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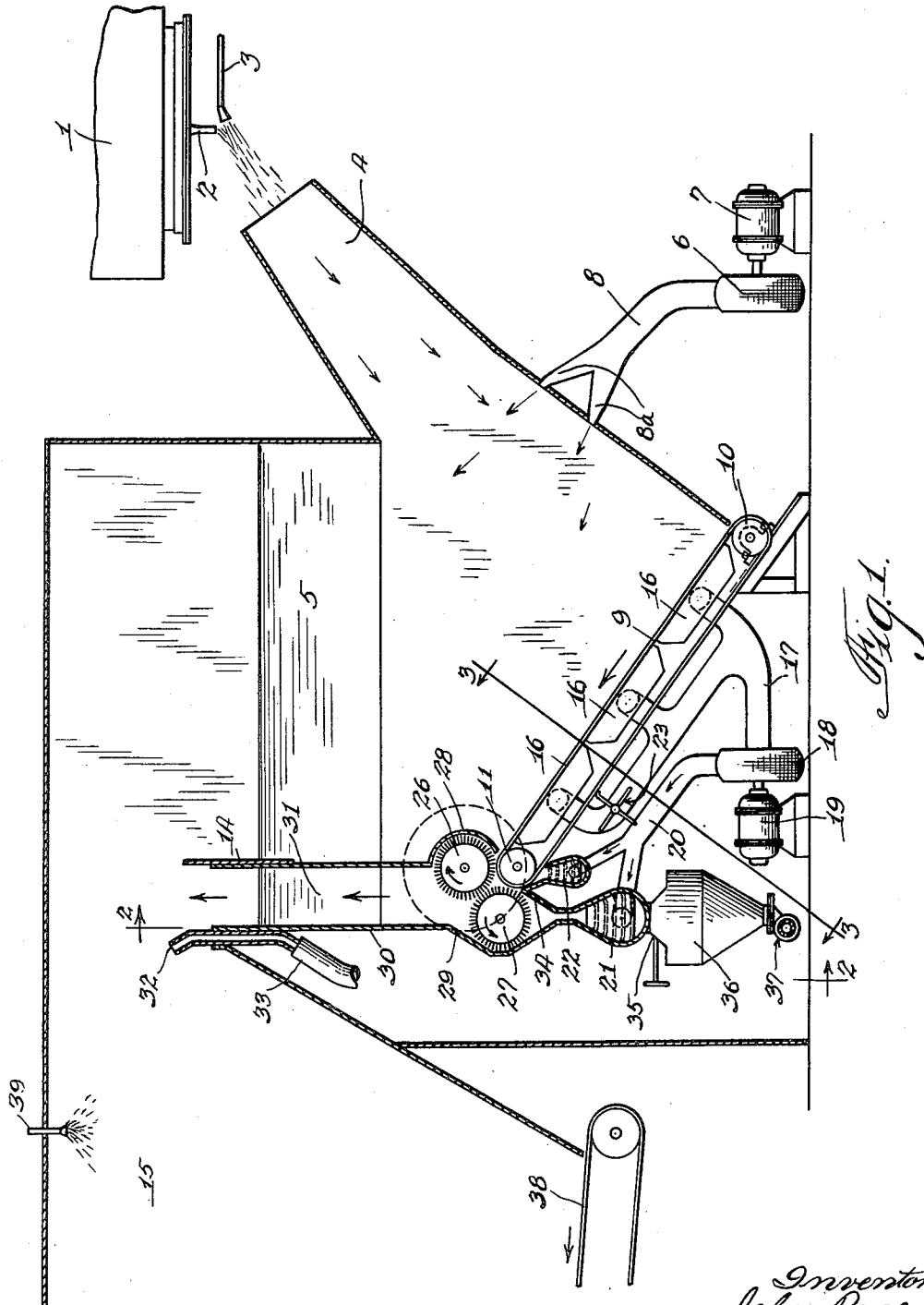
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2,316,451

