Oct. 8, 1957 E. J. FISHER 2,808,929

CLEANING MINERAL WOOL OR ROCK WOOL

Filed Jan. 26, 1952 2 Sheets-Sheet 1

Fig. 1

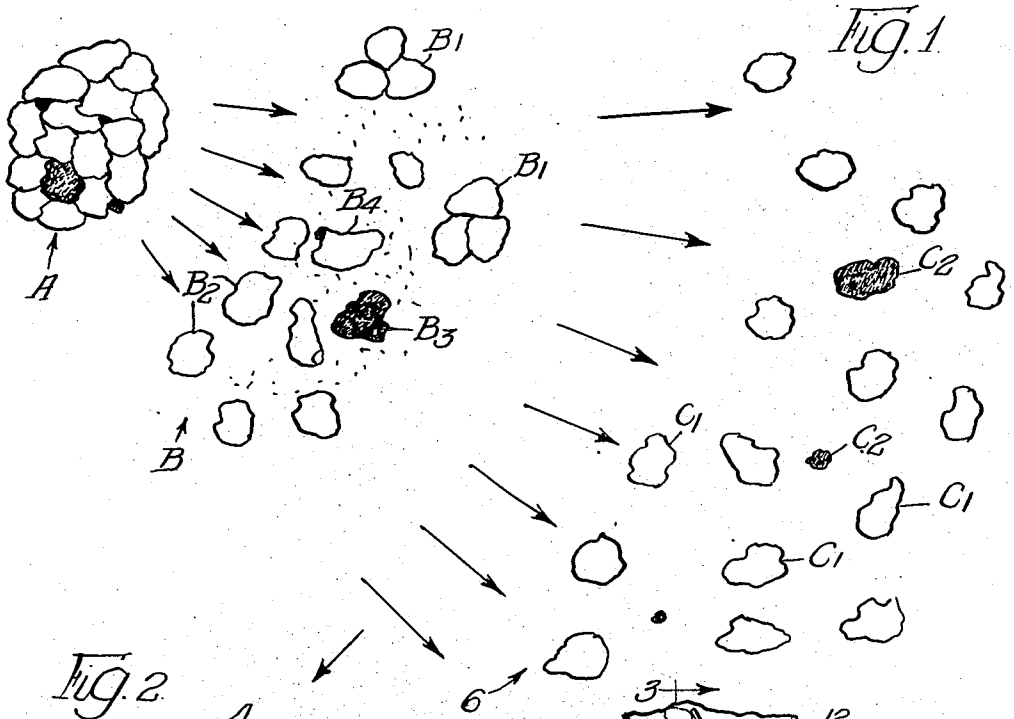
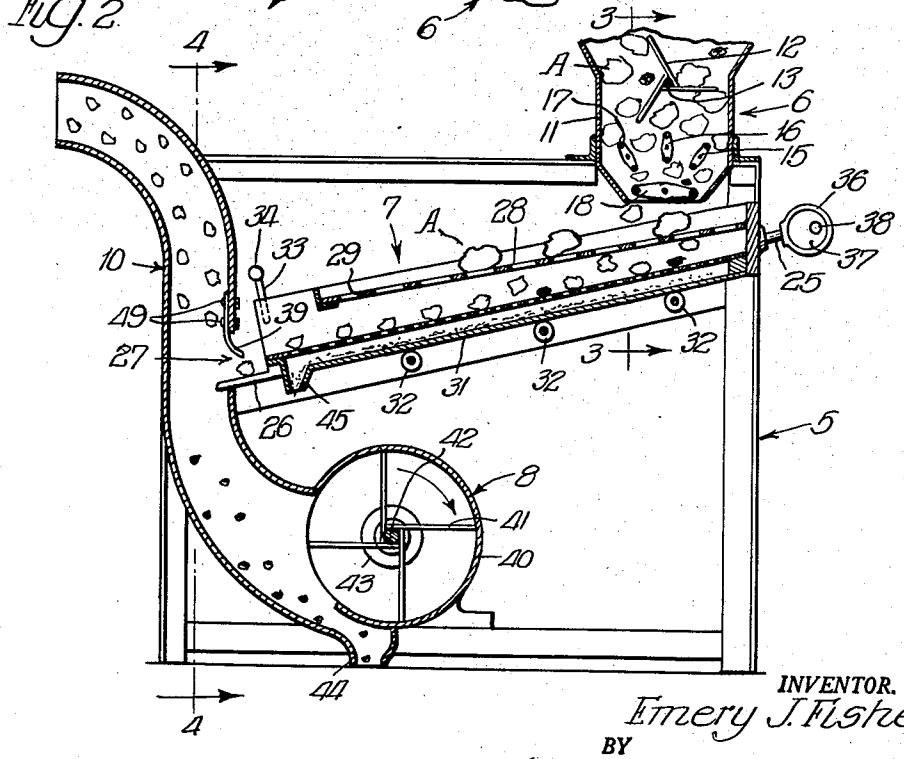



