Nov. 19, 1957 W. D. SHELDON, JR 2,813,306

APPARATUS FOR REMOVING DUST AND GRANULAR MATERIAL FROM ASBESTOS FIBRE

Filed Dec. 16, 1952

4 Sheets-Sheet 1

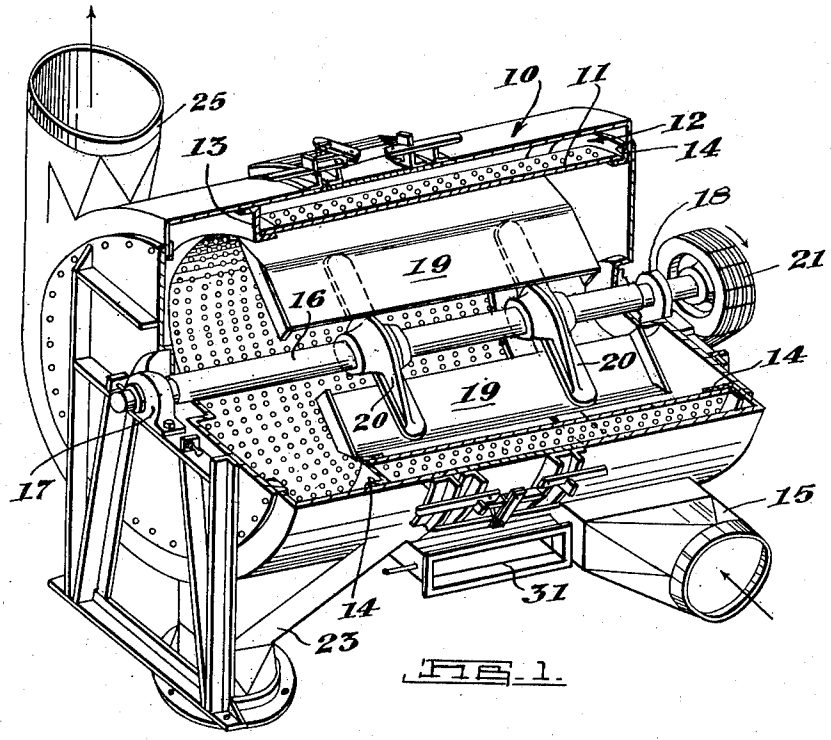


FIG. 1.

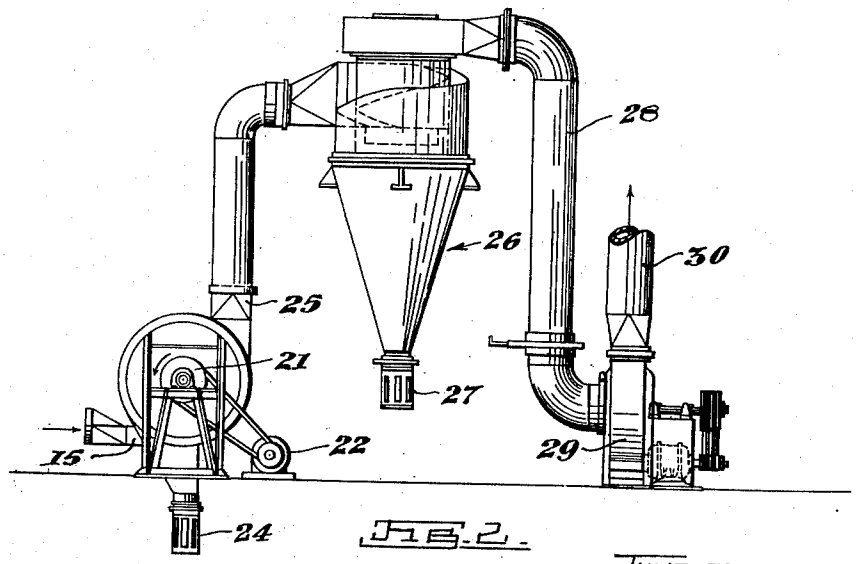


FIG. 2.

