United States Patent [19]

Corsentino, deceased et al.

[11] **3,773,485**

[45] **Nov. 20, 1973**

[54] **APPARATUS FOR PRODUCING FIBER MATS OF MINERAL FIBER**

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[73] Assignee: **The Susquehanna Corporation,** Alexandria, Va.

[22] Filed: **Nov. 8, 1971**

[21] Appl. No.: **196,504**

Related U.S. Application Data

[63] Continuation of Ser. No. 880,160, Nov. 26, 1969, abandoned, which is a continuation-in-part of Ser. No. 496,987, Oct. 19, 1965, abandoned.

[52] **U.S. Cl.** **65/9,** 65/10, 65/14

[51] **Int. Cl.** **C03b 37/04**

[58] **Field of Search** 65/6, 8, 9, 10, 14, 65/15, 16; 264/8, 12

[56] **References Cited**

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2,255,227	9/1941	Parsons	65/10
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2,328,714	9/1943	Drill et al.	65/6
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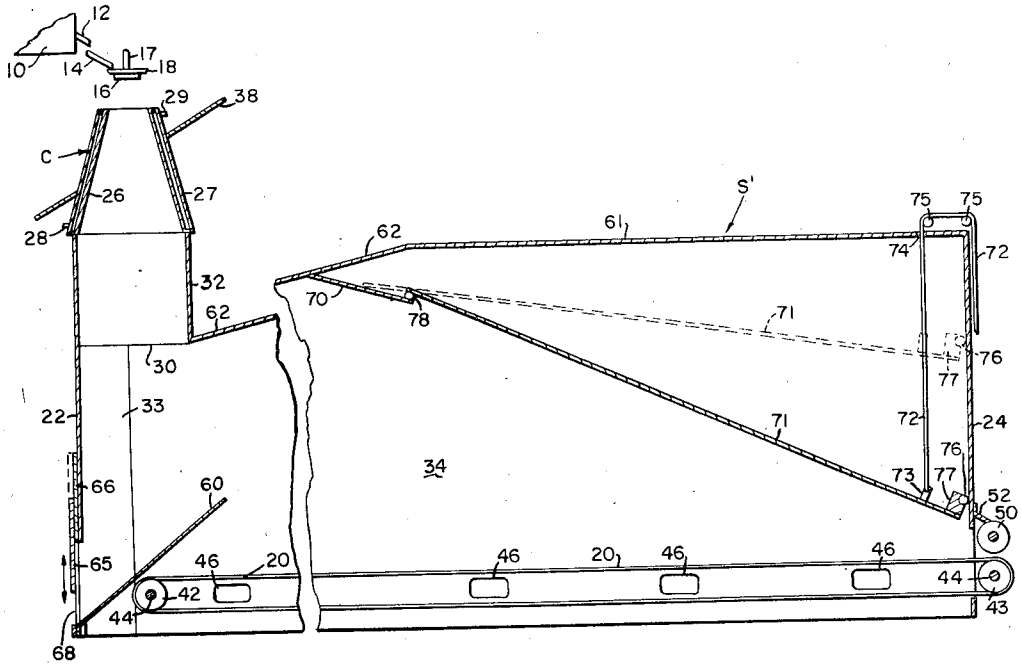
715,728	12/1941	Germany	65/9

Primary Examiner—Robert L. Lindsay, Jr.
Attorney—Horace B. Van Valkenburgh

[57] **ABSTRACT**

Apparatus for producing mineral wool fibers and the like including a longitudinal settling chamber having a foraminous conveyor, through which air is drawn, and a fiber producing device, preferably a head rotating about a vertical axis and annular steam ring surrounding but above the head, above the rear end of the chamber, with an open topped passage, conical or at first conical and then cylindrical, extending to the top of the rear end of the chamber. A binder me be sprayed downwardly and at an acute angle to fibers and air drawn with them, which are permitted to expand in moving into the rear of the chamber, while a constricted throat section in the chamber, followed by a section of greater cross sectional area, causes the air and fibers to turn and move forwardly for deposition on the conveyor, with shot and slugs dropping out as the air and fibers turn. A rear baffle extending upwardly and forwardly over the rear end of the conveyor serves to guide falling shot and slugs to a rear point of collection and removal. A major portion of the top of the chamber is inclined at an acute angle of not more than 20° to the conveyor. A false ceiling or longitudinal upper baffle may also be adjusted upwardly and downwardly to control the deposition of the fibers on the conveyor.

12 Claims, 10 Drawing Figures



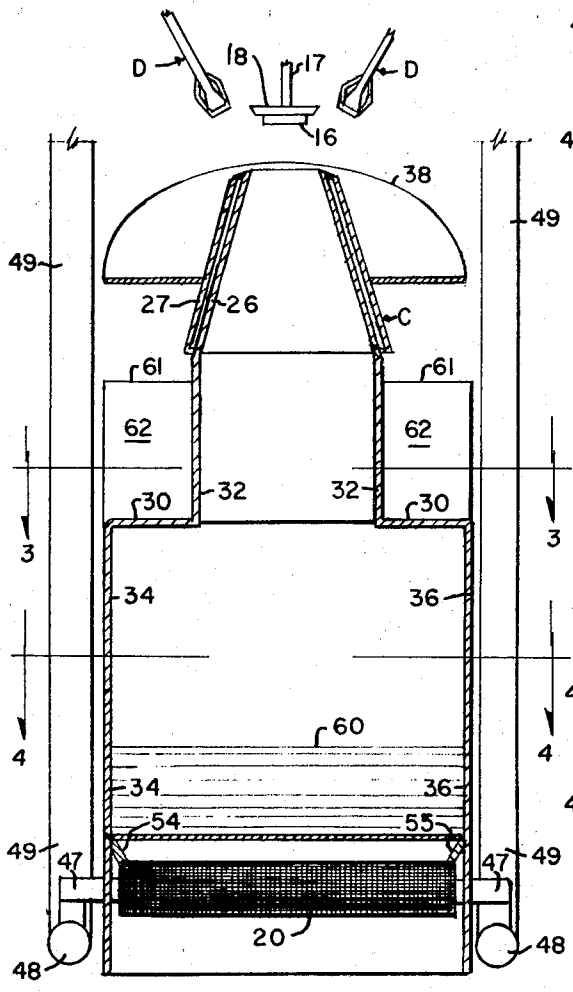


FIG. 2.

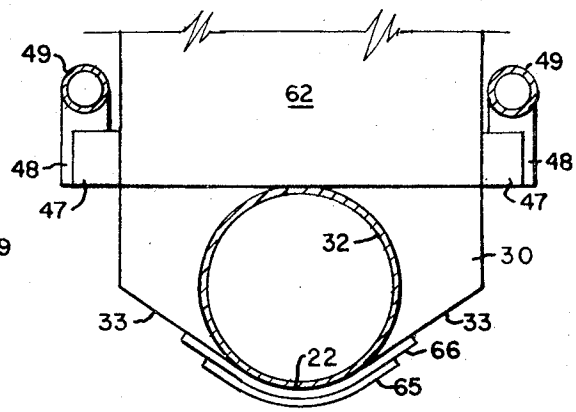


FIG. 3.

