a stream of molten material, a rotatable solid body whereon to deliver the stream of molten material, means for imparting a high rotary speed to the said body, and means for directing a circular downward current of air around said body substantially parallel to the axis of rotation of the same.

2. A device for producing fibers from molten glass, slag and the like material, comprising a melting furnace for the material, an outlet in the bottom of the furnace wherethrough to discharge a continuous thin stream of molten material, a circular disc at a distance below this outlet whereon to deliver the stream of molten material, an annular air nozzle around the said outlet for directing a circular current of air parallel to the stream of molten material in spaced relation thereto and past the circumference of the said disc, and means for imparting a high rotary speed to the disc.

3. A device for producing fibers from molten glass, slag and the like meltable material, comprising a melting furnace for the material, an outlet in the bottom of the furnace wherethrough to discharge a continuous thin stream of molten material, a horizontally disposed circular disc below this outlet whereon to deliver the stream of molten material, means for imparting a high rotary speed to the disc, guard walls about the path of the stream and the rotating disc in spaced relation thereto, an annular gap in the guard walls at substantially the same level as the top surface of the rotating disc, and means for cutting the fibers as they sink down from the disc about the same in the space defined by the guard walls.

4. A device for producing fibers from molten glass, slag and the like meltable material, comprising a melting furnace for the material, an outlet in the bottom of the furnace wherethrough to discharge a continuous thin stream of molten material, a horizontally disposed circular disc below this outlet whereon to deliver the stream of molten material, means for imparting a high rotary speed to the disc, guard walls about the path of the stream and the rotating disc in spaced relation thereto, an annular gap in the guard walls at substantially the same level as the top surface of the rotating disc, an annular air nozzle above the disc opening downwardly for directing a current of air around the disc substantially parallel to the axis of rotation of the same, and means for cutting the fibers as they move downwardly away from the disc.

5. In a device of the character described, the combination with means for delivering a downwardly flowing stream of molten material, of a disc mounted for rotation in a horizontal plane in a heated zone in the path of said stream, and means for rotating said disc at a speed sufficiently great to project the molten material therefrom in fiber form, and means for directing a current of air downwardly around the disc.

6. In an apparatus of the character described, the combination with means for projecting horizontally from a center fibers of vitreous material, and means for directing a current of air downwardly around such center and across the path of the fibers.

7. The hereinbefore described process of producing fibers from molten glass or similar material which comprises projecting the material in the form of fibers from the periphery of a horizontally rotating disc and collecting and compacting the fibers by projecting across the path of the fibers a downward current of air.

8. The hereinbefore described method of producing fibers from a material having no definite melting point but having a definite range of softening, which comprises flowing a stream of molten glass or slag, onto a member rotating horizontally, projecting the material from the member and thereby forming fibers therefrom anchored to the member at points angularly spaced around the axis of rotation of the member by the centrifugal force due to the rotation of the member, and maintaining the material while being projected at a temperature sufficiently high to give the material a viscosity suitable for the formation of the fibers from the projected material under the forces acting thereon.

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