

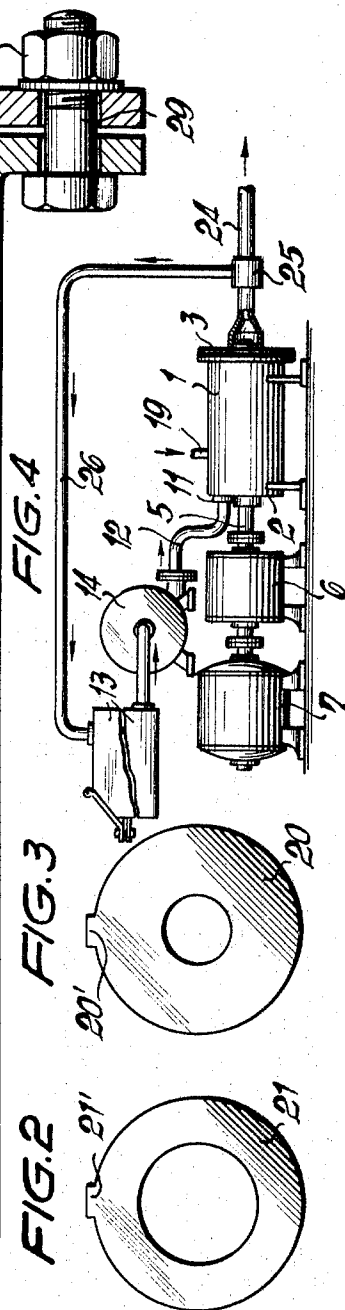
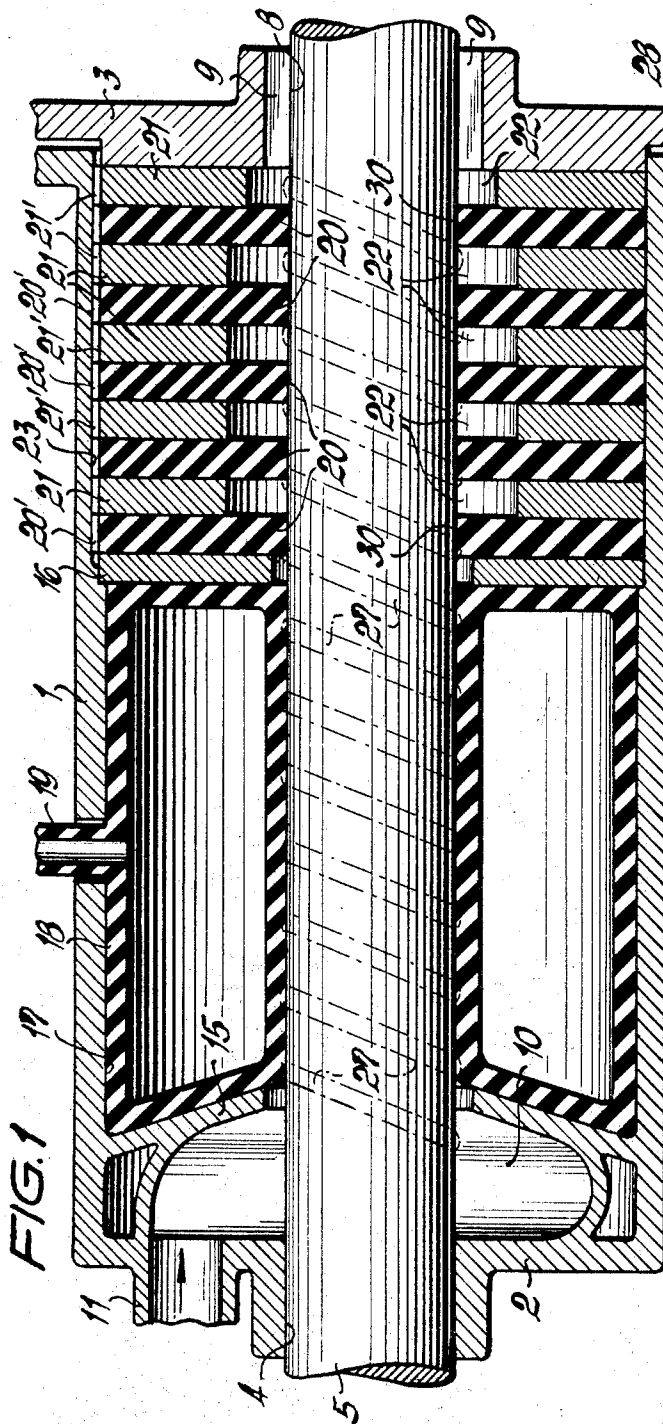
Feb. 18, 1969