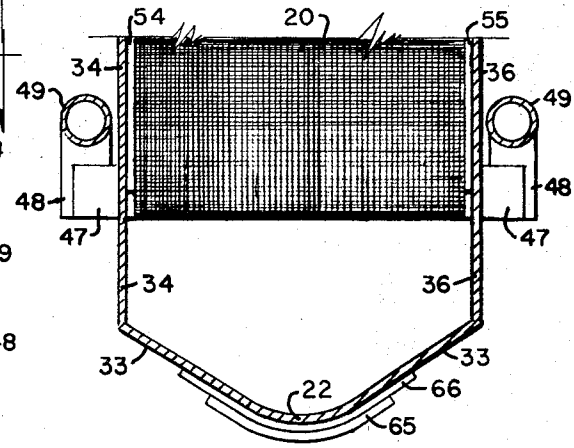


FIG. 4.

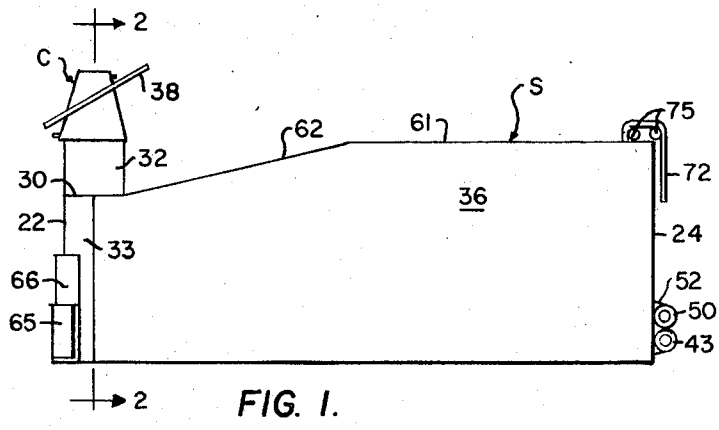


FIG. 1.

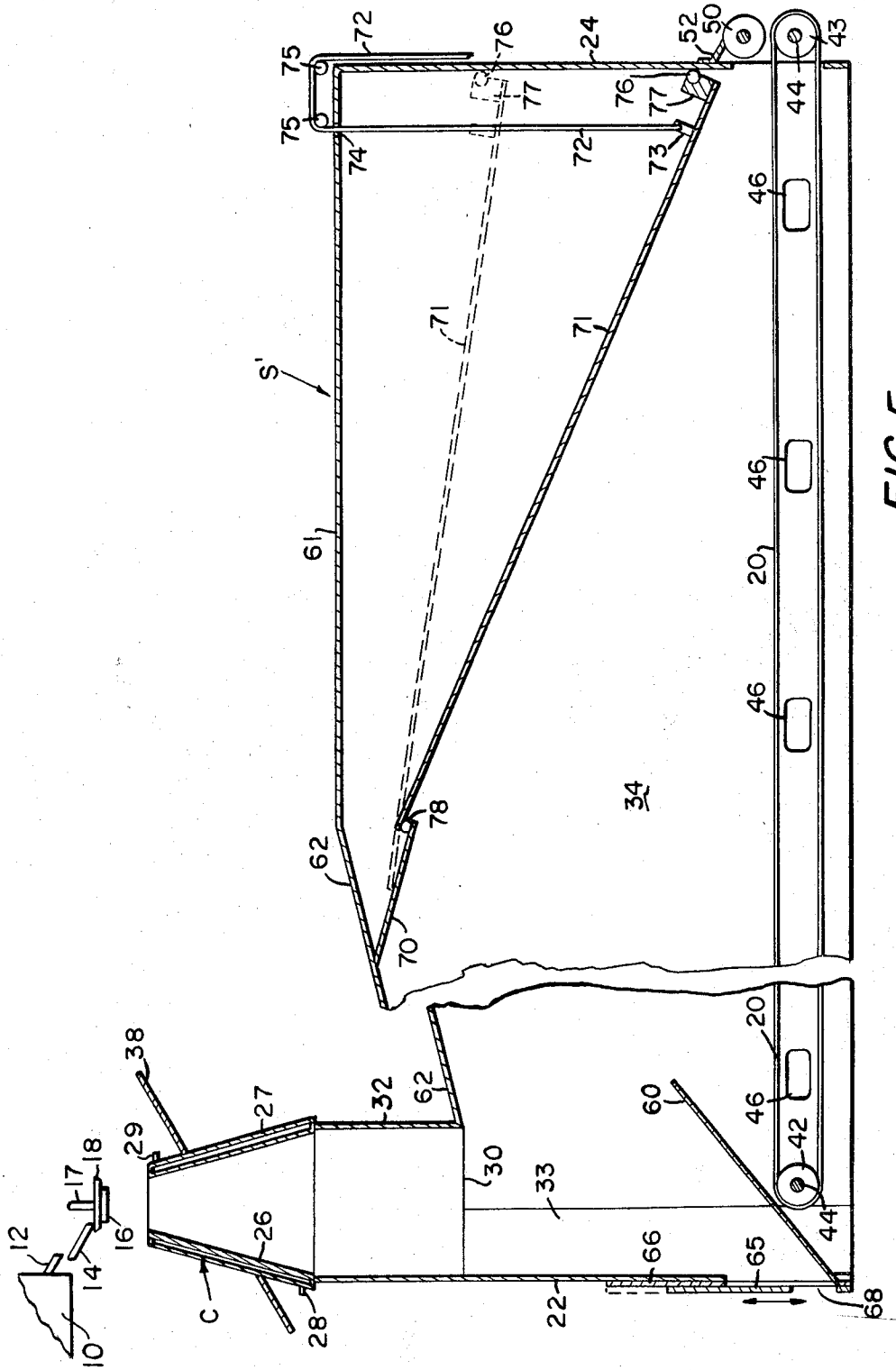

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FIG. 5.

