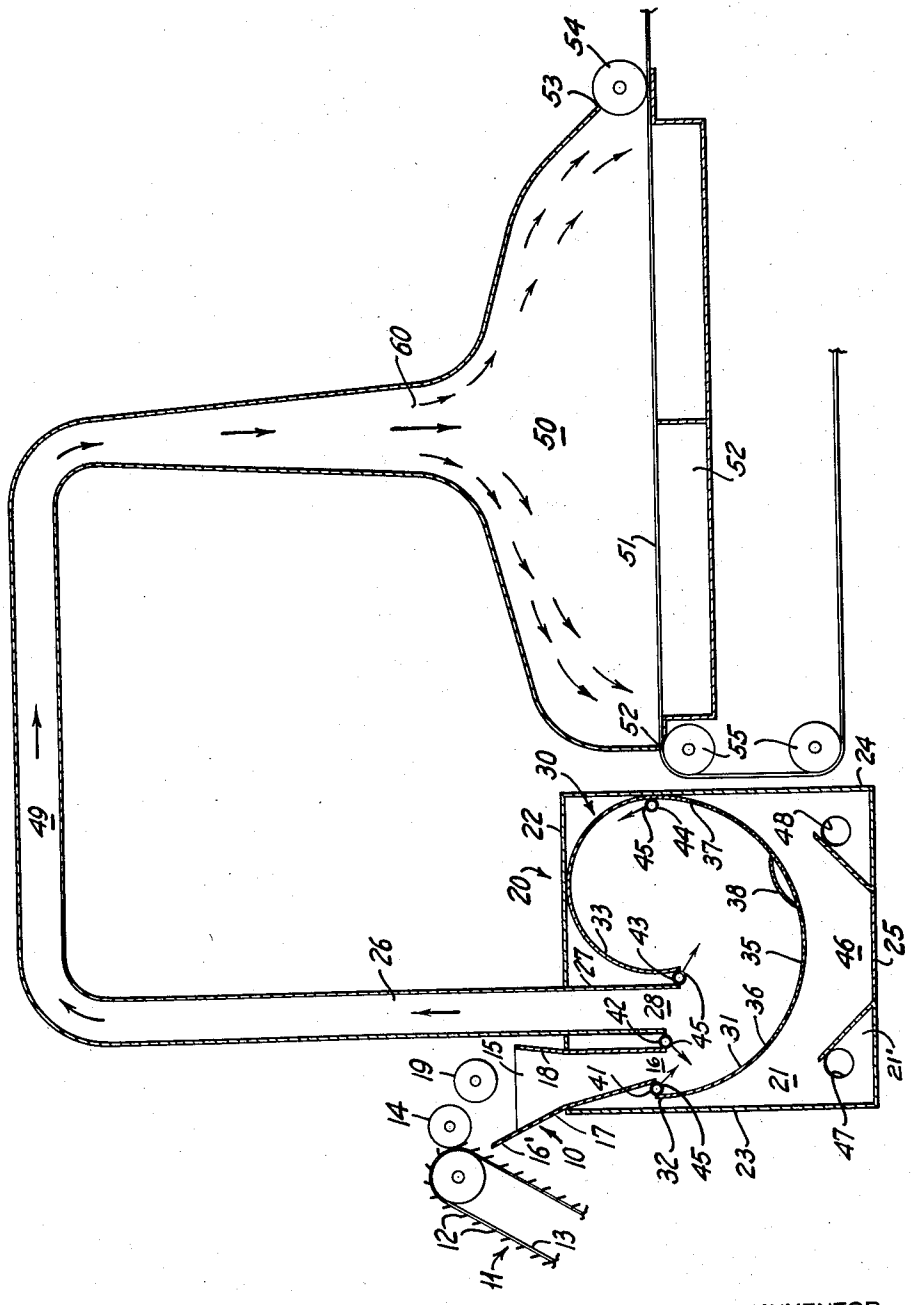
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FIBER OPENER AND CLEANER

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FIBER OPENER AND CLEANER

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The instant invention relates to a process and apparatus for opening, cleaning and felting of any fragile fibrous material and is particularly directed to a process or apparatus applicable to brittle mineral wool fibers. However, other materials such as asbestos, which normally is in the form of asbestos bundles prior to the opening or exfoliating thereof, staple glass, conventional textile fibers, and other similar fibers are intended to fall within the scope of the invention.