K. A. OESTERHELD
APPARATUS FOR DRESSING CRUDE ASBESTOS
SEPARATED FROM THE SOURCE ROCK

3,428,265

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Sheet / of 2



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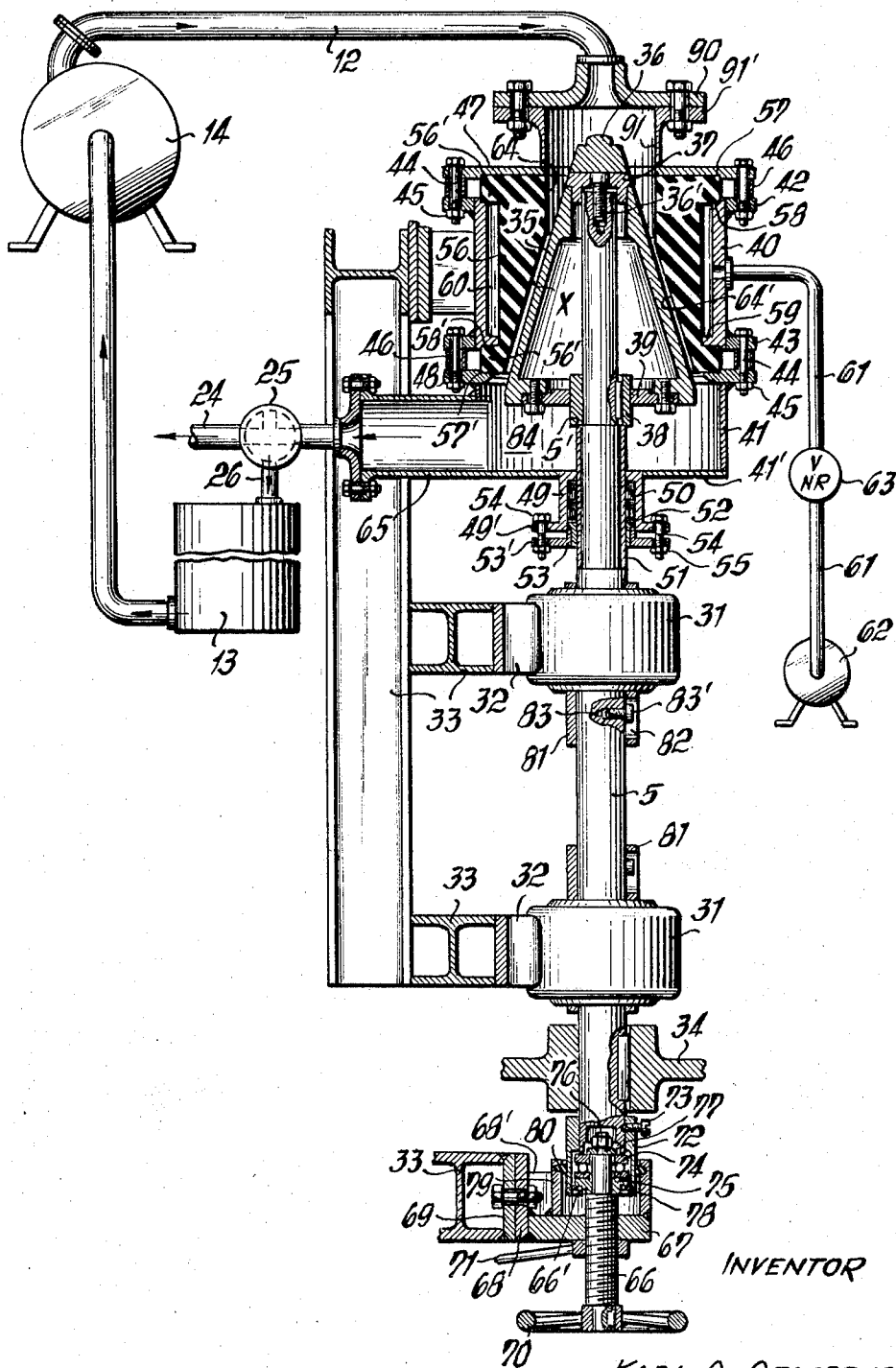
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Sheet 2 of 2

FIG. 5



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1

2

3,428,265 APPARATUS FOR DRESSING CRUDE ASBESTOS SEPARATED FROM THE SOURCE ROCK

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Continuation-in-part of application Ser. No. 413,665,
Sept. 9, 1964. This application Aug. 23, 1966, Ser.
No. 574,425

Claims priority, application Germany, July 20, 1960,
O 7,532

U.S. Cl. 241—259

9 Claims

Int. Cl. B02c 13/26, 25/00

This invention relates to an apparatus for dressing crude asbestos separated from the source rock and is a continuation-in-part of the divisional application, Ser. No. 413,665, filed Sept. 9, 1964, now Patent No. 3,286,940, and embodies improvements in the art thereover.