APPARATUS FOR PRODUCING MINERAL WOOL

Filed Nov. 18, 1939

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

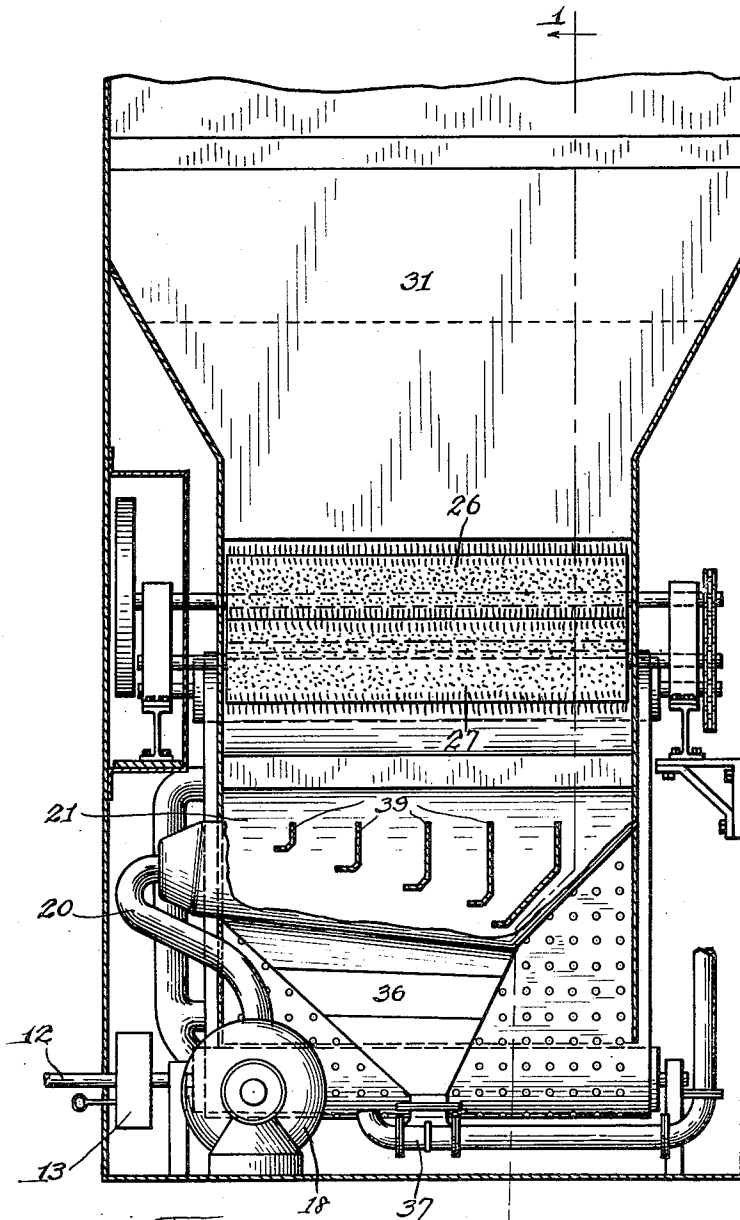


Fig. 2.

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3 Sheets-Sheet 3

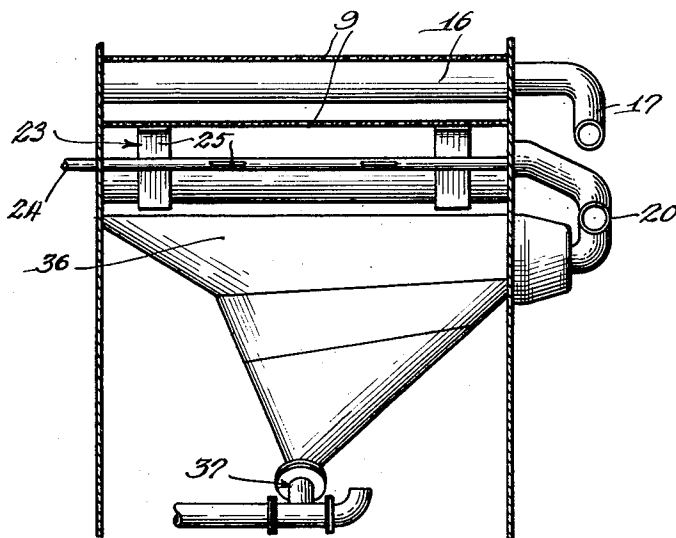


Fig. 3.