In the normal operating procedures, mineral wool is formed by any conventional fiberization system and carried in an air suspension into a collection chamber where it settles onto a conveyor to form a fibrous felt. The fibrous felt thus formed is then conveyed to appropriate locations for such finishing operations as being converted into batts, blankets or nodules or packaged as loose wool. The fibrous felts, formed as above, have a serious inherent disadvantage in that a considerable quantity of unfiberized particles, such as shot, dust and the like, become intermixed in the fibrous felt and are carried into the final product. Numerous attempts have been made to remove or reduce the quantity of unfiberized particles in the fibrous felt, but in general, these attempts have not been greatly successful. Also, where mineral wool felts are involved, they cannot be subjected to relatively rough treatment since, because of the brittleness of the fiber, rough treatment would cause the mineral wool fibers to be broken or destroyed.

It is a primary object of this invention to provide a method and apparatus for the opening, cleaning and felting of fragile fibers to eliminate or greatly reduce the unfiberized particles present in the final fibrous material.

It is a further object of this invention to provide a method and apparatus for the opening, cleaning and felting of fibrous material so that a uniform felt of a more homogeneous nature is produced.

It is another object of this invention to provide a method and apparatus for the opening, cleaning and felting of fibrous material so that the final fibrous felt has an internal laminar structure.

The foregoing objects are attained by the method and apparatus of the instant invention, wherein the fibrous material to be opened, cleaned and felted is subjected to a completely pneumatic opening and cleaning action. The fibers are introduced into a spiral type opening and cleaning unit wherein a plurality of air jets act on the fibrous material. The air jets are so arranged to direct the fibrous material around the spiral interior of the unit to separate the fibrous material into opened and cleaned fibers and unopened fibrous clumps and to return the unopened fibrous clumps back into the system for further opening and cleaning. The opened and cleaned fibers pass in an aeriform suspension into a collection chamber, wherein they are deposited on a conveyor to form a homogeneous fibrous felt having an internal laminar structure. A portion of the spiral interior of the opening and cleaning unit is constructed of interchangeable screening so that various screens may be inserted for different degrees of shot removal and fiber cleaning depending upon the desired quality of the finished fibrous felt. Where a bonded product is desired, a binder, which may suitably be in a powdered form, is intermixed with the fibers at any convenient location up to the actual fiber collecting or felting so that the binder becomes thoroughly distributed in the felted layers.

The invention will be more fully understood and further objects and advantages thereof will become apparent when reference is made to the more detailed explanation which is to follow and to the accompanying drawing in which the single FIGURE is a view partially in elevation and partially in section of an apparatus in accordance with the invention.