Fig. 2




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Fig. 3

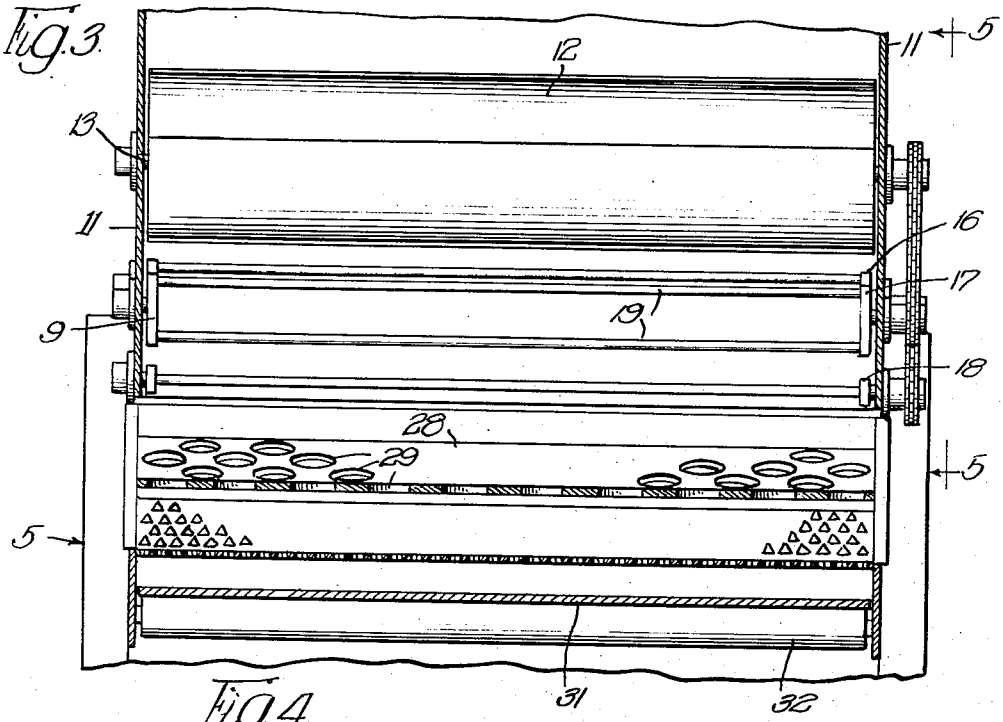



Fig. 4

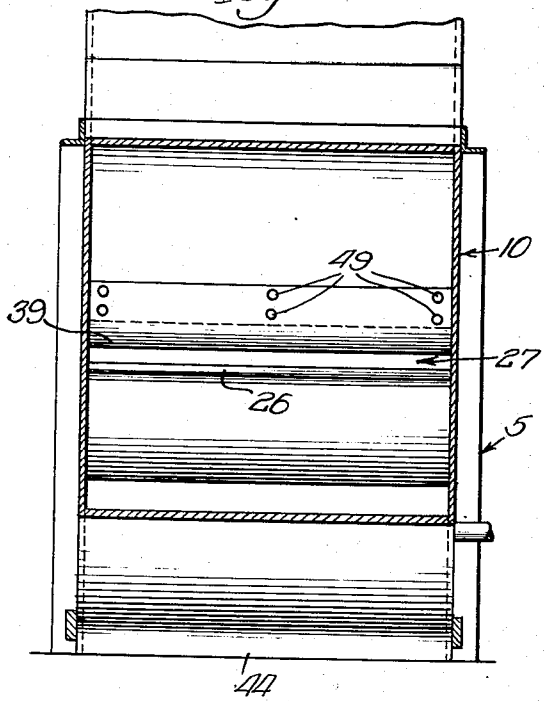
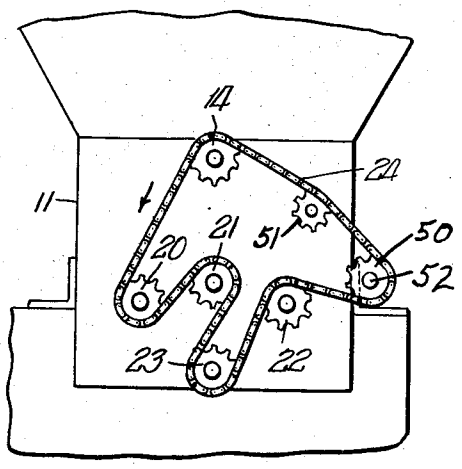



Fig. 5




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2,808,929

Patented Oct. 8, 1957



2,808,929

# CLEANING MINERAL WOOL OR ROCK WOOL

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Application January 26, 1952, Serial No. 268,429

1 Claim. (Cl. 209—36)

My invention relates to a process and apparatus for cleaning commercial mineral wool and rock wool so as to free and remove therefrom the hard, non-fibrous particles ranging in size from fine sand up to large nuggets which become enmeshed in mineral wool and rock wool during the course of manufacture.

Commercial mineral wool and rock wool is in the form of small wads or pellets of the wool fibers which have a characteristic tendency to bunch or cling together in clumps. Throughout a mass of such rock wool or mineral wool wads will be found hard foreign particles which range in size from fine sand or grit up to large nuggets or cinders. The very fine sand is derived mainly from the fracturing or powdering of the individual fibers making up the mineral wool or rock wool. In addition to such fine sand there will be an appreciable quantity of small hard bodies in the form of solidified nodules or granules of the molten slag or rock from which the wool is formed, such particles having a size in the order of pinheads. In addition to these fine foreign bodies, there will be larger hard pieces of rock, slag and coke having irregular shapes and ranging in size up to as much as an inch or more in the longest direction.