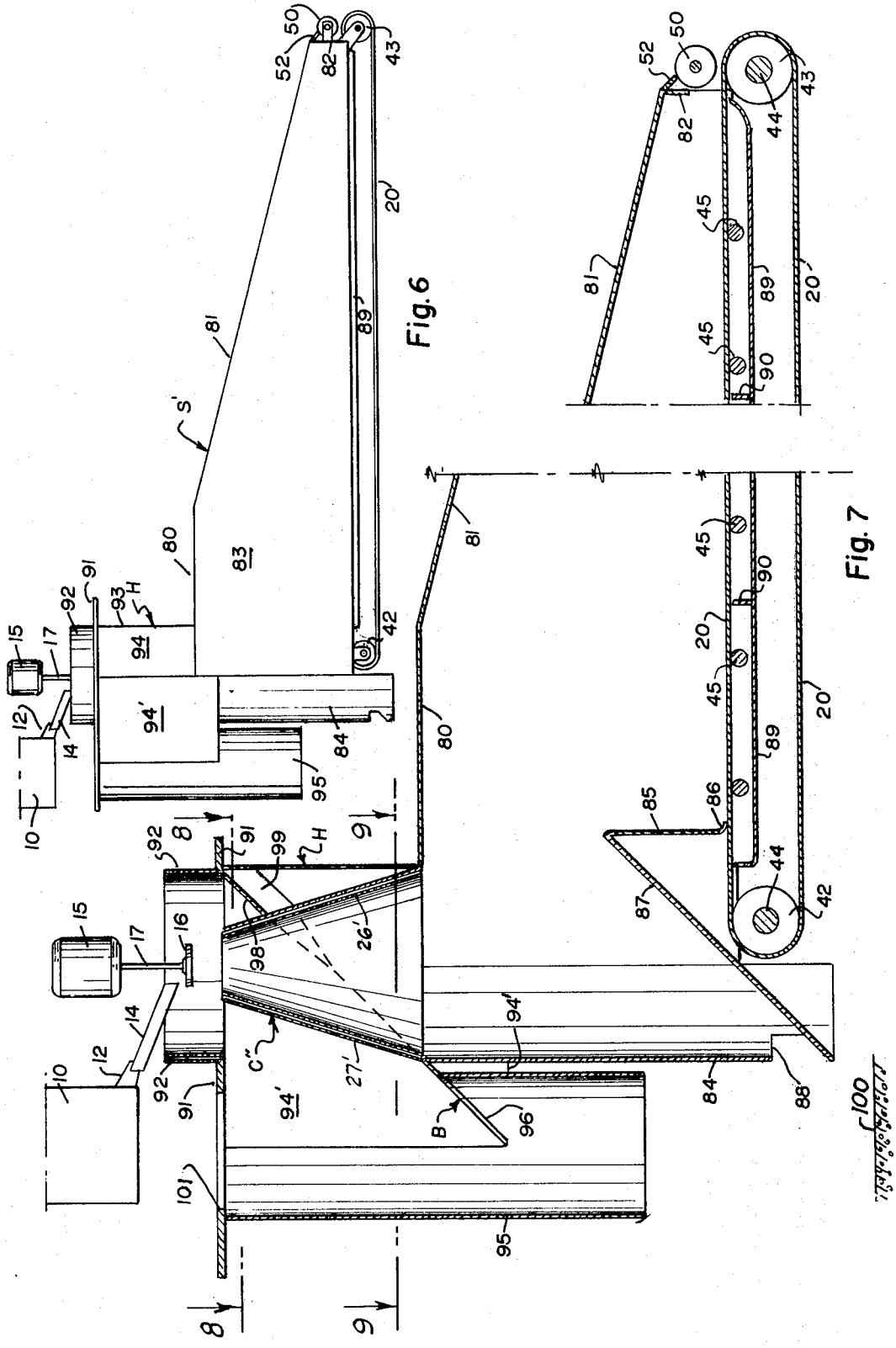
Fig. 6
Fig. 7
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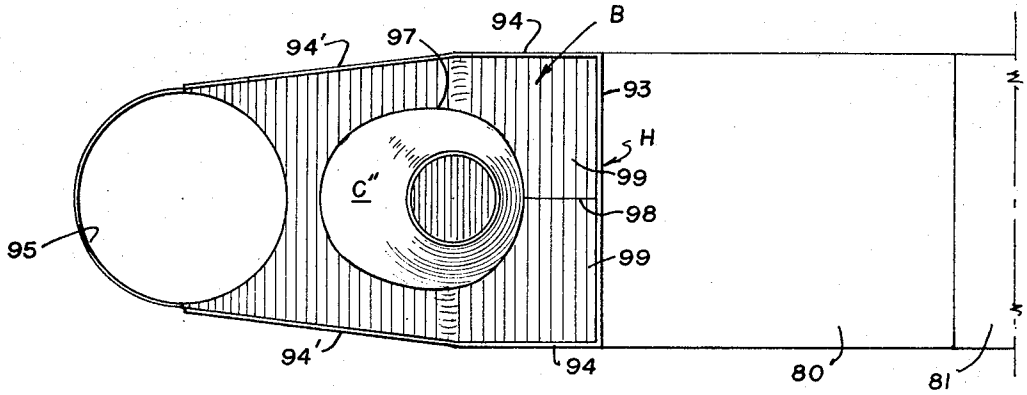

Fig 8

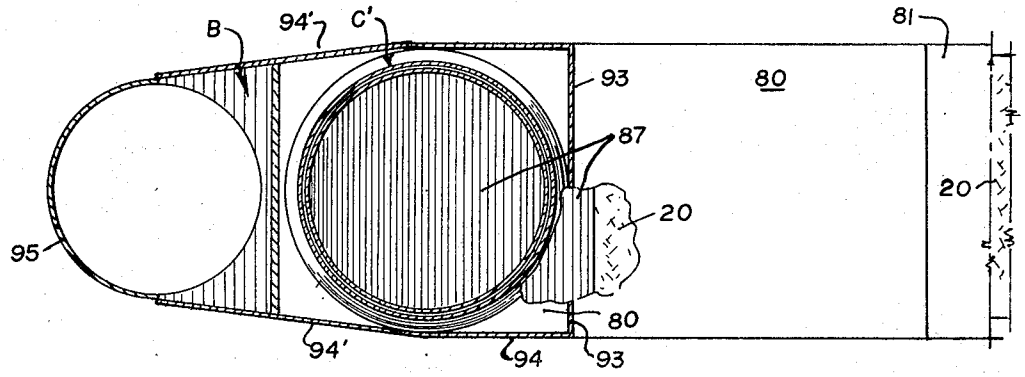

Fig. 9

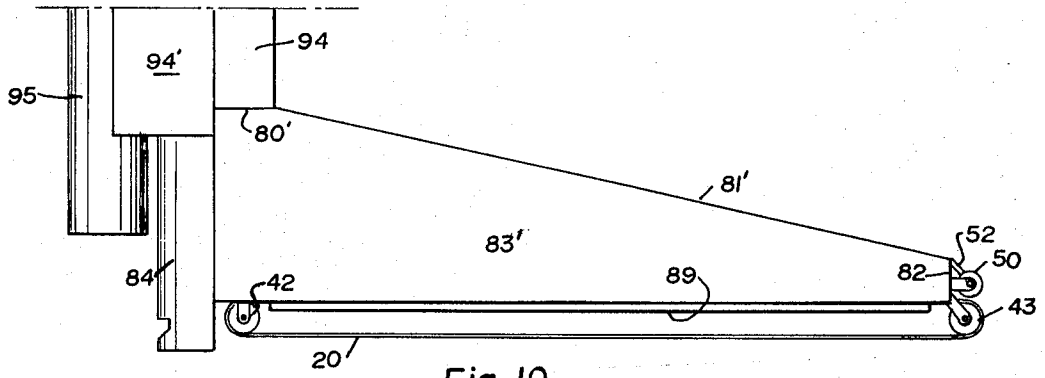

Fig. 10

APPARATUS FOR PRODUCING FIBER MATS OF MINERAL FIBER

This application is a continuation of the copending application of Joseph Corsentino, deceased, Ser. No. 880,160, filed Nov. 26, 1969, in turn a continuation-in-part of the application of Joseph Corsentino, Ser. No. 496,987, filed Oct. 19, 1965 both now abandoned.