Referring now to the drawing, the opening and cleaning section of the apparatus includes a hopper 10 adapted to receive the fibrous material to be processed, such fibrous material including unfiberized particles such as shot, dirt and the like. The fibrous material is delivered to the hopper 10 by a conventional Bramwell feeder 11 in which the teeth 12 on the belt 13 pick up and loosen the fibrous material from a source (not shown). The fibrous material is removed from the feeder 11 by the brushing action of a roll 14 which is mounted directly above the inlet mouth 15 of the hopper 10. The fibrous material falls from the feeder 11 and roll 14 through the mouth 15 into the hopper 10. An extension lip 16′ extends from the hopper 10 to a position directly below the roll 14 so that all the fibrous material will be directed into the hopper 10. The side walls 17 and 18 of the hopper 10 relatively converge from the inlet mouth 15 to form an outlet 16 reduced in area from the inlet 15. This arrangement of the feeder 11 and the hopper 10 assures that a constant flow of fibrous material will be supplied for the efficient operation of the apparatus. A small electromagnetic vibratory feeder 19, of a conventional type, is located above the inlet mouth 15 of the hopper so that a conventional dry binder may be introduced to the process when desired. The opening and cleaning unit indicated generally as 20 is enclosed in a housing 21 having end walls, as 21^1, a top wall 22, side walls 23 and 24 and bottom wall 25. The hopper 10 is mounted in the top wall 22 with the outlet 16 extending into the housing 21 while the inlet mouth 15 is located above the top wall 22. A vertical cylindrical transfer duct 26 passes through the top wall 22 and extends into the housing 21. The lower end 27 of the duct 26 terminates in an opening 28 which lies approximately in the same horizontal plane as the outlet 16. The duct 26 is adjacent but spaced from the hopper 10. A baffle 30 is secured in the housing 21 so that its inner surface 31 defines a spiral-like path. The baffle 30 opens transversely and ultimately upwardly of the housing 21 and extends for the full longitudinal dimension of the housing. The baffle 30 begins with a section 32 secured to the end walls 21^1 of the housing 21 adjacent the outlet 16 and moves at first toward the bottom wall 25 in a spiral path of decreasing radius. After 180° of travel the baffle 30 contacts the side wall 24 and then continues onward to again contact the housing 21 at the top wall 22. The end section 33 of the baffle 30 marks approximately 360° of travel and is located adjacent the lower end 27 of the transfer duct 26. At various points, the baffle 30 is secured in position in the housing 21 by conventional mountings (not shown). If desired, the spiral-like path for the baffle 30 may be defined by two semi-circular sections of different radii joined to form a continuous, closed curve at one end and with their centers on a common center line.

Substantially the entire lower portion of the baffle 30 consists of a screen area 35 which begins at a point 36 about 45° removed from the initial section 32 and ends at a point 37 adjacent the point of contact of the baffle 30 with the side wall 24. The screen area 35 consists of a plurality of frames (not shown) to each of which is secured screening of various types and sizes. The frame screening is detachably secured in any conventional

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manner to the baffle 30 so that the size of the screening in the screen area 35 may be readily varied. The screen area 35 allows for the removal of the unfiberized particles, such as shot, dust or the like, from the opening and cleaning section with the various sized screens determining the degree of removal of the unfiberized particles and fiber loss. The description of the particular formation of the screened area 35 is given for illustration only since it may be formed in any desired manner. In each screen area 35, there is secured a fixed impervious impingement plate 38 for a purpose to be described later.

A plurality of fluid jets 41, 42, 43 and 44 are positioned at various locations inside the housing 21. Each jet consists of a hollow pipe having a longitudinal row of spaced orifices 45 having parallel axes and through which the fluid under pressure passes, so that there is a coalescence some distance from the orifices. Therefore, the square of the velocity of the resultant jet is equal to the sum of the squares of the velocities in the individual orifices. Each jet is rotatably mounted on fixed pivots in the housing 21 so that the direction of the force of the fluid issuing therefrom may be varied. In a preferred embodiment of the invention, the jets 41, 42, 43 and 44 were positioned so that the fluid discharged (air, in this preferred embodiment) was discharged in a direction as indicated by the arrows.

Jet 41 is rotatably mounted in the housing 21 and so positioned that the outer surface of the pipe is contiguous to the outer surface of the end of the side wall 17 of the hopper 10 adjacent the outlet 16 and also to the inner surface of the end section 32 of the baffle 30. Jet 41 imparts an initial velocity to the fibrous material entering the opening and cleaning unit 20 in a direction so that the fibrous material will have a tendency to follow the spiral path defined by the baffle 30.

Jet 42 is rotatably mounted in the housing 21 and so positioned that the outer surface of the pipe is contiguous to the outer surface of the side wall 18 of the hopper 10 adjacent the outlet 16 and also to the outer surface of the end 27 of the transfer duct 26 adjacent the opening 28. Jet 42 is positioned and directed so as to converge upon the fluid stream emanating from jet 41, so as to impart a fluid force in a direction to open the fibrous material entering the opening and cleaning unit 21 through the outlet 16 of the hopper 10. The fluid issuing from the jet 42 combines with the fluid issuing from the jet 41 to provide a controlled turbulence zone for the opening and cleaning of the fibrous material. The agitation in this zone opens the fibrous material, loosens the unfiberized particles therefrom, and separates the fibrous material into opened fibers and unopened fibrous clumps. The turbulence zone is created over the screen area 35 so that the unfiberized particles, such as shot, dust and the like, will fall by their weight out of the fluid stream onto and through the screen area 35. The opened fibers and the unopened fibrous clumps flow with the fluid stream in the direction defined by the generally spiral baffle 30.