Commercial mineral wool and rock wool contain such inclusions of hard foreign particles inherently as a result of the methods by which these products are manufactured. When mineral wool or rock wool is produced with equipment maintained in the best of condition and properly operated there will be a smaller amount of such hard foreign particles in the commercial product than where the producing machinery is clogged and in poor adjustment and the operators are unskilled or careless. Under these latter conditions the commercial product will contain a much larger proportion of the hard bodies.

Large quantities of mineral wool and rock wool are used for insulation purposes. For example, large quantities of mineral wool and rock wool are used for "blown in" type insulation which is installed by special equipment including feeders and pneumatic conveyors. Mineral wool and rock wool are also used in another process of installing insulation which is known as the "sprayed-on" process and which is described, for example, in Patents Nos. 1,718,507, 1,888,841 and 2,179,679 to Wenzel et al. In the sprayed-on process either mineral wool or rock wool is often blended with another insulating material such as asbestos fiber and then this blended mixture is pneumatically conveyed to the spray gun from which it is blown onto the wall or ceiling surface while receiving a coating of an adhesive from the gun. The various pieces of power-driven equipment used in handling mineral wool and rock wool insulation such as star-wheel type feeders, proportioning devices, etc. have moving parts which are designed to close tolerance for efficient operation. A great deal of difficulty has been encountered in handling commercial mineral wool and rock wool in such equipment due to the inclusions therein of the solid foreign bodies ranging in size from fine sand up to large nuggets, as described above.