This invention relates to a method of and apparatus for the production of attenuated fibers from molten material, such as molten slag, from which is made an insulating material known as rock wool, or glass, from which is made fiberglass, also an insulating material.

This invention is an improvement upon the method and apparatus of the Drill and Davis U. S. Pat. No. 2,328,714. As disclosed therein, a vertical shaft is mounted above a blow chamber, while a head or spinning wheel, which may be saucer shaped and onto which a stream of molten slag is discharged from a trough leading from a cupola, is mounted on the lower end of the shaft. A steam ring, from which an annular blast of steam is discharged against the material discharged by centrifugal force from the spinning wheel, is mounted in coaxial position, surrounding but spaced slightly from the upper edge of the spinning wheel, to produce attenuated fibers moving downwardly. The spinning wheel and steam ring are positioned at the upper end and centrally of an upright sheet metal cylinder forming part of the blow chamber, through which the fibers move downwardly and directly onto an apertured conveyor for deposition and retention thereon, through a suction effect exerted by exhaust fans connected to the space between the upper and lower reaches of the conveyor. In addition, shot or slugs produced, being heavier than the fibers, are intended to move outwardly, through the lateral impetus provided by centrifugal force, over the top of the sheet metal cylinder, for collection in a trough surrounding the upper edge thereof. The method and apparatus of the aforesaid patent, now expired, exhibited a high degree of ingenuity but unfortunately did not prove satisfactory for commercial operation, having been operated for a short period of time and then abandoned, due to difficulties in achieving an even layer of fibers on the belt, an undue amount of shot and slug entrained in the fibers, inability to apply a binder to the fibers when making so-called batts and inability to control the operation adequately. Thus, a principal object of this invention is to overcome the difficulties encountered with the above described Drill and Davis apparatus and thereby provide a commercially satisfactory method and apparatus for the production of fibrous material, particularly rock wool and the like.

Other objects of this invention are to provide a novel method and apparatus for the production of attenuated fibers from a molten slag or the like; to provide such a method and apparatus by which the amount of shot and slugs entrained in the fibers is reduced to a minimum in the final product; to provide such a method and apparatus by which an even deposition of fibers on a conveyor may be obtained; to provide such a method and apparatus by which the deposition of fibers on a conveyor may be controlled, as between the central portion and the outer edges of the conveyor; to provide such a method and apparatus by which a binder may be more uniformly and effectively distributed in the fibers;

and to provide such a method and apparatus which is effective and reliable in operation.

Additional objects and the novel features of this invention will become apparent from the following description, taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a side elevation, on a reduced scale, of a mineral fiber producing apparatus constructed in accordance with this invention and particularly adapted to carry out the method thereof;

FIG. 2 is a transverse vertical section, on an enlarged scale and taken along line 2—2 of FIG. 1;

FIG. 3 is a fragmentary, horizontal section, taken along line 3—3 of FIG. 2;

FIG. 4 is a fragmentary horizontal section, taken along line 4—4 of FIG. 2;

FIG. 5 is a condensed, longitudinal vertical section of the apparatus of FIG. 1, on an enlarged scale;

FIG. 6 is a side elevation, on a reduced scale, of an additional embodiment of a mineral fiber producing apparatus constructed in accordance with this invention and particularly adapted to carry out a modification of the method thereof;

FIG. 7 is a condensed, longitudinal vertical section of apparatus of FIG. 6;

FIG. 8 is a fragmentary horizontal section, on a slightly enlarged scale, taken along line 8—8 of FIG. 7;

FIG. 9 is a similar fragmentary horizontal section, taken along line 9—9 of FIG. 7; and

FIG. 10 is a fragmentary side elevation, corresponding to FIG. 6 but showing an alternative construction of a settling chamber.

As shown in the drawings, a cupola 10 or other conventional type of furnace is utilized to melt the slag or other material, the molten slag flowing from the notch of the cupola through a spout 12, from which the molten material is discharged into a trough 14, which directs the molten material against a rotating head 16, which may be saucer shaped, as indicated above, or may be constructed in the manner of my U. S. Pat. Re. 25,306, and is mounted at the lower end of a hollow shaft 17. A steam ring 18, which has a greater diameter than the head 16, is positioned adjacent and above the head and is provided with a series of orifices in the bottom, for directing an annular series of steam jets downwardly about the head 16. One or more conventional inlet pipes (not shown) are connected to the steam ring, for supplying steam or air thereto, which will be discharged from the orifices and against the material travelling outwardly from the rotating head under centrifugal force, thus effectively aiding in the conversion of the molten material to fibers. The fibers are also blown downwardly by the steam jets, while air is pulled downwardly, along with the steam jets. The steam ring may be constructed as shown in Re. 25, 306, while the head 16 may be watercooled through shaft 17 and supports for the shaft and steam ring may be provided in a manner similar to that disclosed therein. It is to be noted that the slag may vary in temperature at different times or for different charges to the cupola, but such variations are readily accommodated by movement of the inner end of trough 14, so as to direct the slag stream closer to shaft 17 for higher temperatures and further from the shaft for lower temperatures.

As the fibers move downwardly, a binder may be sprayed into them, as from a pair of spray devices D mounted at each side of the head or in any other suit-

able position or positions. A suitable spray device D is shown, described and claimed in a division of the aforesaid parent application Ser. No. 496,987 now abandoned, said division being Ser. No. 845,123, filed July 22, 1969, now U.S. Pat. No. 3,626,722. Such a binder may be a mineral oil or a resin product, together with suitable additives, to facilitate the compression and packaging of the fibers. Slugs, which are larger masses of unfiberized slag, and shot, which are normally small bead-like, solid particles much heavier than the fibers and possibly produced from the tail ends of insufficiently attenuated fibers but breaking off therefrom, will tend to fly outwardly from the head, but many will be deflected by the steam jets but still continue in a generally outward rather than a downward direction. However, others will be deflected downwardly by the steam jets.

To cooperate with other features of this invention, the downwardly travelling stream of fibers enters a cone C, installed atop the rear end of a settling chamber S, also referred to as a collection chamber, and in which the upper reach of a conveyor **20** travels from the rear or inlet end **22** toward the front or opposite end **24.** Cone C diverges at a suitable angle, such as approximately that shown, and may have a conical inner wall **26** and a conical outer wall **27,** spaced apart, so that a cooling medium, such as water, may be circulated between,as supplied by an inlet pipe **28** adjacent the lower edge and removed through an outlet pipe **29** adjacent the upper edge and opposite inlet pipe **28.** The opening at the upper end of cone C is, of course, larger in diameter than the head **16,** as shown, while cone C may be supported above a rear top wall **30** of the settling chamber by a sheet metal cylinder **32,** or may be connected directly with the top of the settling chamber. The central portion of rear end **22** of the chamber may conform in shape to sheet **32,** with lateral portions **33** formed as tangents thereto and extending to side walls **34** and **36** of the chamber, as in FIGS. **3** and **4.** The distance between the upper end of cone C and the lower edge of head **16** should be greater than the diameter of the head, such as slightly less than the diameter of the upper end of the cone. This distance should be adjusted carefully, so that substantially all of the fibers produced will enter cone C but as many slugs and shot as possible will fall outside the cone. Of course, this distance should also be sufficient to permit the binder to be sprayed by the devices D into the stream of downwardly travelling fibers.