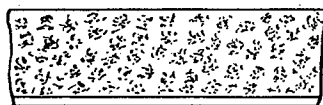


Fig. 5.

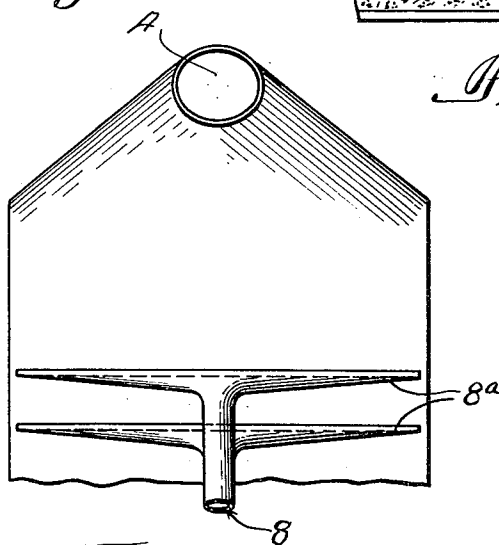


Fig. 4.

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UNITED STATES PATENT OFFICE

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APPARATUS FOR PRODUCING MINERAL WOOL

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11 Claims. (Cl. 154—27)

This invention relates to apparatus for producing mineral wool and more particularly for debeading mineral wool and forming bats or the like having desirable dustproof or waterproof characteristics, or both.

The invention is also adapted for the production of debeaded and tufted mineral wool bats in which short fibers and more or less granular material may be intermingled to form tufts and in which these tufts are intermingled and intermeshed with long fibers in a manner to produce a tufted mineral wool bat having effective insulating properties combined with sufficient resilience to retain the bat form when compressed between building studs.

In a bat of this type, the closely adjacent and substantially uniformly distributed tufts provide efficient heat insulating characteristics and the comparatively large amount of long fibers intermeshed with the tufts retains the form of the bat and provides the desired resilience and flocculence of the entire unit.

An object of the present invention is to provide an apparatus for producing loose fibrous mineral wool from which the so-called slugs, shot, and beads have been removed.

One of the more serious problems confronting the manufacturer of fibrous insulation from molten mineral and rock is the production of fine fibers which are free from solidified glassy globules. The globules are formed while in the molten state by the usual fiberizing blast used in the manufacture of mineral wool. For the purposes of this specification, such globules will be termed beads, although they are known in the industry as slugs, shots, or beads, depending upon their size. A substantial number of these beads are attached to fibers and must be broken free before they can be segregated therefrom. The presence of these beads in mineral wool is objectionable for a number of reasons, among others their adverse effect upon the insulating qualities of the wool, the color darkening effect which they exert upon the matted wool, the increase in weight per unit volume which they occasion, and the increased cost of production.

A number of means have been suggested for preventing formation of or eliminating beads from mineral wool during manufacture. None of these means, however, have been entirely satisfactory, at least not for use on a commercial scale.

It is another object of this invention to provide a means for diminishing or entirely eliminating the bead content of blown fibrous mineral wool.

A further object is the provision of means for debeading mineral wool and simultaneously forming tufts of short fibers and more or less granular material and thereafter combining these tufts with the long fibers in a manner whereby they are intermingled and intermixed to provide a tufted mineral wool bat in which the tufts are substantially uniformly distributed and intermeshed with long resilient fibers.

It is also an object to provide an apparatus whereby the debeading of mineral wool may be accomplished with a minimum of time and labor and at a minimum expense without subjecting the bead-free fibers to any operation which will cause them to be broken and which will leave all of the original bead-free fibers in their natural fluffy and flocculent state.

Another object is the provision of a new and novel tufting mechanism for forming a continuous stream of tufts and simultaneously separating the beads therefrom.

Still another object is the provision of an apparatus for continuously debeading, dustproofing, and/or waterproofing mineral wool and forming bats therefrom.

Further objects will be apparent from the specification, the drawings, and the appended claims.

In the drawings:

Fig. 1 is a longitudinal sectional view through one embodiment of the invention, portions being shown in full lines for purposes of illustration.