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4 Sheets-Sheet 2

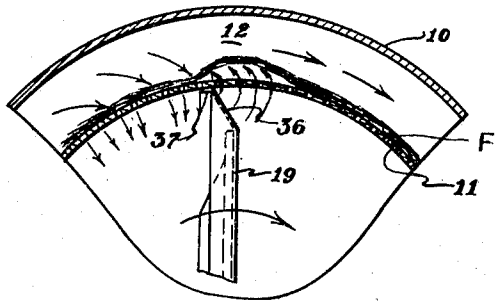


Fig. 3.

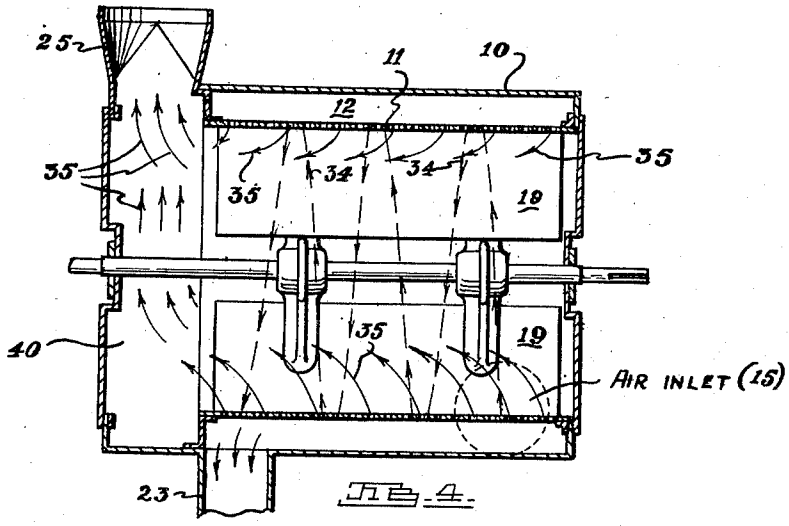


Fig. 4.

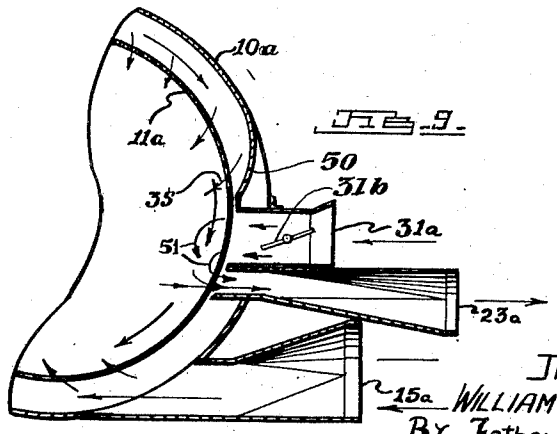


Fig. 9.