In my U.S. Patent 3,170,834 a method of opening up fibrous bundles of crude asbestos separated from the source rock is described which enables the fibers hanging firmly together in bundles to be opened up to such a degree of perfection while maintaining the natural length of the fibers and without damaging the structure of the fibers that was not attainable with the previously known dressing methods and apparatuses used in practice. This success is based on the fact that the crude asbestos material suspended in a liquid is forced by means of a pump with controllable hydraulic pressure between the inner wall of a housing and the surface of a motor-driven shaft or a rotor mounted on the shaft along rigid friction surfaces and elastically yielding counterfriction surfaces over a long helical path having a length amounting to a multiple of the length of the fibers and during this operation the fibers are subjected to friction and continuously bent to and fro in constantly varying directions. The frictional effect and bending effect causing the fibers to be completely opened up can be realized by various apparatuses of appropriate construction, e.g. by the apparatus shown and described in my pending U.S. patent application Ser. No. 413,665, which apparatus consists of a conical housing and a conical rotor rotatably mounted in the housing and formed of a plurality of annular rubber disks fixed on a motor-driven shaft.

Practice has shown that the kinds of asbestos varying considerably according to the place of their origin must be subjected in each case to a particular individual treatment when it is intended to achieve the best possible degree of dressing the fibers while meeting at the same time the requirements that the natural length of the fibers should be maintained and the fibers should not be damaged. By controlling the hydraulic pressure with which the fiber-liquid mixture is forced by the feed pump through the dressing apparatus between the rigid friction surfaces and the elastically yielding counterfriction surfaces and/or by varying the speed of the shaft rotatably mounted in the housing, it is not possible to regulate the operation of the dressing apparatus in a fully satisfactory manner. A third possibility of influencing the operation of the dressing apparatus consists in varying the elastic compressibility of the elastically yielding counterfriction surface cooperating with the rigid friction surface in accordance with the respective requirements.

It is the object of the present invention to construct the elastic counterfriction surface in such a way that a change of its elastic compressibility can be effected with

simple means and in a convenient manner and performed any time during the operation of the dressing apparatus.

This object is achieved according to the invention in that a housing of the dressing apparatus accommodates a lining of elastically yielding material which is inflatable with compressed air and in its fully inflated condition engages closely the surface of a shaft or of a rotor mounted on the shaft and a regulating member is fitted in a compressed-air pipe subjecting the lining to the action of compressed air, the operation of which regulating member permits the bearing pressure of the lining against the shaft or the rotor to be adjusted in such a manner that it ensures, in conjunction with the hydraulic feed pressure and with the speed of the shaft, the frictional effect and the intensity of bending necessary for completely opening up the fibrous bundles.

The apparatus for dressing fibers as proposed by the present invention may be used equally well for all kinds of asbestos because the elastic compressibility of the inflatable lining can be very accurately regulated. It saves the purchase and provision of a plurality of apparatuses which can be used only for opening up crude asbestos having particular properties, such as, e.g. short-fibered, medium-fibered or long-fibered crude asbestos, or for asbestos material with a definite thickness of the individual fibers. The arrangement of the inflatable lining provides the advantageous possibility of bringing the elastic counterfriction surface into engagement with the motor-driven shaft expediently equipped with one or several helical flat ribs or with the rotor mounted on the shaft by increasing the internal pressure and without leaving a gap between the engaging parts, after previously the regular passage of the fiber-liquid mixture in a helical flow has been initiated with the lining first inflated to a slight degree only and consequently lifted slightly off the shaft or the rotor.

The inflatable elastic lining, in case it is heavily worn after a long period of use, can be replaced in a simple manner by a new lining without excessively high costs and without the dressing apparatus becoming unserviceable for a longer period of time.

The rotor co-operating as a rigid rotating friction surface with the inflatable lining acting as elastically yielding counterfriction surface may be of solid construction or constructed as a hollow body in cylindrical form or in the form of a truncated cone. The inner wall surface of the inflatable lining must in any case be such that the lining in its inflated condition tightly encloses the rotor at least with a section of its inner wall surface.