As the stream of fibers moves downwardly to enter cone C, those slugs and shot which are not blown downwardly by the steam jets and therefore move outwardly, will impinge or fall upon a baffle **38,** which is inclined at a suitable angle to intersect cone C adjacent the lower end at the rear and adjacent the upper end at the front. The inclination of baffle **38,** such as shown, is sufficient to cause slug and shot falling thereon to slide downwardly along the baffle and to the rear, then fall to the rear of chamber S into collecting bins or cars, or onto a platform from which they may be removed at suitable intervals.

Conveyor **20** may be a conventional conveyor, such as a chain link conveyor or formed of transverse slats having a plurality of openings therein, passing at ooposite ends over sprockets **42** and **43,** which are mounted on shafts **44,** either or both being driven by a conventional motor (not shown). The upper reach of the conveyor is supported by a series of longitudinally spaced rollers **45,** as shown in FIG. **7,** journalled in conventional bearings (not shown) mounted in side walls **34** and **36** of chamber S or separately supported. A series of suction openings **46,** between the upper and lower reaches of the conveyor and in each side wall, are each connected by a pipe **47** with the inlet of a corresponding blower **48,** each of which discharges through a stack **49.** The suction produced beneath the upper reach of conveyor **20** pulls air through the apertures in the conveyor and pulls the mineral wool fibers, along with the air, against the conveyor. The fibers thereby form a mat or blanket on the upper reach of the conveyor, which increases in thickness as the conveyor moves along to the front end and is there compressed by a roller **50** turned by a shaft **51** and associated with a flap seal **52** on the upper side. Conveyor **20** is driven at a rate which is correlated with the amount of fibers settling thereon and the thickness of the blanket produced. A pair of angularly disposed strips **54** and **55,** as in FIG. **3,** may extend along each side wall **34** and **36,** with clearance for the conveyor, to prevent fibers from being sucked between the edge of the conveyor and the side wall and clogging that space.

In cooperation with other features of this invention, the fibers are now blown directly downwardly onto the conveyor, but are forced to turn sharply into the settling chamber, as by the restricted opening between the rear top wall **30** of chamber S and the upper edge of a baffle **60** which extends upwardly from the rear of chamber S and above the rear end of conveyor **20** to a point directly beneath or forwardly of the lower front edge of cylinder **32.** Baffle **60** extends the width of the settling chamber, while the slope of baffle **60** may be altered considerably, as well as its shape, the principal requirement being that it extend above the rear end of the conveyor and that it terminate below or forwardly of the position indicated. More than one baffle, or a combination of baffles, for achieving substantially the same purpose as baffle **60,** may be utilized. The distance between the front, upper end of baffle **60** and the rear top wall **30** may be adjusted in accordance with conditions, although a greater distance between the baffle and the rear top wall, and a lesser distance between the conveyor and the front, upper edge of baffle **60,** will normally be found to be desirable.

As will be evident, the action of the steam jets and particularly the suction of the blowers causes a mass of air to move downwardly with the fibers, as they enter the top of cone C. This air will expand slightly as it moves downwardly through the cone C, then expand further as the full width of the chamber is reached. As this air expands, it loses velocity, so that the fibers tend to float downwardly, or move downwardly at a lesser rate, in the rear end of the chamber. However, since the blowers are pulling air through the conveyor and out of the chamber, the air carrying the fibers moves to replace the exhausted air, turning to pass through what may be called a throat section, between the rear top wall **30** and the front, upper end of baffle **60,** increasing in velocity as it does so and then expanding in the chamber after passage through the space. This apparently produces two extremely important results. First, the fibers are more evenly distributed longitudinally of the chamber, due to the longitudinal impetus given to the air carrying the fibers as it moves through the throat section and the upward impetus given by baffle **60.** Sec-

ond, slugs and shot which have been driven downwardly by the steam jets, being much more difficult to carry by air currents, continue to drop and fall onto the lower, inclined baffle **60**, from which they may be removed periodically. Thus, the fibers are placed on the conveyor, not only in a more uniform distribution but also in a cleaner condition. As will be evident, as nearly uniform deposition as possible, both longitudinally and laterally of the conveyor, is highly desirable. For instance, if all of the fibers proceeded directly onto the rear end of the conveyor, they would tend to be concentrated in the center of the conveyor and also to fall in batches or mounds, with little possibility of filling thin spots, even though the suction effect through thinner spots, further along the conveyor, would be greater than over thicker areas. Too great a supply of fibers at any longitudinal or lateral position tends to cause an undue thickness of the blanket at that position, with little chance for correction. A uniform longitudinal distribution of the fibers also enhances lateral uniformity, since what is desired is a chamber full of fibers, settling at a uniform rate everywhere; thus, an undersupply of fibers at one longitudinal position means that there are not enough fibers to spread laterally. Furthermore, an unexpected discovery was made which assists materially in achieving uniform lateral distribution. It was found that, for any given set of conditions, when the upper end of baffle **60** was lowered, away from wall **30**, the deposition of fibers toward the sides of the conveyor increased, while when the upper end of baffle **60** was raised, toward wall **30**, the deposition of fibers on the central portion of the conveyor increased. As will be evident, in the event the deposition of fibers laterally of the conveyor is not as uniform as desired, this condition is readily corrected by upward or downward adjustment, as the case may be, of the upper edge of baffle **60**.

As in FIGS. **1** and **5**, the settling chamber S has a horizontal top wall **61** which extends rearwardly from front wall **24** to approximately the center of the settling chamber, there merging with a rearwardly inclined, top wall **62** which, in turn, merges at the rear with the rear horizontal top wall **30**, having a length corresponding to the diameter of cylinder **32**. The inlet end **22** of the settling chamber is provided with an air gate **65**, movable upwardly and downwardly on a support **66**, for a purpose described later. The mass of fibers, which are blown downwardly through cone C and through cylinder **32**, expand below cylinder **32** both laterally and fowardly, and are also changed sharply in direction to move forwardly in the settling chamber S. Since the suction fans pulling air through openings **46** will normally remove a considerably greater amount of air than can enter through the top of cone C, air gate **65** is adjusted upwardly, from the closed position shown in FIG. **1**, to an open position, such as shown in FIG. **5**, to provide an opening **68**, it being noted that air gate **65** can, if desired, be moved upwardly to the dotted position of FIG. **5**. The amount of air admitted by gate **65** is adjustable to compensate for the air removed through suction openings **46** and not supplied through the upper end of cone C. The air which is admitted through the opening **68** impinges against baffle **60** and assists in carrying the fibers into the settling chamber, so that an adequate deposition of fibers or blanket can be formed at the front end of the settling chamber, or at any intermediate point, as well as at the rear end of the settling chamber. The opening **68**, may, of course, be adjusted so that the amount of air coming into the settling chamber will equal the amount removed from the settling chamber, but the velocity of the air passing through opening **68** should be insufficient to carry slugs or shot onto the conveyor. As indicated, the slugs and shot tend to separate from the fibers, as the fibers turn to enter the settling chamber, so that the slugs and shot will fall onto inclined baffle **60** for later removal, as through opening **68**. The inclined top wall **62** also provides an increasing cross sectional area of the settling chamber, so that the fibers may be carried further into the settling chamber, to provide a more even deposition of the fibers on the conveyor **20**. However, as air is removed through the suction openings **46**, there will be less air to carry the fibers, so that more of the fibers may tend to be deposited on the rear half of the conveyor, and the blanket of fibers will not build up on the conveyor uniformly from the rear end to the front end of the conveyor.