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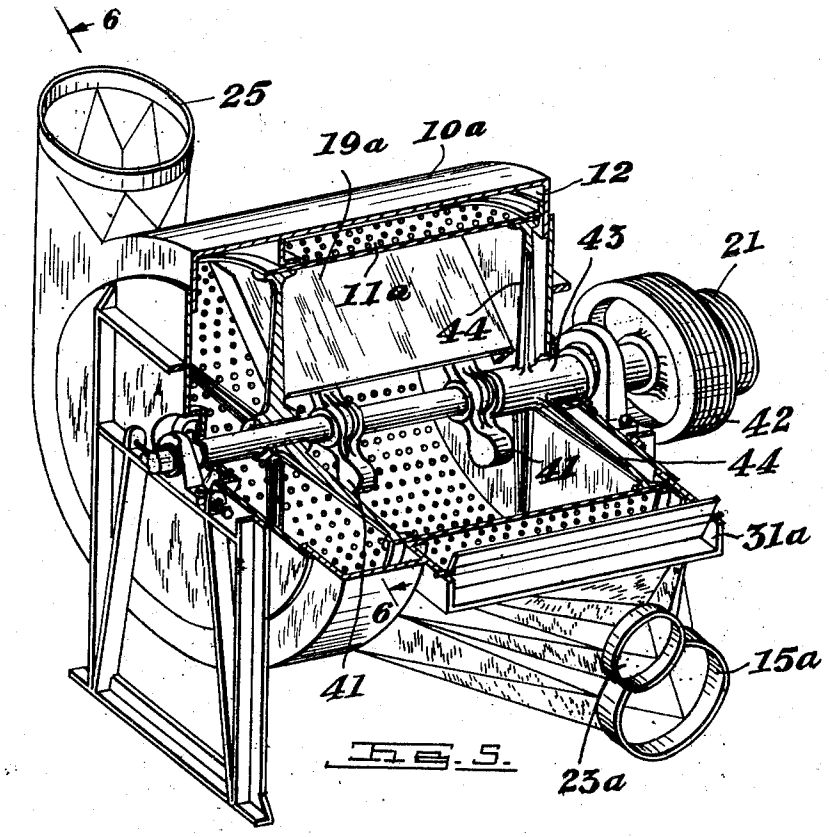


FIG. 5.

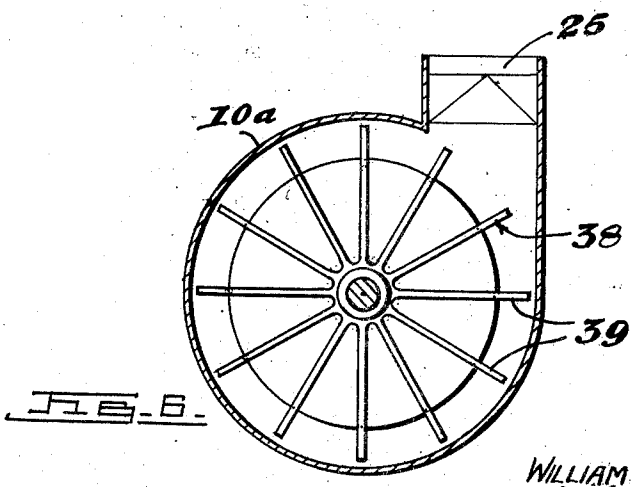


FIG. 6.

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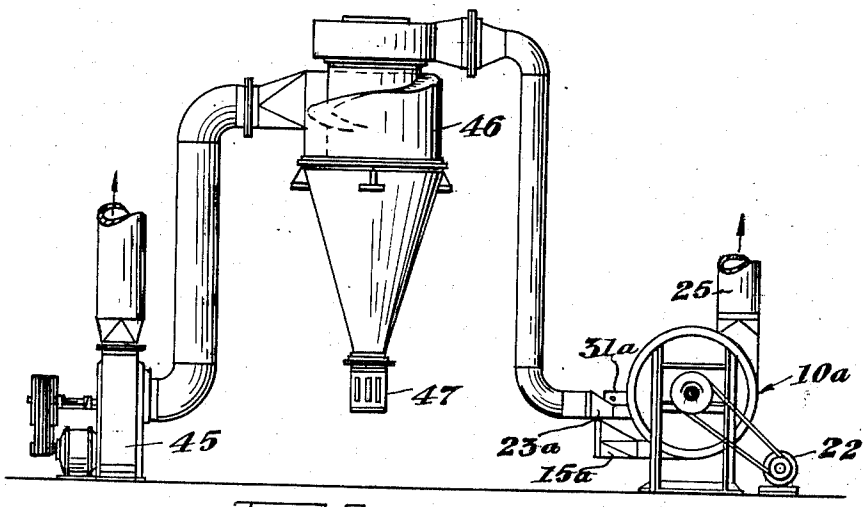


FIG. 7.