In some kinds of asbestos the best degree of opening up the fibers is achieved when the fibrous bundles are first subjected to a less heavy rubbing and bending action and subsequently submitted to an intensified after-treatment. To be able to carry out also such manner of treatment with the dressing apparatus as proposed by the invention, the invention further suggests to arrange a packet of annular disks in the housing on the downstream side of the inflatable lining surrounding the shaft equipped with one or several helical flat ribs, which packet of annular disks is composed of rigid annular disks with a bore diameter greater than the diameter of the shaft and yieldable annular disks of elastic material, such as, e.g. rubber, with a bore diameter equal or approximately equal to the diameter of the shaft, the rigid annular disks being ar-

ranged so as to alternate with the yieldable annular disks thereby to form annular chambers.

The bearing pressure of the annular rubber disks against the shaft can be varied in a range which is, however, not very wide by tightening to a more or less great extent screws which connect a cover of the housing to the body of the housing, thus increasing or reducing the pressure exerted by the cover on the annular disks of the packet of annular disks, whereby an appropriate bearing pressure of the annular rubber disks against the shaft is obtained. In this case it is, of course, not possible to regulate the bearing pressure as accurately as in the case of the elastically yielding inflatable lining, but this is not necessary for the intensified after-treatment of the asbestos fibers which are in part already opened up by the inflatable lining.

Two embodiments of the invention will now be described by way of example and with reference to the accompanying drawings, in which:

FIG. 1 is a diagrammatic longitudinal section through a first embodiment of the dressing apparatus according to the invention having an inflatable lining directly enclosing the motor-driven shaft and further having a second functional part for the intensified after-treatment of the fibers arranged on the downstream side of the lining;

FIGS. 2 and 3 are diagrammatic side elevational views, on a reduced scale, of component parts of the apparatus of FIG. 1;

FIG. 4 is a diagrammatic view of a plant in which the fiber-liquid mixture is circulated several times through the dressing apparatus of FIG. 1, and

FIG. 5 is a diagrammatic longitudinal section through a second embodiment of the dressing apparatus having an elastically yielding inflatable lining which encloses a conical rotor.

In all the figures all similar or similarly acting parts are designated by the same reference numerals.

In FIG. 1, reference numeral 1 designates a horizontally arranged elongated housing of a dressing apparatus which has on the left-hand side of this figure a rigid end wall 2 and is closed on the right-hand side by a screwed-on-cover 3. In a central bore 4 in the end wall 2 a rigid shaft 5 is rotatably mounted which extends through the entire length of the housing 1. As shown in FIG. 4, the end of the shaft 5 projecting beyond the end wall 2 is connected to an electric motor 7 through the intermediary of a variable intermediate gear 6 and can be driven at an adjustable speed. The other end of the shaft passes through a central bearing bore 8 in the cover 3. Longitudinal channels 9 are formed in the bearing bore 8 for the discharge of the fiber-liquid mixture from the dressing apparatus.

Behind the end wall 2 (FIG. 1) there is an annular chamber 10 which is open towards the shaft 5. This annular chamber 10 communicates with a container 13 (FIG. 4) by means of a connecting piece 11 and a pipe conduit 12 connected thereto, which container 13 accommodates asbestos material to be dressed mixed with water or any other suitable liquid. In the pipe conduit 12 a feed pump 14 is arranged which feeds, in the arrowed direction, the asbestos material suspended in liquid into the annular chamber 10 under high pressure.

Between two partition walls 15 and 16, of which the partition wall 15 shown on the left of FIG. 1 and extending at an incline to the shaft 5 forms part of the wall surrounding the annular chamber 10, there is a space 17 for receiving an inflatable hollow body 18 of annular cross-section and made from rubber or rubber-like material. The annular hollow body 18 is inflated by means of a connecting piece 19 passing through the wall of the housing 1 and fitted with a manually regulable check valve (not shown in FIGS. 1 and 4 of the drawings), to such an extent that the cylindrical inner wall of the annular hollow body 18 bears tightly against the shaft 5. The inflation pressure must be so adapted to the

pressure produced by the feed pump 14 that the latter is capable of forcing the fiber-liquid mixture slowly between the cylindrical inner wall of the annular hollow body 18 and the shaft 5 in the direction towards the other end of the shaft thereby pushing back the elastically yieldable cylindrical inner wall of the inflated annular hollow body 18.

As the shaft 5 rotates during this operation, the fiber bundles passing between the shaft 5 and the elastically yieldable hollow body 18 are divided up into separate fibers in a gentle manner by friction and the individual separated fibers are continually bent to and fro on the surface of the shaft 5 as they continue to pass through the narrow gap between the cylindrical inner wall of the annular hollow body 18 and the shaft 5.