Fig. 2 is a transverse sectional view through the embodiment illustrated in Fig. 1 and taken on a line substantially corresponding to line 2—2 of Fig. 1.

Fig. 3 is a transverse sectional view through the debeading belt and illustrates the operation of the belt beater and the blower and is taken on a line substantially corresponding to line 3—3 of Fig. 1.

Fig. 4 is a fragmentary end elevation of a portion of the embodiment shown in Fig. 1 and illustrates the blower nozzles for segregating the bead-free fibers and particularly the long bead-free fibers from the loose beads and from fibers having beads thereon.

Fig. 5 is a fragmentary sectional view through one of the tufted bats manufactured by the debeading and tufting device disclosed herein.

Referring to the drawings in detail, the embodiment illustrated comprises a cupola or furnace 1, from which is delivered a stream of molten vitreous material 2, which stream is delivered into the path of a stream of gas such as steam

or hot air delivered from a nozzle 3 in the usual manner for producing blown mineral wool fibers. The fibrous material produced in this manner is directed angularly downward through an elongated angular inlet passage 4 into a debeading chamber 5.

An air pump or blower 6 may be driven by means of a motor 7 or from any suitable power source, and this blower is provided with an outlet conduit 8 terminating in nozzles 8a for directing air currents into the debeading chamber 5. These air currents cause the fibers not connected to beads and which are light and easily air floated to be blown upwardly and distributed more or less evenly throughout the entire upper part of the chamber.

A belt 9 forms the bottom of the chamber 5 and is preferably formed of foraminous material such as comparatively fine-mesh wire screen or the like and is preferably angularly positioned as shown, with the lower end mounted on a pulley 10 and the upper end supported on a corresponding pulley 11. This belt may be constantly driven in the direction of the arrow through a transmission including a shaft 12 (Fig. 2) and a variable speed mechanism 13 which may be manually controlled to vary the speed of the belt as desired. The air currents from the nozzles 8a are sufficient to blow the bead-free fibers upwardly into the upper part of the chamber 5, where they pass over the top of an adjustable partition 14 and into a so-called wool room 15. The heavier fibers, however, and the separate beads and fibers with beads and globules thereon will fall downwardly onto the belt 9 and be carried angularly upward and over the pulley 11 where they are processed in a manner which will be later described.

Adjacent the under side of the upper flight of the belt 9 are positioned a plurality of suction chambers 16. These chambers are connected by means of conduit 17 with the inlet of an air pump or blower 18, which may be operated by a motor 19 or from any suitable power source. The pump 18 discharges a blast of air through a conduit 20 and into suitable wind chambers 21 and 22 which are positioned beneath the upper end of the belt 9. It will, therefore, be seen that the heavier fibers and fibers having glassy globules or beads thereon will be deposited by gravity and suction on the belt 9 and will be carried upwardly over the pulley 11 in a comparatively uniform layer which may be of any thickness desired by regulating the speed of the belt. A beater 23 is positioned underneath the lower flight of the belt, as shown in Figs. 1 and 3, and may comprise a shaft 24 driven from any suitable power source and provided with a plurality of beater arms 25. This beater is for the purpose of cleaning the belt and removing any small amount of material which may adhere to the lower flight.

Closely adjacent the upper belt pulley 11 are positioned two spiked or toothed rolls 26 and 27. These may be termed combs or combing rolls. The roll 26 continuously rotates in a clockwise direction, as shown by the arrow, while the roller 27 is continuously operated in a counterclockwise direction. These rollers may be driven by any suitable means through a variable speed mechanism, whereby they may be caused to operate at any desired speed. However, it has been found that the roller 26 operates satisfactorily at from 100 to 800 revolutions per minute, while the roller 27 may rotate in the opposite direction at a somewhat higher speed, preferably at about 125 to 1500

revolutions per minute. These rollers are provided with so-called spikes or teeth 28 which are distributed over their entire surface or, in other words, they are in the form of rotary brushes or combs having comparatively stiff teeth or bristles.