In further accordance with this invention, a false top **70** extends laterally across the conveyor beneath the front end of inclined top wall **62**, the false top **70** being inclined downwardly and forwardly, for a purpose described below. An adjustable baffle **71** extends from the false top **70** to the front wall **24** of the settling chamber and is moved upwardly and downwardly by one or more cables **72**, each of which is attached to the baffle **71**, as at a bracket **73**, and extends upwardly through a hole **74** in the top wall **61**, thence over a pair of pulleys **75** to a conventional winch (not shown), or any other suitable device for pulling in or letting out the cables. There may be a pair of cables **72**, such as one cable adjacent each side of baffle **71**, or three or more cables distributed across the width of the baffle. Through the cables **72**, the front end of adjustable baffle **71** may be moved upwardly or downwardly, such as between the full and dotted positions of FIG. **5**, in order to vary the cross sectional area of generally the front half of the settling chamber, so that a greater cross sectional area may be provided along the front half of the settling chamber, to provide a larger space for the air carrying the fibers, when the deposition of fibers is to be increased along the front half of the conveyor, or a smaller space, when the deposition of fibers is to be decreased. For sealing purposes, a transversely extending seal **76**, engaging the inside of front wall **24**, is carried by a transverse block **77** mounted on the front end of baffle **71**, while a transversely extending seal **78** may be mounted on the underside of baffle **71**, at the rear end, for engagement with a sliding on the false top **70** when the position of the baffle **71** is changed. A similar seal, or any other suitable type of seal, may be provided at each lateral edge of baffle **71**.

The position of baffle **71** may be adjusted in accordance with an increase or decrease of the amount of fibers produced, which will vary in accordance with the production rate of molten material by the cupola. Of course, the amount of air removed from the settling chamber by the various blowers connected to the suction openings **46** may be varied in accordance with such cupola production rate, while the adjustment of air gate **65** should be correlated with the adjustment of the air removal rates of the blowers. As will be evident, the expansion and sharp turn of the air carrying the fibers will tend to separate out slugs and shot which will fall onto baffle **60**, since a throat section is provided be-

tween the upper edge of lower baffle **60** and the front end of top wall **30.** Also, the position of baffle **71** may be adjusted upwardly or downwardly, not only in accordance with the variations in the cupola production rate, but also to accomodate differences in the floating tendency of the fibers produced by variations in the charges to the cupola. As will be evident, when a uniform build-up of the blanket of fibers on the conveyor is obtained, there will be little tendency for thicker or thinner spots or areas to be produced, and the ultimate product will thus be much more uniform.

As shown in FIG. **5,** the maximum angle between the baffle **71** and the top of the conveyor is approximately 20°, with this angle decreasing as the front of the baffle is moved upwardly, while the angle between false top **70** and the top of the conveyor, as shown, is less than 20°. As will be evident, the settling chamber S may be constructed to have a top corresonding in contour to the inclined top wall **62,** i.e., between the front edge of cylinder **64** and the rear edge of false top **70,** as well as the false top **70** and the baffle **71.** Also, the top of the settling chamber may be inclined in a straight line, downwardly and forwardly from the lower front edge of cylinder **32** to a position just above the discharge opening, corresponding to the front edge of baffle **71** at the position shown in full. Thus, the entire top of the settling chamber will slope downwardly and forwardly, as at an angle of approximately 10° to the top of the conveyor. In this instance, the front edge of baffle **60** should be disposed forwardly of the front edge of the opening leading from cone C. It will be noted that, in FIG. **5,** a majority of the length of the effective top of the settling chamber, including the false top **70** and baffle **71,** slopes downwardly at an angle of 20° or less to the top reach of the conveyor. It will further be noted that, as shown in FIG. **5,** the settling chamber is elongated with the ratio between the distance from the front edge of baffle **60** to the front end of the chamber and the distance from the conveyor upwardly to the maximum height inside the settling chamber, i.e., at the rear edge of false top **70,** preferably being in excess of 3.0.

The spray devices D, as in FIG. **2** and as indicated previously, are adapted to produce finely divided droplets or a mist of a suitable binder, normally initially in liquid form, with sufficient velocity to penetrate the stream of fibers. The spray devices D are conveniently placed at each side of the head **16,** at approximately the same level, to direct the high velocity mist into the travelling stream of fibers, the particles or droplets of the mist being sufficiently small to coat the fibers more evenly and the mist having sufficient velocity to penetrate the fiber stream. The high velocity fiber mist is directed angularly to the axis of shaft **17,** such as about 30°, so that the mist will clear the head but will penetrate and mingle with the fibers as they travel downwardly. In accordance with the invention of said divisional application Ser. No. 845,123, the liquid binder is first formed into a mist by a jet of steam and is then picked up by an additional jet or jets to insure that the mist has an adequate velocity. These additional steam jets preferably surround the subdividing jet, although other patterns might be utilized, while it may be found, in certain instances, that compressed air may be substituted for steam. Each of the spray devices D is similar in construction, a preferred form being shown in said divisional application Ser. No. 845,123.

In the apparatus of FIGS. **7–9,** a cone C′ is greater in height than cone C of FIGS. **1** and **5,** so that the base of cone C′ has a diameter corresponding to the width of a settling chamber S′ which has a top wall having a shorter horizontal portion **80** and a much longer forwardly and downwardly slanting portion **81,** together with a short, depending front wall **82** spaced from conveyor **20** and upright side walls **83.**The cone C′ is double walled, having an inner wall **26′** and an outer wall **27′**, so that a coolant may be circulated therethrough, as in the manner described previously, while the horizontal portion **80** of the top wall of the settling chamber surrounds the front half of the base of the cone C′, as in FIG. **9.** The upright rear wall **84** of the settling chamber is semicircular in shape, corresponding to the base of cone C′, and is connected at its front edges to the respective side walls **83,** the upper edges of which correspond in contour to the top wall portions **80** and **81.** The top reach of a conveyor **20** closes the bottom of the chamber between front wall **82** and an upright transverse partition **85** provided with a seal **86,** as of rubber or the like, which engages the upper reach of the conveyor **20** across the width thereof, while partition **85** extends downwardly from the front upper edge of an inclined baffle **87** which extends upwardly above the rear end of conveyor **20** to a point beneath and preferaby forwardly of the base of cone C′. Baffle **87** operates similarly to baffle **60,** to collect slugs and shot separated from the fibers and permit the same to slide rearwardly to a discharge opening **88** at the base of rear wall **84.** If desired, the entire top **81′** of the settling chamber may slant downwardly from the lower front edge of the cone, as shown in FIG. **10.** When the alternative top wall **81′** is utilized, a horizontal top wall **80′**, corresponding to that portion of top wall **80** rearwardly of the rear edge of top wall **81′** and surrounding the front half of the base of cone C′, is retained. The alternative construction of FIG. **10** may be otherwise similar to the construction of FIGS. **7–9,** except that the top of side walls **83′** correspond to the top wall **81′**, forwardly of the cone C′.