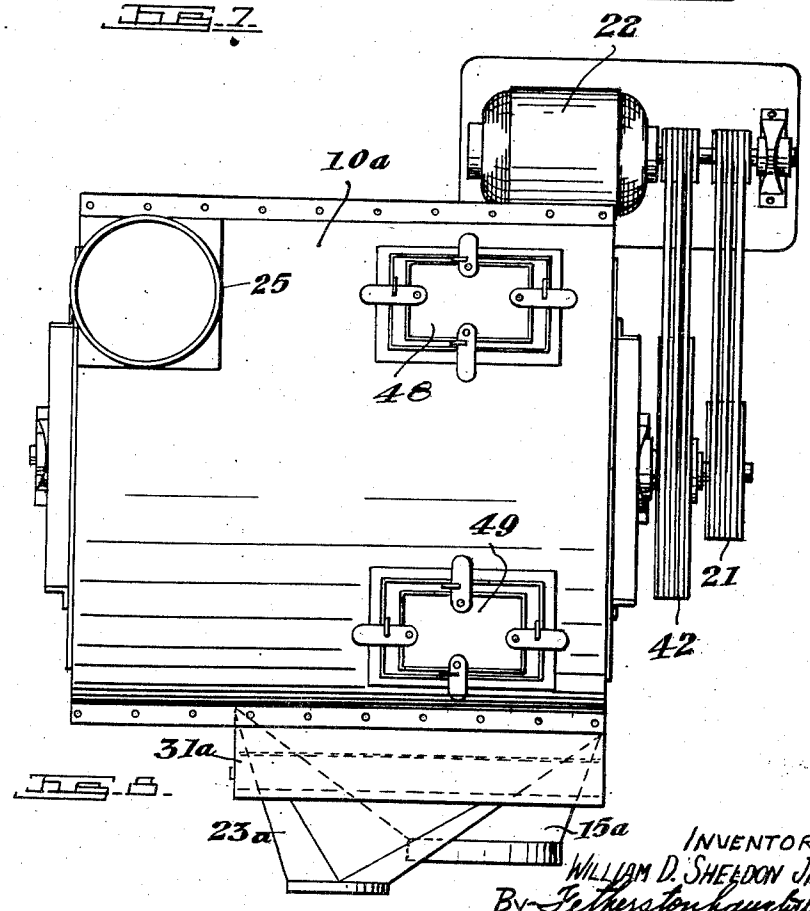


FIG. 8.

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APPARATUS FOR REMOVING DUST AND GRANULAR MATERIAL FROM ASBESTOS FIBRE

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Application December 16, 1952, Serial No. 326,239

5 Claims. (Cl. 19—90)

This invention relates to a method and apparatus for cleaning asbestos fibre.

Asbestos fibre is released from the host rock in which it occurs by crushing the rock to set free bundles of fibre, which bundles are then opened or fluffed-up by a rubbing action or by a gentle abrading. The release of the fibre may be carried out in the same operation as opening of the fibre bundles, or the bundles may first be released and then opened separately in a different operation. In either event, the open fibre will always contain a considerable amount of dust and granular material which must be removed from it before the fibre can be used commercially. Asbestos fibre is very delicate and any working tends to break down the longer fibres into less valuable shorter fibres. Thus, since the value of the fibre depends upon its length, great care must be taken to insure that in removing the dust and granular material the fibre length is not shortened, and the value of the product consequently reduced.

Up to the present time, no entirely satisfactory means have been available for removing dust and granular material from the fibre without breaking down some of the fibre, and the consequent loss in value of the product has generally been accepted in the industry as a necessary evil.

The present invention provides a novel method and apparatus for accomplishing the removal of dust and granular material from asbestos fibre with a minimum of work being done on the fibre itself and with a consequent minimum of reduction in fibre length during the operation.