The comb rollers are enclosed in a housing 29, which includes an upwardly extending wall 30 which is related to the wall 14 to provide an upwardly extending channel or conduit 31. This channel is preferably adjustable in height, which adjustment may be accomplished in any desired manner, as by telescoping the upper and lower sections of the walls 14 and 30. The upper end of the wall 30 is provided with a nozzle 32, through which a continuous current of air may be directed from a conduit 33 which latter may be connected to any suitable pressure source.

The housing 29 extends downwardly below the rollers 26 and 27 and communicates with the wind box 21, as illustrated. The auxiliary wind box 22 communicates with the chamber 29 through a narrow passage 34 adjacent the end of the belt. These wind boxes or wind chambers direct a constant current of air past the rollers 26 and 27 and past the end of the belt and upward through the chamber 21, as shown by the arrows. Below the wind box and in communication therewith, through a shut-off valve 35, is a hopper 36. This hopper is provided with a self-feeding discharge valve 37, whereby such globules and coarse fibers as are directed to the chamber 36 are withdrawn as desired.

The wool room 15 may be provided with a continuously moving belt 38, on which the debeaded fibers and tufts are uniformly distributed in the usual method of forming mineral wool bats. The air conduit 20 leading to the wind chambers 21 and 22 preferably communicates with these chambers through the end walls and both chambers are preferably provided with baffles such as indicated at 39 in Fig. 2. These baffles are so shaped and positioned as to provide a uniform air volume and velocity throughout the entire length of the wind chamber.

The operation of the embodiment described is substantially as follows. The stream of molten material from the cupola 1 is atomized by the air or steam blast from the nozzle 3, which draws the molten material into very fine fibers. The fibers and beads, which latter may or may not be attached to the fibers, are passed through the directing passage 4, where the lighter and comparatively globule-free fibers are carried upwardly and out into the wool room by means of the air currents from the nozzles 8a. The heavier fibers, which contain a considerable amount of beads, drop by gravity, assisted by the suction chambers 16, to the upper surface of the belt 9. The speed of travel of the belt 9 is so synchronized with the rate of fiberization that an appreciable thickness, for example, $\frac{3}{8}$ inch, of fibers and beads collects on any given area of the belt by the time it reaches the spiked combing roll 26. The teeth on the roll 26 operate to remove most of the fibers from the belt, and any fibers remaining thereon will be removed either by the comb roll 27 or by the upward blast from the wind chamber 21 and the wind chamber 22, which latter discharges closely adjacent the surface of the belt. Those fibers which are picked up by the blast from the air chamber 22 are largely lodged upon the spiked roll 27.

The rolls 26 and 27 are closely adjacent each other and function to comb the fibers lodged thereon, thereby substantially completely remov-

ing the globules attached to the fibers. The detached globules, being comparatively heavy, descend against the air current from the wind chamber 21 and are deposited in this chamber, from which they are removed at intervals into the hopper 36 and are intermittently removed from the hopper 36 and returned to the cupola 1. The upward current from the wind chamber 21, in addition to depositing any stray fibers, which may have gotten below the levels of the spiked rolls 26 and 27, upon said rolls, further operates to convey globule-free fibers and tufts from the rolls up through the conduit 31. Once past the top of the conduit 31, the fibers and tufts are carried by the current from the nozzle 32 into the wool room 15, where they are deposited on the belt 38. The current of air from the nozzle 32 also serves to mix the fibers and tufts coming from chamber 21 and passage 31 with the other fibers coming from chamber 5. The force of the current from the wind box 21 may be accurately regulated to prevent fibers carrying excess globules from being carried beyond the top of the chamber 31 and the height of the chamber may be so adjusted that free globules and relatively large fiber-attached globules will not be thrown from the top thereof, but will fall back against the rolls 26 and 27, where they are again subjected to the combing operation.

Variable speed motors or other variable speed devices are preferably used for driving the air pumps or blowers and for driving other operating parts of the device. By this means, all of the operations may be synchronized as desired. By properly synchronizing the mechanisms and the air currents, the debeading rolls will discharge a substantially uniform continuous stream of tufts and fibers upwardly through the passage 31, and the structure and size of these tufts may be controlled by a proper synchronization of the various mechanisms and a proper control of the air currents directed into the device. The tufts and debeaded fibers will pass upwardly and over the top of the partition 30 in a continuous, evenly distributed stream, and the long fibers from the chamber 5 which are separated from the beads and beaded fibers by means of the air currents from nozzles 8a will also flow into the chamber 15 in an evenly distributed continuous stream. The slight turbulence of the air stream will cause the fibers originally blown as bead-free fibers to be intermingled and intermeshed with the debeaded fibers and the tufts and a substantially uniform mineral wool bat will be deposited on the continuously moving belt 38, from which it may be removed and disposed of as desired.