In accordance with this invention, the angle between the slanting top wall of the chamber and the upper reach of the conveyor **20** is again 20° or less, the angle for wall **81** being between 10° and 15° and the angle for alternative top wall **81′** of FIG. **10** being approximately 10°. Also, the ratio of the distance between the front end of baffle **87** and front wall **82,** i.e., the length of the area of the conveyor on which fibers are deposited, and the maximum height along this length, i.e., from the top reach of conveyor **20** to the top of the chamber, i.e., to top wall portion **80** or approximately the rear edge of top wall **81′**, is again preferably greater than 3.0, such as approximately 3.6 to 3.7.

Conveyor **20** is, as before, of conventional construction, such as formed of chain links or of transverse slats, having a plurality of openings therein, passing at opposite ends over sprockets **42** and **43,** which are mounted on shafts **44,** either or both being driven. The upper reach of the conveyor may be supported by a series of longitudinally spaced rollers **45,** as described previously. Air is drawn through the conveyor by one or more suction fans which are connected to the space between the underside of the upper reach of the conveyor and a plenum **89,** with one or more partitions **90** separating the spaces for the suction fans, the latter of which are similar to those previously described. As be-

fore, a roller **50** engages the mat or blanket on the upper reach of the conveyor and is associated with a flap seal **52** on the upper side. The settling chamber S', forwardly of the rear wall **84**, is preferably mounted above a concrete floor or the like, so that the lower reach of the conveyor **20** is exposed beneath the settling chamber, to facilitate maintenance of the conveyor.

The molten slag is produced by a cupola **10** having a discharge spout **12**, from which the molten slag is conveyed by a trough **14** onto a rotating head **16**, which is preferably constructed as described previously, being rotated by a shaft **17** driven by a motor **15**. A steam ring and binder spraying devices are associated with the head **16** and operate in the manner previously described, being omitted from FIGS. **6** and **7** for clarity of illustration. Previously, it had been thought necessary to place the operating platform above the level of the head **16**, so that chunks of molten slag thrown accidentally off by the head would be thrown off beneath the operating platform. However, it is more convenient for the operating platform **91** to be below the level of the head **16**, so that the operator is able to more easily reach the spout **12** and trough **14**, as well as the head **16** and the steam ring, to remove any slag solidified thereon as a result of spattering. For a dual purpose, including protection of the operator, an upright ring **92**, which may be double walled, as shown, so that a coolant may be circulated therethrough, and having a suitable height, to extend above head **16**, is mounted in a circular opening of corresponding size in the platform **91**. The additional function of ring **92** is to restrict the direction in which air may be sucked into the cone, either by the steam jets or by the suction in the settling chamber, requiring substantially all of this air to be sucked down from above, thus producing a more uniform distribution of the annular body of air entering the top of cone C', which is located centrally of ring **92** and the upper edge of which is approximately level with the platform **91** and the lower edge of ring **92**.

Cone C' is mounted within a housing H having a front wall **93** and side walls **94**, each of which are vertical and extend to a height corresponding to the top of the cone C', i.e., to the underside of the platform **91**. The side walls of housing H, as in FIG. **9**, are directly above the side walls **83** of the settling chamber, rearwardly to the vertical centerline of cone C', but then slant inwardly but remain vertical as portions **94'**, to approximately the center of an upright, cylindrical waste tube **95**. The side wall portions **94'** extend downwardly below the upper edge of the settling chamber, as in FIG. **7**, for a purpose described below.

An inclined baffle B is installed in housing H and extends around the cone C' to waste tube **95**, to cause slugs and shot thrown from the head **16** and impinging against ring **92** or otherwise falling downwardly outside the cone, to slide down the baffle and into waste tube **95**. Solidified chunks of slag removed from the steam ring, or from the chute or trough, also are dropped onto the baffle B and slide down into the waste tube. The rear half of waste tube **95** extends upwardly to the underside of platform **91**, while the front half of the waste tube extends upwardly to a notch **96** to which baffle B is welded, the baffle B being provided with an elliptical cutout to correspond to the contour of notch **96**. The baffle B is also provided with an elliptical hole **97** corresponding to the contour of the intersection between the baffle and the cone C'. The major portion of baffle B is slanted rearwardly at a suitable angle, such as 45°, but the upper end of the baffle has a greater slant, since slugs, shot and the like dropping on the upper portion of the baffle do not fall as far and therefore have less velocity due to falling. Thus, the greater slant of the upper end of the baffle tends to insure that anything falling thereon will slide downwardly into the waste tube **95**. For this purpose, a ridge **98** having a higher elevation than a projection of the lower portion of the baffle, as in FIG. **7**, is provided. Ridge **98** is flanked on each side by a dihedral surface **99** which is inclined with respect to the horizontal at an angle greater than 45°, with the dihedral surfaces **99** merging into the remainder of the baffle, at each side of the cone C', as indicated by the shading in FIG. **8**. The upper, front edges of the baffle B are welded to the inside of front wall **93** of housing H, with the side edges of dihedral surfaces **99** being welded to the inside of side walls **94** of the housing, and the remainder of the side edges of the baffle being welded to the inside of the side wall portions **94'** of the housing. The lower edges of the side wall portions **94'** of the housing H extend downwardly to the lower end of notch **96**, to close the space at each side of the baffle.

An apron **100**, as of concrete, may be installed beneath the waste tube **95**, so that material sliding down baffle B and through waste tube **95**, as well as material sliding downwardly along interior baffle **87**, will collect on the apron, for removal. Water jets may be arranged to cool this material, particularly prior to removal. The apron is also preferably disposed below the lower end of interior baffle **87**, so that a reasonable amount of material may collect on the apron without plugging the discharge hole **88**, through which some air is sucked into the settling chamber S'. The waste tube **95** may also be positioned directly beneath the cupola **10** and a hole **101** provided in platform **91**, so that when necessary to do so, the material in the cupola may be discharged through the waste tube onto the apron, described above, merely by opening the bottom doors of the cupola.