The method of the present invention consists essentially in depositing the dirty fibre on a screen through which air is being drawn, which screen has suitable openings for retaining the fibre but permitting the dust and granular material to pass through. The air flow through the screen is then briefly reversed lifting the fibre from the screen and allowing it almost immediately to redeposit. This operation is repeated a relatively large number of times and each time the fibre redeposits, more of the dust and granular material will be carried through the screen, eventually leaving the fibre completely free of dust and granular material. The flow of air over and through the screen is controlled and directed in such a fashion that each time the fibre is lifted from the screen, it is carried a certain distance towards a point of withdrawal from the apparatus before it is redeposited. Thus, the process may be carried out continuously without any moving parts coming in contact with the fibre itself.

The novel apparatus of the invention which is arranged to carry out the above process consists essentially of a horizontal cylindrical drum concentrically within which is a cylindrical screen, providing an annular space between the screen and the drum wall. An air duct which conveys dirty fibre to the apparatus feeds in tangentially through the cylindrical wall of the drum, while cleaned fibre is continuously removed from the screen and conducted away therefrom. Dust and granular material which pass through the screen are removed axially from

the interior of the screen, at the outlet end of the apparatus. The air which enters via the inlet duct at considerable speed will follow a course around the screen within the drum before eventually being withdrawn through the central outlet at the other end thereof. Mounted upon a shaft located on the axis of the drum and screen above referred to is at least one radial baffle arranged to be rotated in a direction corresponding to the movement of air in its helical path around the drum. This baffle extends the entire length of the screen and is arranged to sweep very close to the inner side of the screen. When the baffle is rotated at a speed which is in excess of the peripheral speed of the air following its course around the screen within the space between the screen and the drum, the pressure in front of each baffle as it rotates will build up while the pressure on the following side of the baffle will be diminished. Thus, as the rotating baffle approaches a given point on the screen, air will be caused to flow from within the screen into the annular space between the screen and the drum, and the fibre and dust on the screen at that point will be lifted and advanced by the airstream a certain distance around the screen. When the baffle has passed the material thus raised, the material will once again be deposited on the screen. Owing to the slightly different aerodynamic characteristics of the fibre and dust and granular material, the free dust and free granular material will return to the surface of the screen before the fibre which has been raised and will pass through it and be removed. In addition, the slight impact of the fibre against the screen when it is redeposited will loosen more dust and granular material which will partly then pass through the screen and be removed or will be removed the next time the fibre is lifted and redeposited. This operation is repeated every time the baffle passes beneath the fibre, and it will be appreciated that whenever it is raised from the screen, the fibre is carried along the path of the airstream until finally it arrives fully cleaned at a point on the screen from which it is removed and conducted away.

According to one embodiment of the invention, the screen is stationary and there are two rotating baffles. The dirty fibre is fed in an airstream tangentially to the screen at one end of the apparatus and clean fibre is withdrawn from the screen at the other end thereof, the fibre on the screen following a generally helical path as it is intermittently raised and redeposited by the action of the rotating baffles.

According to another embodiment of the invention the screen is rotated at a relatively slow speed, in the same direction as the rotation of the baffles. In this embodiment, the clean fibre is removed by suction and carried away in an airstream. The rotation of the screen ensures that it is progressively cleaned by the suction and the foraminations therein remain free of clogging.

The invention will be more fully understood from a reading of the following detailed specification in conjunction with the accompanying drawings which illustrate several embodiments thereof, and wherein

Figure 1 is a perspective view of a preferred embodiment of the invention partly broken away to illustrate interior details,

Figure 2 is an elevation of the apparatus illustrated in Figure 1 showing its manner of connection with other components in a circuit,

Figure 3 is a fragmentary cross section of the screen in the apparatus illustrated in Figure 1 showing the action of the apparatus in removing dust and granular material from the fibre,

Figure 4 is a diagrammatic illustration of the screen illustrating the path followed by the airstream and by the material flowing through the apparatus,

Figure 5 is a sectional view of the outlet end of an apparatus similar to that shown in Figure 1 but wherein the withdrawal of air centrally from the end of the interior of the screen is motivated by an impeller mounted on the end of the baffle shaft,

Figure 6 is a perspective view, partly broken away, of an alternative embodiment of the apparatus according to the invention,

Figure 7 is a side elevation of a circuit layout including the embodiment of the invention illustrated in Figure 6, and

Figure 8 is a top plan view of the embodiment of the invention illustrated in Figure 5,

Figure 9 is a detailed cross section of the apparatus illustrated in Figures 5 and 8 showing details of the air entry port and product withdrawal means.