Jet 44 is rotatably mounted in fixed pivots in the housing 21 so that the outer surface of the pipe is contiguous to the inner surface 31 of the baffle 30 at the point where the baffle 30 contacts the side wall 24. Jet 44 is positioned to impart an additional velocity to the opened fibers and unopened clumps so that they will continue in the generally spiral path defined by the baffle 30 toward the end section 33. The fibrous material reaching the end section 33 is of two distinct natures. The opened fibers are thoroughly opened, cleaned and hence lofty so that they retain no appreciable energy. These opened fibers are relatively in an aeriform suspension and ready to be conveyed by the volume air, to be described, to the collection chamber. The unopened clumps have sufficient mass so that with their stored energy or momentum, these clumps remain in motion. The end section 33 of the baffle 30 is so positioned to direct the unopened clumps back into the turbulent zone for further opening and cleaning.

Jet 43 is rotatably mounted in fixed pivots in the housing 21 so that the outer surface of the pipe is contiguous to the outer surface of the section 33 of the baffle 30 and also to the outer surface of the lower end 27 of the transfer duct 26. Jet 43 is positioned to impart a force on the unopened fibrous clumps to direct them toward the screen area 35. The force emanating from jet 43 is regulated so that the combination of this force and the momentum of the unopened clumps will be combined in a resultant force so that the unopened fibrous clumps will strike the impingement plate 38. As the unopened fibrous clumps strike the impingement plate 38, the fibers are opened to dislodge unfiberized particles therefrom. The unfiberized particles, such as shot, dust and the like, fall through the screen area 35.

In the bottom section of the opening and cleaning unit 20, there is located the shot sump 46. The unfiberized particles passing through the screen area 35 fall into the shot sump 46 and are removed therefrom by any conventional method. Two ducts 47 and 48 are secured in the housing 21 adjacent the bottom wall 25. These ducts 47 and 48 are connected to a source (not shown) of low pressure air. The ducts 47 and 48 have openings within the housing 21 and the air flowing out of these ducts constitutes the volume air previously mentioned for transferring the opened fibers to the collecting and felting area 50. The air from the ducts 47 and 48 flows through the screen area 35 where it dislodges any opened fibers that have been caught thereon. The volume air then carries the opened fibers in an air suspension up through the transfer duct 26. The opened fibers flow with the volume air through a transition section 49 and then downwardly to the felting area 50. The final section 60 of the transfer duct 26 is of much larger diameter than the initial section 27 so that the fibers falling into the felting area 50 will be at a velocity only a little greater than free fall.

The collecting or felting area 50 is of an inverted T-shape so designed to block off all turbulent areas and approach the predominant natural flow of the fibers. The fibers are collected on a wire mesh conveyor 51 which passes over the open areas of a two-zone suction box 52. The suction boxes and the felting areas are arranged so that a larger portion of the felting area is over the exit end of the conveyor. This arrangement allows the fines to be more evenly distributed throughout the finished felt. In normal circumstances the fines, being lighter than the fibers, would be unduly concentrated near the beginning of the first layer of the felt on the conveyor. The only openings in the felting area 50 are a small gasketed slot 52 for the entrance of the conveyor 51 and at the exit end 53, a floating seal roll 54 which is driven by a source (not shown) at the same surface speed as the conveyor 51 which is guided over a plurality of rolls 55 and driven by an appropriate conventional system, such as a Vicker transmission system (not shown). The cleaned fibers are deposited on the conveyor 51 under the influence of the suction in the box 52.