As before, the mass of fibers directed downwardly by the steam jets, along with air sucked into the top of the cone C', will travel downwardly in the cone and expand both laterally and longitudinally, moving downwardly into the rear end of the settling chamber S'. Due to the annular distribution of the air sucked into the cone, occasioned by the ring **92**, the expansion of the air and fibers in the cone will be more uniform. When the mass of fibers and air enters the rear end of the settling chamber, it will be turned from a vertical to a generally horizontal direction by passage through the throat section between the top of baffle **87** and the underside of top wall portion **80** of FIG. **7** or **81'** of FIG. **10**. As air is progressively sucked through the conveyor, there will be less and less volume of air to carry the fibers, which will also decrease in number, due to settling on the conveyor as the mass moves longitudinally and forwardly in the settling chamber. However, the downward inclination of the top wall of the chamber, either for a major portion thereof or for substantially the entire chamber from a point directly above the upper edge of baffle **87**, will cause the fibers to be more uniformly deposited on the conveyor, both laterally and longitudinally. As before, the position of the upper end of baffle **87** may be adjusted to insure a more uniform deposition of the fi-

bers, laterally of the conveyor. The semi-cylindrical rear wall **84** of the chamber also assists in causing the fibers to be more uniformly distributed in the mass of air, as they move forwardly through the throat section. The small acute angle between the upper reach of the conveyor and the downwardly and forwardly slanting top wall of the settling chamber, which angle should not exceed 20° and may be less than 20°, together with the length of the conveyor area on which the fibers are deposited, in proportion to the maximum height of the chamber above the area of the conveyor on which fibers are deposited, the ratio of which should exceed 3.0 and preferably is considerably greater than 3.0, are also each of considerable importance in insuring an even distribution of fibers, particularly longitudinally of the conveyor.

As will be evident, the method and apparatus of this invention fulfill to a marked degree the objects and requirements set forth hereinabove. The use of a cone and the rear end of a settling chamber to provide an expansion of air as the stream of fibers moves downwardly, together with a throat section at the entrance to the area of the conveyor on which fibers are deposited, overcome difficulties in the prior apparatus referred to above. By producing an abrupt turn of the air carrying the fibers, as well as an upward impetus thereto, the fibers are carried upwardly and further longitudinally in the settling chamber. Also, the use of an elongated settling chamber and a forward and downward inclination of at least a major portion of the top of the settling chamber produces a more uniform distribution of the fibers on the conveyor. The cone also assists in the separation of shot and slugs from the fibers, while the decrease of velocity in the rear of the settling chamber, coupled with the sharp turn of the air, assists materially in the removal of shot and slugs which may have been driven downwardly with the fibers by the steam jets surrounding the head. The use of a preferably water cooled ring surrounding but spaced from the head not only protects the operator and renders the parts to which he must pay attention more accessible, but also produces a more uniform distribution of air sucked into the top of the cone. Thus, an economically satisfactory commercial operation results.

Although several embodiments of this invention have been described and illustrated and certain variations therein described, it will be evident that other embodiments may exist and that other changes may be made, all without departing from the spirit and scope of this invention.

What is claimed is:

1. Apparatus for producing mineral wool fibers and the like, comprising:

a longitudinally elongated settling chamber having in the lower portion thereof foraminous, horizontally disposed conveying means for receiving fibers thereon and moving said fibers from at least adjacent the rear end to the front end of said chamber and means for removing air downwardly through substantially the entire length of said conveying means;

fiber producing means disposed above the rear end of said chamber and including means for blowing said fibers downwardly into said chamber;

a passage through which said fibers pass downwardly into the rear end of said chamber;

means for producing a turning movement of the air carrying said fibers as said fibers move from the rear end of said chamber, so as to cause slugs, shot and the like to continue to move downwardly while said fibers are moved forwardly in said chamber;

at least the major portion of the top of said chamber, above said conveying means through which air is removed downwardly, is inclined downwardly toward the front end of said chamber at an acute angle of between 10° and 20° with respect to said conveying means; and

the length of said settling chamber, forwardly of said turning means, is at least three times its maximum height above said conveying means.

2. Apparatus as defined in claim **1** wherein:

said fiber producing means disposed above the rear end of includes a head rotating about a generally vertical axis for receiving molten material and discharging material laterally by centrifugal force and means for directing a gaseous fluid downwardly past said head for blowing said fibers downwardly into said chamber;

a restricted, generally conical, downwardly flaring passage having an open upper end is said fiber producing means but above the rear end of said chamber and through which fibers move in passing downwardly to the rear end of said chamber;

an operating platform is disposed adjacent the upper end of said passage but below said head; and

an upright ring larger than the upper end of said passage is mounted on said platform to surround said head in spaced relation thereto and to extend both above and below said head, so as to intercept material thrown outwardly from said head and also to affect the flow of air into the upper end of said passage, said platform having an opening corresponding to said ring.

3. Apparatus as defined in claim **1**, wherein:

the top of said chamber, forwardly of said passage, extends upwardly and then downwardly to the front end thereof.

4. Apparatus as defined in claim **1**, wherein:

the top of said chamber, forwardly of said passage, extends generally parallel to said conveying means and then downwardly to the front end of said chamber.

5. Apparatus as defined in claim **1**, wherein:

the top of said chamber, forwardly of said passage, extends substantially continuously downwardly to the front end of said chamber.

6. Apparatus as defined in claim **1**, wherein:

said passage includes an inverted cone having a base diameter approximately the width of said chamber.

7. Apparatus as defined in claim **1**, wherein:

said passage includes an inverted cone;

a housing generally encloses the outside of said cone; and

a baffle extends downwardly and rearwardly on the outside of said cone, the upper end of said baffle having a generally central ridge extending upwardly from said cone and a dihedral surface on either side of said ridge inclined at a greater angle to the horizontal than the remainder of said baffle.

8. Apparatus as defined in claim **7**, wherein:

a cupola for producing molten material for said fiber producing means is disposed rearwardly thereof; and

an upright waste tube is disposed below said cupola, said waste tube having an opening in one side and said baffle being connected to the lower edge of said opening, so that material sliding down said baffle will slide into said waste tube.

9. Apparatus as defined in claim **1**, including:

a baffle at the lower rear end of said chamber extending upwardly and forwardly and over the rear end of said conveying means, said chamber being unrestricted above said baffle.

10. Apparatus as defined in claim **9**, including:

an upright partition extending downwardly from the front upper edge of said baffle; and

flexible sealing means between the lower end of said partition and said conveying means.

11. Apparatus as defined in claim **1**, wherein:

said means for producing a turning movement of the air carrying said fibers as said fibers move from the rear end of said chamber includes a throat section in said chamber of restricted cross sectional area in comparison with the cross sectional area of said chamber for at least a substantial distance forwardly thereof, so as to cause slugs, shot and the like to continue to move downwardly while said fibers are moved forwardly in said chamber; and

said throat section is provided between the top of said chamber adjacent the forward edge of said passage and a baffle, in the lower rear end of said chamber, extending upwardly and forwardly and over the rear end of said conveying means.

12. Apparatus as defined in claim **1**, including:

a downwardly extending baffle disposed in the front portion of said chamber; and

means for adjusting the angular position of said baffle.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,773,485 Dated November 20, 1973

Inventor(s) Joseph Corsentino, deceased

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Claim 2, column 12, lines 16 and 17, "disposed above the rear end of" should be cancelled; line 24, after "is", --below-- should be inserted.

Signed and sealed this 16th day of April 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

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