In Figure 1, **10** represents a generally cylindrical-shaped casing within which is arranged concentrically a cylindrical screen **11**. Between the casing **10** and the screen **11** is an annular space **12**. The screen **11** is fixed to the casing **10** at the left hand end through a Z-section annular ring **13** and at the right hand end through an angle section annular ring **14**. Thus, in the embodiment of Figure 1, the screen **11** is stationary.

The inlet duct (for the dirty fibre mixed in a stream of air) is shown at **15**. The duct **15** discharges into the annular space **12** in a direction tangential to the screen **11**. Concentric with the screen **11** is a shaft **16** mounted in bearings **17, 18** at either end of the casing **10**. Baffles **19** are fixed to the shaft **16** through members **20**. Any suitable driving means, such as an electric motor as indicated at **22** in Figure 2, may be used to drive the shaft **16** and associated baffles **19** through means such as a pulley **21** and belts at a speed which is in excess of the peripheral speed of the air travelling in the annular space **12**. A damper **31** is provided in the casing **10**.

The outlet duct for the cleaned fibre is shown at **23** while the outlet duct for the tailings (dust, granular material, etc.) and the air is shown at **25**. The outlet duct **23** discharges into an auto-discharge trap **24** (Figure 2) from which the cleaned fibre is retrieved. The tailings along with the air are fed into a cyclone separator **26** shown in Figure 2 which separates out the tailings and discharges them into another auto-discharge trap **27**, while the clean air is drawn off through duct **28** by the action of the blower **29**. This clean air is discharged through the duct **30**, but it may be used in further operations if desired.

The operation of the embodiment of Figure 1 will now be described and reference will be made to Figures 3 and 4.

The dirty fibre along with a quantity of air is fed to the duct **15** and sucked into the annular space **12** tangentially to the screen **11** through the action of the blower **29** (Figure 2). The dirty fibre will generally follow a helical path as indicated by the arrows **34** in Figure 4 while the air in the annular space **12** will tend to be sucked through the screen **11** and out through the outlet duct **25** as indicated by the arrows **35** in Figure 4. As the air is sucked through the screen **11** it will tend to carry some of the dust and granular material with it. A good deal of the dust and granular material however will be held in the mat of fibres F which will form against the screen **11**. In accordance with the present invention, means are provided for periodically gently lifting this mat and allowing it to fall back against the screen. This gentle lifting and subsequent falling back against the screen will tend to tamp out the duct and granular material which is trapped in the mat. Further, because of the different aerodynamic characteristics of the fibre, on the one hand, and the dust and granular material, on the other hand the latter will tend to fall down and go through the screen before the former has had a chance to reform as a mat. It will be understood that because of the generally helical path **34** of the material in the annular space

12, the mat will tend to move around the screen and towards the left (that is, towards the output) every time it is lifted. In other words, the periodic lifting of the mat of fibres will allow the fibres to follow the helical path **34**.