In the operation of the apparatus described above and in carrying out the method of the instant invention, the fibrous material is deposited into the hopper 10 from the feeder 11. As the fibrous material falls through the outlet 16 of the hopper 10, it is acted on by the fluid jets 41 and 42 which combine to form a turbulence zone for the opening and cleaning of the fibrous material. The pneumatic agitation in this area opens the fibrous material to loosen the unfiberized particles therefrom. Also, the fluid jets 41 and 42 impart a velocity to the opened fibrous material in a direction defined by the generally spiral baffle 30. The fibrous material which now consists of opened fibers and unopened fibrous clumps tends to flow in a generally spiral path guided by the baffle 30. The unfiberized particles, such as shot, dust and the like, fall

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through the screening in the screen area **35**. As the opened fibers and the unopened fibrous clumps reach the vertically directed portion of the baffle **30**, they tend to lose velocity. The fluid jet **44** imparts an additional force so that the opened fibers and the unopened fibrous clumps will continue in their generally spiral path. The unopened fibrous clumps travel relatively close to the baffle **30**. These clumps have an appreciable mass so that they have the ability to store energy or gain momentum and therefore to remain in motion. The end section **33** of the baffle **30** is positioned to direct these unopened fibrous clumps back into the turbulence zone for further opening and cleaning. Fluid jet **43** is positioned to impart an additional force to these unopened fibrous clumps. The unopened fibrous clumps, as a result of their own momentum and the force of the fluid jet **43**, strike the impingement plate **38** to open the fibers and loosen unfiberized particles therefrom. The opened and cleaned fibers are very lofty and have no appreciable weight or momentum and are in an aeriform suspension and in perfect condition to be transferred to the collection or felting area **50**.

Low pressure volume air is admitted to the opening and cleaning unit **20** through ducts **47** and **48**. The suction box **52** acting through the transfer duct **26** causes an air flow of the volume air up through the screen area **35**. The opened and cleaned fibers flow with the volume air up through the transfer duct **26** to the felting area **50**. The opened fibers in the felting area **50** fall onto the conveyor **51** to form a desired felt.

Various types of screens may be used in the shot separating screen area **35**, the type used being dependent upon the amount of shot and dust to be removed and the allowable fiber loss. Excellent results have been obtained with a screen of approximately ½ x ¾ inch diamond mesh expanded and flattened steel sheet. This large-opening sheet type screen provides a multiplicity of bars against which the fibrous material impinges in its travel through the apparatus. This additional action contributes to the opening and cleaning characteristics obtained.

Also, the directions of the fluid jets **41**, **42**, **43** and **44** may be varied depending upon the type of material being fed and the amount of opening and cleaning desired. For a particular type of mineral wool, jet **41** was positioned so that the fluid discharged therefrom flowed in a downward direction inclined approximately 30° from the vertical and away from the inner surface **31** of the baffle **30**. Jet **42** was positioned to discharge fluid in a direction perpendicular to that of jet **41** so that the fluid from jet **42** flowed across that of jet **41**. Jet **44** was positioned to be discharged in an upward direction inclined approximately 5° from the vertical and away from the inner surface **31** of the baffle **30**. Jet **43** was positioned to be discharged in a slightly downward direction inclined approximately 75° from the vertical and directed toward the side wall **24**. The pressure of the fluid emanating from the jets **41**, **42**, **43** and **44** may be varied in accordance with the material being fed and the amount of opening and cleaning desired. With the above mineral wool fiber, jet **41** had an operating pressure of 6 p.s.i.g.; jet **42**, an operating pressure of 7 p.s.i.g.; jet **43**, an operating pressure of 2 p.s.i.g.; and jet **44**, an operating pressure of 2 p.s.i.g. The above operating conditions are given for illustration purposes only and it is not intended that the invention be limited thereto.

If desired, the apparatus of the instant invention may also be used as a blender to produce felts having multiple types of fibers. The apparatus is converted into a blender by inserting an impervious plate for the screen area **35**. Various types of fibers are introduced into the hopper **10** for opening, blending, and felting on the conveyor **51**. Also, a suitable binder, such as a dry resin, may be introduced into the fibers by a small electromagnetic vibratory feeder **19** positioned to discharge into the hopper **10**.

Although the invention has been described in rather full detail, it will be understood that these details need not be strictly adhered to and that various changes and modifications may suggest themselves to one skilled in the art, all falling within the scope of the invention as defined by the subjoined claims.