The fibers which pass through the debeading drums are broken down and shortened to some extent in the combing action. To produce a uniform bat, the combed fibers and tufts should be mixed with the longer uncombed bead-free fibers. If desired, the present invention may be used solely for the purpose of producing long-fibered substantially bead-free mineral wool, in which case the conduit 31 may be arranged to discharge outside the wool room or may discharge into the cupola 1.

By proper regulation of the air pressures and the speed of the spiked rolls 26 and 27, and the spacing of the spikes thereon, only bead-free fibers without tufts may be discharged upwardly through the passage 31 while the beads will all be segregated from the fibers and directed downwardly.

If desired to produce a stronger or stiffer bat than can be obtained by natural felting of the fibers alone, a binder may be sprayed or atomized into the felting room through proper nozzles such as shown at 39. This will coat the fibers and, when felted, a strong stiff bat may be produced by means of the binder more effectively adhering the fibers together. Waterproofing or dustproofing materials may also be introduced onto the fibers in this same manner through the same nozzles or by the use of additional nozzles or atomizers, if desired. A starch solution or the like may be used for dustproofing, and oil or melted paraffin is suitable for waterproofing.

Modifications may be made without departing from the spirit of the invention, and it is therefore desired that the invention be limited only by the prior art and the scope of the appended claims.

Having thus described this invention, what is claimed and desired to be secured by Letters Patent is:

1. Apparatus for debeading mineral wool comprising means for directing a stream of fiberized mineral wool into a chamber, means for directing a gaseous current transversely of said stream to separate the lighter bead-free fibers from the beads and beaded fibers, a moving belt adapted to catch and support thereon the beads and heavier fibers, means to comb the material from said belt, and means to direct a gaseous current through said combed material of only sufficient force to remove the fibrous and lighter granulated material therefrom and enable the beads to be separated by gravity, said gaseous current being arranged to direct said material to intermingle with said first segregated fibers.

2. Apparatus for debeading mineral wool comprising a continuously moving foraminous support, means for directing a stream of fiberized material toward said support, means for directing a transverse gaseous current through said fibrous stream to separate the lighter fibrous material therefrom without materially diverting the heavier fibers and beads, whereby they are collected on said support, automatic combing means for removing said heavier fibers and beads from said support, and means for directing a gaseous current through said combing means to remove the lighter fibers therefrom while permitting said beads to fall by gravity away from said combing means.

3. Apparatus for producing debeaded mineral wool comprising means for projecting a gaseous fluid under pressure across a descending molten mineral to produce a stream of fibrous wool, a support below said fibrous stream, said gaseous fluid pressure permitting the beads and beaded fibers to drop from said wool stream by gravity onto said support while directing the beadless fibers beyond said support, means for automatically combing the deposited material from said support to separate the fibrous material from the beads, and means to direct a gaseous current to remove said separated fibrous material from said combing means while permitting said beads to drop therefrom by gravity.

4. Apparatus for debeading mineral wool comprising a continuously moving foraminous belt, means for directing a stream of fibrous material over said belt whereby the beads and beaded fibers drop thereon, suction means operable through said belt to assist in drawing the heavier fibers to said belt, a plurality of combing rollers adjacent the end of said belt and having teeth

arranged to comb the accumulated material therefrom, said rollers being enclosed in a housing into which the adjacent end of said belt extends, and means for directing a gaseous current through said housing to remove the combed material while allowing the beads to separate therefrom by gravity.

5. A debeading apparatus for mineral wool comprising a continuously moving belt on which a comparatively thin layer of beaded fibrous material may be deposited, movable combing means closely adjacent the end of said belt and constructed to comb said fibrous material from said belt and to partially granulate a portion of said material and to intermingle said granular material and fibrous material, and means for directing a gaseous current around and through said combs to blow said material therefrom in the form of tufts and simultaneously permitting the beads to separate from said material by gravity.