The baffles **19** as stated hereinabove are rotated at a speed which is in excess of the peripheral speed of the material in the annular space **12**, and are arranged to sweep very close to the inner surface of the screen **11**. The baffles **19** create a back pressure and subsequent movement of air outwardly through the screen in the region immediately in front of the forward surface thereof. The inclined surface **36** (Figure 3) of the baffles **19** aids in effecting this reversal of the air flow through the screen **11**. Further, there will be a region of increased inward pressure and subsequent inward flow of pressure immediately behind the trailing edge **37** (Figure 3) of the baffles **19**. It will be understood that the said reversed air flow will effect the lifting of the mat referred to above, while the said increased inward flow will effect the falling back of the lifted mat. This lifting and falling back will occur each time one of the baffles **19** sweeps close to a predetermined point on the periphery of the screen **11**. Thus, the fibres will follow the helical path **34** until they reach the region close to the outlet duct **23**. In this region, most of the air has passed through the screen **11** so that there is little suction pressure to hold the fibres (which by this time have been cleaned) against the screen and they will tend to fall down into the outlet duct **23**. The damper **31**, which is situated preferably about half-way between the inlet duct **15** and the outlet duct **23**, may be employed to reduce the suction pressure in the event that the fibres still cling to the screen **11** in the region of the outlet duct **23**. It will be appreciated, however, that use of the damper **31** is not essential to the operation of the device.

In Figure 6 there is shown a modification of the embodiment of Figure 1 wherein an impeller **38** having a plurality of blades **39** is arranged in the output end of the apparatus in the annular space indicated at **40** in Figure 4. It will be understood that driving means and shaft means separate from the shaft **16** would be provided so that speed of the shaft of the impeller **38** would not depend directly on the speed of the shaft **16**. The impeller **38** may be employed to supply the suction pressure instead of the blower **29** of Figure 2.

The embodiment illustrated in Figures 5, 7 and 8, and 9 will now be described and like reference characters will be employed to designate parts which are the same as those of the embodiment of Figures 1, 2, 3 and 4. Whenever the parts differ slightly the subscript "*a*" will be used.

In Figure 5, **10***a* represents a cylindrical casing which is similar to casing **10** of Figure 1, except that the cleaned fibre outlet duct **23***a* is located at a different point than the duct **23** of Figure 1. Moreover, the damper **31***a* is slightly different from damper **31** as is apparent from a comparison of Figures 5 and 1.

One difference between the embodiment of Figure 1 and the embodiment of Figure 5 is that in Figure 5 a single baffle **19***a* is employed instead of the two shown in Figure 1. It will be understood, however, that any suitable number of baffles may be employed. In Figure 5 the single baffle **19***a* is balanced by the counterweights **41**.

Another difference is that the screen **11***a* is rotated by means of a pulley **42**, sleeve **43**, and arms **44**. The pulley **42** may be belted to the same motor **22** as pulley **21**, as shown in Figure 8, or if preferred a separate driving means may be employed. In the embodiment of Figure 5, the screen **11***a* is rotated at a speed which is slow compared to the speed of the baffle **19***a*. (It is noted that the rotation of the screen **11***a* is in the same direction as the baffle **19***a*.)

In the embodiment of Figures 5, 7 and 8 the operation of the apparatus is basically similar to that of Figures 1, 2 and 3. The dirty fibre and a quantity of air is fed

through the inlet duct **15***a* and is sucked into the annular space **12** tangentially to the screen **11***a*. It will be apparent from Figures 5 and 8 that the dirty fibre is admitted across the entire length of the screen **11***a* instead of merely the right end thereof as in Figure 1. As the fibre is lifted and redeposited on the screen **11***a* by the action of the baffle **19***a*, it will follow a generally circumferential path around the screen **11***a* instead of the helical path previously described with reference to Figure 4. This circumferential path results from the dirty fibre being applied through the length of the screen **11***a*, and the cleaned fibre being taken off throughout the screen length. Generally, the fibre between admission from duct **15***a* to exit through duct **23***a* will travel only once around through the annular space **12**. In the embodiment of Figure 1 the fibre might travel several times around in the annular space **12** in a helical path before being exhausted.