What I claim is:

1. A method for opening, cleaning and collecting fibrous material comprising subjecting the fibrous material to a partial opening action, suspending the partially opened fibrous material, containing opened and unopened parts, in a fluid stream travelling over a path having a final portion curving back toward but not reaching and then veering away from a first portion thereof, maintaining the velocity of the fluid stream at a level to cause the unopened parts of said fibrous material to be projected out of said final portion of the path of the fluid stream back into said first portion of the path of the fluid stream, suspending the opened parts of said fibrous material in an aeriform suspension, and removing the opened parts of said fibrous material in a direction foreign to the first portion of said path.

2. A method for opening, cleaning and collecting fibrous material comprising subjecting the fibrous material to a partial opening action, suspending the partially opened fibrous material in an air stream travelling over a path having a final portion curving back toward but not reaching and then veering away from a first portion thereof, maintaining the velocity of the air stream at a level to cause the unopened parts of said fibrous material to be projected out of said final portion of the path of the air stream back into said first portion of the path of the air stream, suspending the opened parts of said fibrous material in an aeriform suspension, passing volume air through said aeriform suspension, and suspending the opened parts of said fibrous material in said volume air for transfer in a direction foreign to the first portion of said path to a collection zone.

3. A method for opening, cleaning and collecting fibrous material comprising subjecting the fibrous material to a partial opening action, suspending the partially opened fibrous material, containing opened and unopened parts, in an air stream travelling over a generally spiral path having a final portion curving back toward but not reaching and then veering away from a first portion thereof, maintaining the velocity of the air stream at a level to cause the unopened parts of said fibrous material to be projected out of said final portion of the path of the air stream back into said first portion of the path of the air stream, suspending the opened parts of said fibrous material in an aeriform suspension, and passing volume air through said aeriform suspension in a vertical direction passing initially through at least a part of said first portion of said spiral path and then contacting said opened parts of said fibrous material so that said opened parts will be suspended in said volume air and be transferred in a direction away from said part of said first portion of said spiral path to a collection zone.

4. A method for opening, cleaning and collecting fibrous material comprising subjecting the fibrous material to a partial opening action, suspending the partially opened fibrous material, containing opened and unopened parts, in an air stream travelling over a generally spiral path having a final portion curving back toward but not reaching and then veering away from a first portion thereof, maintaining the velocity of the air stream at a level to cause the unopened portion of said fibrous material to be projected out of said final portion of the path of the air stream back into said first portion of the path of the air stream, suspending the opened parts of said fibrous material in an aeriform suspension, passing volume air through said aeriform suspension in a direction passing initially through at least a part of said first portion of said spiral path and then contacting the opened parts of said fibrous material so that said opened parts will be

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suspended in said volume air and be transferred in a direction away from said part of said first portion of said spiral path to a collection zone and inducing said volume air flow by suction from an outlet in said collection zone.

5. Apparatus for opening, cleaning and collecting fibrous material comprising a plurality of fluid jets positioned to open said fibrous material to dislodge unwanted particles therefrom and to impart thereto a velocity, means for guiding said moving fibrous material over a path having a final portion curving back toward but not reaching and then veering away from a first portion thereof, means forming a zone for removing said unwanted particles, means for separating said opened fibrous material into opened fibers in an aeriform suspension and unopened fibrous clumps, another fluid jet for directing said unopened fibrous clumps back into said zone for removing unwanted particles, and means for transferring said opened fibers in a direction foreign to the first portion of said path to a collection zone.

6. Apparatus for opening, cleaning and collecting fibrous material comprising a plurality of fluid jets positioned to open said fibrous material to dislodge unwanted particles therefrom and to impart thereto a velocity, means for guiding said moving fibrous material over a path having a final portion curving back toward but not reaching and then veering away from a first portion thereof, means forming a zone for removing said unwanted particles, an impingement plate in said zone, means for separating said opened fibrous material into open fibers in an aeriform suspension and unopened fibrous clumps, another fluid jet for directing said unopened fibrous clumps toward said impingement plate for further opening, and means for transferring said opened fibers in a direction foreign to the first portion of said path to a collection zone.