6. Apparatus for debeading mineral wool comprising a continuously moving belt, means for directing a stream of fibrous material toward said belt, means for deflecting the lighter beadless fibers upwardly from said belt and permitting the beads and heavier fibers to fall thereon, an upwardly directed conduit communicating with the end of said belt, automatic combing means in said conduit adjacent the end of said belt and adapted to comb the material therefrom, means for directing a gaseous current upwardly through said conduit under pressure sufficient to remove the lighter fibers and to enable the beads to drop by gravity, and means adjacent the top of said conduit to direct a gaseous current to intermingle the material from said conduit with the fibrous material from said first stream.

7. Apparatus for manufacturing tufted mineral wool bats comprising two communicating first and second chambers having an adjustable partition therebetween to provide a variable passage thereover, a debeading belt in said first chamber and a bat forming belt in said second chamber, means for directing a stream of beadless fibrous material from the usual fiberizing nozzle through said first chamber so that the beads and beaded fibers are deposited on said debeading belt, and through said passage, whereby the beadless fibers are deposited on said bat forming belt, means for combing said beads and beaded fibers from said debeading belt and simultaneously separating said beads therefrom and segregating said combed fibers in the form of tufts, and means for directing said tufts through said passage into said second chamber and intermingling and intermeshing said beadless fibers with said tufts, and depositing said intermeshed material on said bat forming belt.

8. Apparatus for manufacturing debeaded mineral wool bats comprising a chamber having a foraminous, continuously moving, upwardly inclined belt forming one wall thereof and an angular inlet passage, means for directing a stream of mineral wool fibers downwardly through said angular passage toward said belt, said chamber having an oppositely disposed outlet adjacent

the top thereof, means for deflecting said stream of fibrous material toward said outlet while permitting the beaded fibers and beads to drop by gravity on said belt, a substantially vertical conduit communicating with the upper end of said belt and terminating adjacent said chamber outlet, rotary combs in said conduit closely adjacent the end of said belt and adapted to comb the material therefrom, at least one wind chamber below said combs and the end of said belt and forming an extension of said conduit, means for directing a gaseous current through said wind chamber and conduit to remove the fibrous combed material upwardly through said conduit and through said chamber outlet, means in said wind chamber to equalize the velocity and volume of the gaseous current therethrough over the area of the conduit, and means for directing a gaseous current outwardly from adjacent the lower edge of said chamber outlet whereby the stream of material from said conduit is mixed with the material of said first fibrous stream.

9. Apparatus for producing a substantially bead-free bat from a gaseous suspension of mineral wool, comprising means to project a gaseous suspension of mineral wool fibers containing beads through a chamber, means to pass a gaseous current transversely through the suspended fibers in said chamber to divert the bead-free fibers from the path of suspension, said current being insufficient to divert the beaded fibers and separate beads, means to granulate at least a portion of said undiverted material and to form tufts of intermingled short fibers and substantially granular material, means to direct a second gaseous current to move a substantially continuous stream of said tufts into said suspension of long fibers in a manner to uniformly intermingle and intermesh said long fibers and said tufts and to direct said intermingled material into a second chamber, and means associated with said second chamber to accumulate and remove said intermeshed material in bat-like form.

10. Apparatus for debeading mineral wool, comprising means to subject a stream of vitreous material from a fiberizing nozzle to a transverse gaseous current to remove the lighter fractions and fibers, a moving support to receive the heavier fractions and fibers, means to comb the heavier fractions and fibers from said support, means to separate the beads from the combed fibers and to substantially simultaneously direct the combed fibers into the stream of lighter fractions and fibers.

11. Apparatus for producing debeaded and felted mineral wool comprising means to provide a gaseous suspension of mineral wool containing beads and beaded fibers, means to separate the beads and beaded fibers from said suspension, means to comb the separated beaded fibers to segregate the beads therefrom, means to intermingle the combed fibers in suspension with the original bead-free fibers, means to atomize a fiber-coating agent into said mixed suspension, and means to felt said treated fibers.

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