Since the fibre is being sucked off the screen **11***a*, care must be taken to prevent any appreciable portion of the air, which has passed through the screen **11***a* and which contains the dust and dirt which it is desired to remove from the fibre, from passing outwardly through the screen and out the duct **23***a* with the clean fibre. To prevent this from taking place, the casing **10***a* is curved inwardly at 50 (see Figure 9) so that it clears the screen **11***a* by not more than about ¼". The damper **31***a* is situated immediately below this curving-in, and the duct **23***a* is situated immediately below the damper. The inner ends of the damper **31***a* and the duct **23***a* also extend to within about ¼" of the screen **11***a*. When the damper valve **31***b* is opened, air will flow inwardly through the damper, the screen **11***a* and into the interior of the apparatus; most of this air, however, will short circuit as indicated by arrows **51** and pass outwardly through the screen **11***a* into the duct **23***a*, carrying with it the mat of fibres which is on the screen. Thus very little, if any, of the dirty air from inside the screen **11***a* which originally entered the apparatus with the dirty asbestos feed will find its way into the duct **23***a*.

The tailings and most of the air is exhausted through the duct **25**, as previously, and it will be understood that a cyclone separator such as that shown at **26** in Figure 2 may be used to separate the tailings from the air.

Suction is applied at the outlet duct **23***a* by the action of the blower **45** (Figure 7). A cyclone separator **46** is employed between the outlet duct **23***a* and the blower **45** to separate the cleaned fibre from the air. The cleaned fibre is deposited in the auto-discharge trap **47**.

Access panels through which the screen **11***a* may be inspected are provided at **48** and **49** as shown in Figure 8, and if desired these may be made transparent so that an operator may view the operation taking place in the apparatus.

The following information with respect to the embodiment of Figures 5, 7 and 8 is given to provide a working example:

Inlet (**15***a*) ------	5000 cu. ft./min.
Outlet (**23***a*) ----	2000 cu. ft./min.
Outlet (**25**) ------	3000 cu. ft./min.
Screen (**11***a*) ----	48 inches in diameter—30 inches long, 20 holes per inch—each .026 inch in diameter rotating at 90 R. P. M.
Baffle (**19***a*) -----	rotating at 530 R. P. M.

It will be appreciated, however, that suitable figures must be worked out for each particular case. The above figures are, therefore only indicative of the order of size of the various components, rates of flow and speeds of rotation.

It will also be appreciated that although I prefer, as stated above, to rotate the screen in the same direction as the baffle or baffles, the device will operate satisfactorily if the screen is rotated in the reverse direction, provided the obvious modifications to provide for this are made to the remainder of the apparatus.

What I claim as my invention is:

1. Apparatus for removing dust and granular material from asbestos fibre and the like comprising; a casing of circular cross-section; a foraminous member of circular cross-section mounted within and concentric with said casing, and providing an annular space defined by the foraminous member on the one hand and the casing wall on the other; inlet means for admitting an airstream containing entrained dirty asbestos fibre to said casing for deposit on the outer surface of said foraminous member; outlet means for conducting cleaned asbestos fibre away from said foraminous member; means for withdrawing an airstream and entrained dust and granular material axially from within said foraminous member at one end of said casing; a driven shaft mounted for rotation along the axis of said casing; and at least one generally radial baffle mounted on said shaft for rotation therewith, said baffle extending lengthwise of said foraminous member and being arranged to sweep close to the interior surface thereof; said shaft and baffle being adapted to be rotated by suitable power means.

2. Apparatus as claimed in claim 1, in which said foraminous member is mounted for rotation about the same axis as said baffle and is designed for rotation by suitable power means.

3. Apparatus as claimed in claim 2, in which said inlet means extends lengthwise of said foraminous member and is located at the lower side of the apparatus and said outlet means also extends lengthwise of said screen, and is located above and spaced apart from said inlet means; said apparatus comprising a damper extending lengthwise of said foraminous member and located immediately above said outlet means, said damper and said outlet means extending into the interior of said casing to within close proximity of said foraminous member, and said casing being curved inwardly to within close proximity of said foraminous member to meet the inner extremity of the upper side of said damper; said outlet means being adapted for connection to a source of suction.

4. Apparatus as defined in claim 1, wherein said foraminous member is a screen.

5. Apparatus as defined in claim 4, wherein said casing and said screen are cylindrical.

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