7. In an apparatus for opening, cleaning and collecting a fibrous material containing unfiberized particles, means defining an opening and cleaning chamber into which said fibrous material is deposited, said chamber having one surface therein defined by a generally spiral baffle, means for imparting a velocity to said fibrous material in a direction generally following the path of said spiral baffle, means for opening said fibrous material and dislodging said unfiberized particles therefrom, means defining a zone for removing said unfiberized particles, means for separating said fibrous material into opened fibers in an aeriform suspension and unopened fibrous clumps, means for directing said unopened fibrous clumps back into said zone for removing said unfiberized particles, and means for transferring said opened fibers in said aeriform suspension in a direction foreign to said path to a collection zone.

8. In an apparatus for opening, cleaning and collecting a fibrous material containing unfiberized particles, means defining an opening and cleaning chamber into which said fibrous material is deposited, said chamber having one surface therein defined by a generally spiral baffle, one section of said baffle comprising a screen, fluid jet means for imparting a velocity to said fibrous material in a direction generally following said spiral baffle, means for opening said fibrous material and dislodging said unfiberized particles therefrom so that said unfiberized particles pass through said screen, means for separating said opened fibrous material into opened fibers in an aeriform suspension and unopened fibrous clumps, means for directing said unopened fibrous clumps back adjacent said screen, and means for transferring said opened fibers in said aeriform suspension in a direction foreign to said path to a collection zone.

9. In an apparatus for opening, cleaning and collecting a fibrous material containing unfiberized particles, means defining an opening and cleaning chamber into which said fibrous material is deposited, said chamber having one surface therein defined by a generally spiral baffle, one section of said baffle comprising a screen, fluid jet means for imparting a velocity to said fibrous material in a direction generally following said spiral baffle, means for opening said fibrous material and dislodging said unfiberized particles therefrom so that said unfiberized particles pass through said screen, means for separating said opened fibrous material into opened fibers in an aeriform suspension and unopened fibrous clumps, means for directing said unopened fibrous clumps back adjacent said screen, and means directing a flow of volume air for transferring said opened fibers in said aeriform suspension in a direction foreign to said path to a collection zone.

10. In an apparatus for opening, cleaning and collecting a fibrous material containing unfiberized particles, means defining an opening and cleaning chamber into which said fibrous material is deposited, said chamber having one surface therein defined by a generally spiral baffle, one section of said baffle comprising a screen, fluid jet means for imparting a velocity to said fibrous material in a direction generally following said spiral baffle, means for opening said fibrous material and dislodging said unfiberized particles therefrom so that said unfiberized particles pass through said screen, means for separating said opened fibrous material into opened fibers in an aeriform suspension and unopened fibrous clumps, means directing said unopened fibrous clumps back against said screen, and means admitting low pressure volume air below said screen so that a flow of volume air will pass through said screen and transfer said opened fibers in a direction foreign to any portion of said path to a collection zone.

11. In an apparatus for opening, cleaning and collecting a fibrous material containing unfiberized particles, means for defining an opening and cleaning chamber into which said fibrous material is deposited, said chamber having one surface therein defined by a generally spiral baffle, one section of said baffle comprising a screen, a first fluid jet for imparting a velocity to said fibrous material in a direction generally following said spiral baffle, a second fluid jet directed at an angle to said first fluid jet to open said fibrous material and dislodge said unfiberized particles therefrom so that said unfiberized particles will pass through said screen, said fluid jets and said spiral baffle combining to separate said opened fibrous material into opened fibers and unopened fibrous clumps flowing in an air suspension about a path defined by said spiral baffle, means directing said fibrous clumps back against said screen, and means for transferring said opened fibers in a direction foreign to said path to a collection zone.

12. In an apparatus for opening, cleaning and collecting a fibrous material containing unfiberized particles, means defining an opening and cleaning chamber into which said fibrous material is deposited, said chamber having one surface therein defined by a generally spiral baffle, one section of said baffle comprising a screen, an impingement plate mounted on said screen, a first fluid jet for imparting a velocity to said fibrous material in a direction generally following said spiral baffle, a second fluid jet directed at an angle to said first fluid jet to open said fibrous material and dislodge said unfiberized particles therefrom so that said unfiberized particles will pass through said screen, said fluid jets and said spiral baffle combining to separate said opened fibrous material into opened fibers and unopened fibrous clumps flowing in an air suspension in a path defined by said spiral baffle, means directing said fibrous clumps back against said impingement plate to open said fibrous clumps to dislodge unfiberized particles therefrom, and means for transferring said opened fibers to a collection zone.