The sand is highly abrasive and causes rapid wear of the closely fitting parts. The larger nuggets or lumps cause frequent jamming resulting in damaged equipment, burned-out motors and a great deal of loss in time through shutdown. When one of the devices handling mineral wool or rock wool becomes jammed because of a cinder or nugget it is usually very difficult to locate the hard body in the wads of mineral wool or rock wool, as the case may be, and it is usually necessary to completely clean out the jammed machines in order to correct the stoppage. Sometimes the forces involved are so great that the larger nuggets or cinders are actually driven completely through the sheet metal housings of the equipment. It is not uncommon practice to have two or three extra pieces of mineral wool and rock wool handling equipment on an insulating job in order to keep just one piece of equipment available and operating full time.

In addition to the jamming and rapid wearing problems referred to above, the fine sand particles cause another difficulty in the pneumatic conveying equipment which often is very troublesome. In passing the rock wool or mineral wool through the conduit of a pneumatic conveyor, there is a tendency for electrostatic charges to be built up on the interior wall of the conduit, especially when the humidity is high. While the wads of mineral wool or rock wool themselves do not account for much difficulty in this respect, the fine sandy particles associated with the wads cause a considerable amount of this type of difficulty and result in either poor feeding or complete clogging of the conduits or hoses. Reduction of the fine particle content eliminates this particular difficulty to a very large extent.

The commercial producers of rock wool and mineral wool are acquainted with the above and other problems arising from the inherent inclusion of hard foreign bodies in their products but have been unable satisfactorily to solve the problem of removing these objectionable materials without altering the nature and destroying the characteristic properties of the products. The physical properties of the wads of mineral and rock wool prevent the hard solid foreign bodies from being removed by ordinary mechanical separation techniques. The individual fibers of the wool are so highly frangible that they cannot withstand rough handling or pressure. The individual wads of the wool tend to clump and ball together and tend to adhere firmly to any object which does not have a polished surface. Accordingly, the inclusions of hard foreign bodies tend to remain tenaciously enmeshed in the wads and they are not easily loosened and freed therefrom. Because of the delicate nature of mineral wool and rock wool fibers, precluding application of pressure and rough treatment, and the tenacious manner in which the hard foreign bodies are "stuck" to and in the wads of wool, commercial cleaning of mineral wool and rock wool has not been a practical or commercial operation heretofore.

In accordance with my present invention I provide a process and apparatus wherein and whereby commercial mineral wool and rock wool may be completely freed of the hard foreign bodies in all sizes ranging from the fine sand up to the large size nuggets or clinkers, efficiently and cheaply, without altering or destroying the desirable and characteristic physical properties of the wool, and with practically no degradation of the wool products into useless sand or grit. In accordance with my invention the clumps or bunches of mineral wool or rock wool wads with their inclusions of hard foreign particles are gently shaken or separated into the individual wads or smaller clumps of only two or three wads and these are spread out in a wide stream with the wads being continuously tossed and bounced in a gentle manner so as to divide the clumps into individual wads and shake the hard par-

ticles loose therefrom. The fine particles of sandy texture are then separated out by passage through a screen with fine openings while the thin, spread-out stream of the separated wool wads and large particles and nuggets are fed into a rising air column wherein the wads of mineral wool or rock wool are lifted or carried off with the air current while the hard particles fall out. By making certain modifications and innovations I have found it possible to carry out my mineral wool and rock wool cleaning process on a basically old and well-known piece of equipment, long and widely used for cleaning a very different type of material in an entirely different manner, namely, a grain or seed cleaner.

The object of my invention, broadly stated, is the provision of a process and apparatus for efficiently and economically cleaning mineral wool and rock wool so as to separate out the hard, non-fibrous, foreign particles inherently included therein and ranging in size from fine sand up to large nuggets and clinkers.

An important object of the invention is the provision of a novel process and apparatus for cleaning mineral wool or rock wool without altering the physical properties thereof wherein commercial mineral or rock wool is fed into the apparatus and the clumps of the wool wads are gently opened up and dispersed, separated into smaller clumps or individual wads and the hard foreign particles are shaken loose and freed therefrom, while the entire mass is being spread out into a thin stream of bouncing material passing down an incline, the sandy hard particles being removed through a fine screen having small openings and with the wool wads and larger nuggets being introduced by gravity or a slight negative pressure into an air column of such velocity that the wads of mineral wool are carried off in the air stream while the solid particles fall out.

Another important object of the invention is a method of cleaning commercial mineral wool and rock wool so as to separate hard foreign inclusions therefrom which comprises discharging the commercial products onto the upper end of a downwardly inclined, shaking or vibrating screen having openings therein considerably larger than the average size of the individual wads of wool, catching the wool wads and hard foreign particles falling through the upper screen on a lower screen which is also inclined and shaking, and having openings considerably finer than the average size of the wool wads, with the fine sandy hard particles being separated through this lower screen, and discharging the wool and freed hard foreign bodies of larger size from the lower end of the bottom screen at a neutral or slightly negative pressure into a rising column of air having an upward velocity such that only the wads of wool rise and are carried off while the hard foreign particles fall out.

Another important object of the invention is apparatus for cleaning commercial grade mineral or rock wool so as to separate out the associated hard foreign particles which comprises a set of at least two superposed screens having means attached thereto for imparting a sharp shaking or vibrating action thereto, the upper screen having openings considerably larger than the average size of the individual wads of wool and the lower screen having openings considerably smaller than the average wad size, and an upstanding stack for conducting a rising air column, the stack having a slot-shaped side inlet opening into which the bottom end of the lower screen empties, such inlet opening having a vertical width considerably greater than the average wad diameter but sufficiently small to prevent any outflow of air from the column when the air column is passing through the stack with a velocity which will carry off the wads of wool while allowing the hard foreign particles to fall out.

Certain other objects of the invention will in part be obvious and will in part appear hereinafter.

For a more complete understanding of the nature and scope of the invention, reference may now be had to the following detailed description thereof taken in connection with the accompanying drawings, wherein:



Fig. 1 is a diagrammatic view illustrating the process of cleaning mineral wool or rock wool in accordance with the present invention using the machine shown in the remaining figures of the drawings;

Fig. 2 is a longitudinal vertical sectional view through one form of machine that may be used for cleaning the mineral wool or rock wool in accordance with the invention;

Fig. 3 is an enlarged fragmentary sectional view taken on line **3**—**3** of Fig. 2;

Fig. 4 is a transverse sectional view taken on line **4**—**4** of Fig. 2; and

Fig. 5 is a detail elevational view taken on line **5**—**5** of Fig. 3 showing the sprocket drive mechanism for operating the moving elements in the hopper portion of the machine.

In its over-all general construction the machine shown in Figs. 2 through 5 corresponds to seed and grain cleaning machines of the type disclosed in Patent No. 814,918, for example. However, the machine of Patent No. 814,918 and seed and grain cleaning machines disclosed in the prior art cannot be used to accomplish the purpose and object of the present invention since certain critical modifications and innovations must first be made therein because of the basic difference in the materials being processed in the machines and basic differences in the cleaning processes carried out therein.

The cleaning machine comprises a suitable framing structure of known type and construction which is indicated generally at **5**. The machine comprises four main operating parts or sub-assemblies, namely: a feed hopper assembly, the shaker screen assembly, the blower unit and the separating column. These operating units are indicated generally in the drawings by the reference numerals **6**, **7**, **8** and **10**, respectively. The hopper **6** comprises a housing **11** mounted on the top of the frame **5** adjacent the front end thereof and extending across the width of the machine as shown in Fig. 3. The hopper **6** is provided with an upper agitator paddle wheel **12** mounted on a shaft **13** journaled in opposite ends of the hopper **11** and provided on one end with a drive sprocket **14**. Beneath the paddle wheel **12** is a group of three smaller agitators **15**, **16** and **17** located above a larger agitator **18** of the same type positioned in the bottom of the hopper **11**. The agitators **15**, **16**, **17** and **18**, as shown in Fig. 3, each comprises a pair of longitudinal rods **19**—**19** extending between end fixtures **9**—**9** which are mounted on supporting shafts journaled at their opposite ends in the ends of the hopper **11**. The four agitators are provided with sprockets **20**, **21**, **22** and **23**, respectively, as shown in Fig. 5. The four agitators and the paddle wheel **12** are driven by means of a chain **24** running over the respective sprockets, a drive sprocket **50** and an idler sprocket **51** in the manner shown in Fig. 5. The drive sprocket **50** is carried on a drive shaft **52** which may be driven in known manner by an electric motor or from any suitable source of power. The agitators and the paddle wheel are turned to such positions that they do not clash in operation.