13. In an apparatus for opening, cleaning and collecting a fibrous material containing unfiberized particles, means for defining an opening and cleaning chamber into which said fibrous material is deposited, said chamber having one surface therein defined by a generally spiral

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baffle, one section of said baffle comprising a screen, an impingement plate mounted on said screen, a first fluid jet for imparting a velocity to said fibrous material in a direction generally following said spiral baffle, a second fluid jet directed at an angle to said first fluid jet to open said fibrous material and dislodge said unfiberized particles therefrom so that said unfiberized particles will pass through said screen, said fluid jets and said spiral baffle combining to separate said opened fibrous material into opened fibers and unopened fibrous clumps, a third fluid jet for imparting an additional velocity to said opened fibers and said unopened fibrous clumps, a fourth fluid jet for directing said unopened fibrous clumps back toward said impingement plate to open said unopened fibrous clumps and dislodge unfiberized particles therefrom, and means for transferring said opened fiber to a collection zone.

14. In an apparatus for opening, cleaning and collecting a fibrous material containing unfiberized particles, means for defining an opening and cleaning chamber into which said fibrous material is deposited, said chamber having one surface therein defined by a generally spiral baffle, one section of said baffle comprising a screen, an impingement plate mounted on said screen, a first fluid jet for imparting a velocity to said fibrous material in a direction generally following said spiral baffle, a second fluid jet directed at an angle to said first fluid jet to open said fibrous material and dislodge said unfiberized particles therefrom so that said unfiberized particles will pass through said screen, said fluid jets and said spiral baffle combining to separate said opened fibrous material into opened fibers and unopened fibrous clumps, a third fluid jet for imparting an additional velocity to said opened fibers and said unopened fibrous clumps, a fourth fluid jet for directing said unopened fibrous clumps back against said impingement plate to open said unopened fibrous clumps and dislodge unfiberized particles therefrom, and means admitting low pressure volume air below said screen so that a flow of volume air will pass through said screen and transfer said opened fibers to a collection zone.

15. A process for treating asbestos fiber bundles which comprises providing a vertically disposed vessel having a high velocity circulating fluid stream flowing into the lower end thereof, entraining asbestos fiber bundles in said stream, directing said stream at an acute angle against the wall of said vessel, repeatedly recycling said bundles in said stream to greatly reduce their bulk density, and separating the light-weight fibers by the buoyant effect of the fluid being discharged from said vessel.

16. A process for treating asbestos fiber bundles which comprises entraining said bundles in a high velocity fluid stream flowing in a generally circular path within a confined space, recycling said fibers in said stream to exfoliate the bundles until the fibers acquire a predetermined low bulk density and causing the low density fibers to rise above said fluid stream and the higher density fibers entrained therein and to be discharged from said enclosed space.

17. The process of claim 16 wherein high density fibers are charged into said fluid stream at a rate sufficient to replace the low density fibers discharged from the enclosed space.

18. A process for simultaneously exfoliating asbestos fibers and intermixing them with other complementary fibers which comprises entraining a mixture of said asbestos and said other fibers in a high velocity fluid stream, circulating within a confined space, recycling said fiber mixture to exfoliate the asbestos and homogeneously mixing them with said other fibers while simultaneously reducing the bulk density of said mixture, causing the mixture to rise above said fluid stream and to be discharged from said enclosed space.

19. A method for opening, cleaning and collecting fibrous material comprising suspending fibrous material in a high velocity fluid stream flowing in a generally circular path within a confined space, subjecting said fibrous material to an opening action in at least one portion of said generally circular path, removing the opened parts of said fibrous material from a second portion of said generally circular path by suspending said opened parts of said fibrous material in an aeriform suspension rising above said fluid stream to be discharged from said confined space, recycling the unopened parts of said fibrous material in said generally circular path to be resubjected to further opening action until they have reached a predetermined degree of openness so as to rise in said aeriform suspension and be discharged from said confined space.

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