The shaker screen assembly **7** is positioned on an incline with its upper end being located underneath the hopper **11** and its lower end being provided with a shelf or apron **26** which projects into the opening **27** leading into the flue or air separator column **10**. The screen shaker assembly comprises an upper screen **28**, a lower screen **30**, and a bottom tray **31**. These three members are mounted in a frame of suitable design with the shaker screen being supported on a plurality of rollers **32**—**32** extending across opposite sides of the machine as shown in Fig. 3. The lower end of the shaker screen assembly is supported on opposite sides by arms **33**—**33** pivoted at upper ends **34** to the sides of the machine. At its upper end the shaker screen assembly **7** is connected by means of a connecting

rod 35 to ring 36 which fits over an eccentric 37 supported on a drive shaft 38 whereby the eccentric 37 may be driven at a suitable speed so as to impart a rapid oscillating or shaking action to the screen assembly. It will be understood that this particular method of vibrating or shaking the screen assembly 7 is illustrative of any of several types of vibrating or shaking mechanisms that may be used.

The blower 8 comprises a blower housing 40 in which is located a blower wheel 41 mounted on a drive shaft 42 which is journaled at opposite ends between the sides of the frame 5. The drive shaft 42 is provided with a drive pulley 43 by which the blower may be driven by means of a belt (not shown) running from the pulley 43 to an electric motor or other driving mechanism (not shown). Various types of blowers of known commercial design may be used and selected on the basis of capacity for delivering the required volumn of air at the desired velocity for the flue or air separator column 10.

The opening 27 is wider than normal for a seed or grain cleaner. It must be sufficiently wide to allow the cleaned wool to pass easily therethrough but not so wide as to cause the air column to leak out. In operation the air pressure on opposite sides of the opening 27 will either be balanced or there will be a slight negative pressure on the air column side so as to facilitate inward flow of the material. The upper edge of the opening 27 is defined by a curved sheet member 39 which may be adjusted by loosening the retaining bolts 49—49 passing through vertical slots in the member 39. A width of 1½"–2½" is suitable.

The flue or air separator column 10 is S-shaped with a rectangular cross section which spreads out adjacent the bottom so as to connect with the discharge connection of the blower housing 40. The bottom end of the air column 10 is provided with a discharge spout 44, as indicated in Fig. 2.

The upper screen 28 of the shaker assembly 7 has openings 29 having a diameter of from 1" to 2" with about 16 to 64 of these openings per square foot of area of the screen. These openings are large enough so as to allow individual wads of mineral wool or rock wool and the smaller clumps of these wads to fall through the screen 28 onto the lower screen 30. Screen 30 may be either perforated metal or woven wire screen having openings ranging from 1/16" to 3/16" in diameter or size with about 16 to 144 openings per square inch. The openings in the upper and lower screens need not be circular in shape. For example, the openings in the lower screen 30 may be triangular in shape with the openings so arranged that they point toward the upper end of the screen.

The operation of the machine will now be described in connection with the diagram contained in Fig. 1:

Rock wool or mineral wool of commercial grade containing inclusions of hard foreign materials ranging from sandy fines up to large clinkers and pieces of slag, is fed into the hopper 6. The mineral wool or rock wool passes down through the hopper 6 and is distributed at even rate across the width of the machine and discharged onto the upper end of the shaker screen assembly 7. Referring to Fig. 1, the letter A designates a large composite clump or ball of the wool wads with hard particle inclusions, which is representative of the commercial product fed into the hopper 6. The paddle wheel 12 and the agitators 15, 16, 17 and 18 reduce the size of the clumps somewhat but the action of these elements is neither intended to nor capable of effecting a complete separation of the composite clumps or balls A into the individual wool wads freed of hard particles. As the clumps A of the wads of mineral or rock wool and their hard foreign particle inclusions fall onto the upper screen 28 they are lightly bounced and shaken as they work down the incline until they are reduced in size sufficiently to pass through the large openings 29 in this screen and fall onto the lower screen 30 having the much finer openings therein. The length of the upper screen 28 is such that normally all of the clumps A will have been reduced in size so as to pass through the openings 29 before they reach the lower end of the screen 28. This upper screen 28 also serves to take out any unusually large foreign objects, such as sticks, although such foreign matter is not ordinarily encountered in commercial mineral or rock wool.

The separating action of the upper screen 28 is depicted in Fig. 1 by the second group of wool wads and foreign particles indicated collectively at B. It will be seen that this collection is composed in part of smaller clumps of the wool wads such as are indicated at $B_1$; individual wool wads free of foreign particles indicated at $B_2$, large, hard particles $B_3$, individual wool wads $B_4$ which still have small pieces of hard material attached thereto, and fines indicated by the dots. This collection B is typical of the state of the product and material as it falls onto the second screen 30. As this collection B shakes or bounces down the inclined screen 30 the fines or sand falls through the small openings in the screen 30 and pass off through the discharge spout 45 at the bottom end of the tray 31 in Fig. 2. The bouncing of the small clumps $B_1$ on the screen 30 serves to break these up into individual wool wads while the bouncing of the individual wads $B_4$ having hard particles attached serves to separate these hard particles so that by the time the material has reached the bottom end of the lower screen 30 it will be in the condition depicted collectively at C in Fig. 1. That is, it will be composed of individual wads of wool $C_1$ together with separated pieces of hard particles $C_2$ too coarse to pass through the fine openings in the screen 30.

The product in the condition indicated at C in Fig. 1 discharges from the lower end of the screen 30 through the opening 27 into the rising air column in the separator 10. The blower 8 is operated in such a manner that the volume and velocity of the upstream of air in the flue 10 will be adequate to carry off the lighter wads of cleaned mineral wool or rock wool which are now completely freed of hard foreign bodies, but will not be of sufficient strength so as to carry off any of the hard foreign materials which are separated from the mineral wool or rock wool and which will fall to the bottom of the separator and pass out through the outlet opening 44.

The eccentric 37 is rotated at such a speed as to impart a rapid vibrating or shaking action to the screen assembly 7. This vibrating or shaking action imparts a bouncing movement to the mineral wool or rock wool since this product has sufficient lightness and springiness that it lends itself to this type of movement or action. The hard, relatively dense, foreign particles do not have this same tendency to bounce and this difference in physical properties makes it possible to effect the separation of the foreign particles from the wool wads even though it is otherwise difficult or impractical to free the particles from the wool fibres.

It will be understood that certain modifications and changes may be made in the machine and the method of separation described above in connection with the accompanying drawings, without departing from the spirit and scope of the invention.

What is claimed as new is:

The method of cleaning mineral wool and rock wool wads to separate hard foreign bodies and sandy foreign particles therefrom including relatively large clumps containing all three of said materials, which comprises, spreading clumps of the unclean wool containing the other two materials onto the upper end of an inclined rapidly shaking upper screen having openings therein larger than the individual wool wads contained in said clumps and smaller than the larger of said clumps, breaking up said larger clumps into smaller clumps and wads and simultaneously shaking out said relatively large clumps by said rapidly shaking operation of said upper

screen as said wool to be cleaned works its way down toward the lower end thereof, catching the material falling through said upper screen on a rapidly shaking lower inclined screen having openings therein which are considerably finer than the individual wool wads but large enough to pass the sandy foreign particles, breaking up the unbroken smaller clumps into individual wads and separating the hard particles attached thereto and to the individual wads by said rapidly shaking operation of said lower screen, and separating the individual wool wads from the hard foreign bodies by discharging the stream of individual wool wads and larger hard foreign bodies from the bottom end of said lower screen into a rising



air column having a velocity such that only the wool wads rise therein while the hard foreign bodies fall.

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