The bending movement is caused by the fact that the cylindrical inner wall of the annular hollow body 18, under the influence of the feed pressure, is not lifted continually the same distance from the shaft 5 at all points of its cylindrical surface but is pressed-in more strongly at some places than at others, whereby the strongly pressed-in places change continually. As a result, the fibers are alternately subjected to the feed pressure moving them along the shaft 5 and to the peripheral force of the revolving shaft 5 acting transversely to the longitudinal direction of the shaft, so that the fibers are continually turned and twisted during the rotary movement of the shaft and thereby continually bent to and fro over their entire length in constantly varying directions.

In the example illustrated in FIG. 1, the apparatus is equipped not only with dressing or working elements as described above in a first functional part but also with working elements by which the rigid shaft 5 also cooperates with elastically yieldable counter pressure elements arranged in a second functional part. This second functional part is separated from the first functional part by the partition wall 16 removably fitted in the housing 1 and surrounding the shaft 5 with clearance. Between the partition wall 16 and the cover 3 screwed on to the housing 1 a packet of annular disks 20, 21 is clamped. This packet consists of alternately arranged rubber disks 20, the bore diameter of which is so dimensioned that these disks fit closely around the shaft 5 or extend up to the shaft leaving only a small annular slit up against the shaft, and of rigid annular disks 21 made, for example, of metal and having a bore diameter which is considerably larger than the diameter of the shaft, so that annular spaces or chambers 22 are formed between these annular disks 21 and the shaft 5. The annular disks 20 and 21 are not axially shiftable in the housing 1 by means of the screwed-on cover 3 and secured against rotation in that they are provided, as shown in FIGS. 2 and 3, with noses 20' and 21', respectively, which project from their periphery and are slipped into a longitudinal groove 23 in the inner wall surface of the housing 1 (FIG. 1).

The fiber-liquid mixture passing through the central bore in the partition wall 16 into the second functional part of the dressing apparatus is forced through the small annular slit of the first rubber disk 20, whereby the fibers are subject to strong friction. On entering the annular chamber 22 adjoining the first rubber disk 20, the fibers turning upwards are bent and relieved in the annular chamber 22. The fiber-liquid mixture pressing forward conveys the fibers with the liquid surrounding them past the next rubber disk 20 into the annular chamber 22 following it, whereby the fibers are again subjected to strong friction and on entering the next annular chamber 22 are bent. This procedure is repeated at each successive rubber disk 20 and annular chamber 22.

The fiber-liquid mixture is forced out of the last annular chamber 22 through the already mentioned channels 9 in the bearing bore 8 in the cover 3 into a pipe conduit 24 (FIG. 4) in which it is conveyed to a further treatment stage, for example, a drying place, or is returned through a two-way cock 25 arranged in the pipe conduit 24 and a branch conduit 26 into the container 13 from which the

5

fiber-liquid mixture is again forced into the dressing apparatus by the feed pump 14. Thus the fiber-liquid mixture can be fed once or in repeated circulation through the dressing apparatus until the fiber bundles are completely loosened up in the desired manner.

As indicated in dot and dash lines in FIG. 1, the shaft 5 can have one or several ribs 27 extending in a helical line and assisting in bending the fibers to and fro when the latter slide over the ribs in their forward movement under the feed pressure.

When a kind of asbestos material is concerned in which the individual fibers do not stick together too tightly or are very sensitive, it is recommendable to use only that functional part of the dressing apparatus which has the inflatable hollow body inserted therein. For this purpose either the annular disks 20 and 21 may be removed from the housing 1 or a dressing apparatus may be used which has only the inflatable hollow body 18 inserted therein. In each case the hollow body 18 will be inflated only to a slight extent at the commencement of the opening-up operation in order to first initiate the helical circulating movement of the fiber-liquid mixture in the apparatus and subsequently, by operating the regulating member in the compressed-air pipe leading to the hollow body 18, the internal pressure in the hollow body and consequently the bearing pressure of the cylindrical inner wall of the hollow body 18 against the shaft 5 can be so adjusted to the hydraulic pressure with which the fiber-liquid mixture is conveyed by the feed pump 14 through the dressing apparatus and to the speed of the shaft 5 that the fibers of the crude asbestos material will be completely separated from one another but not shortened and not damaged in their structure.

The operation of the second functional part of the dressing apparatus containing the rigid annular disks 21 and the annular rubber disks 20 can be adjusted only to a limited extent by tightening more or less strongly nuts 28 on bolts 29 connecting the cover 3 with the housing 1. This causes the walls 30 of the holes in the annular rubber disks 20 to be pressed more or less strongly against the shaft 5.

For the proper function of the dressing apparatus it is immaterial whether it is provided with a horizontal shaft as shown in FIG. 1 or with an upright shaft.

FIG. 5 shows an apparatus for dressing crude asbestos which has a vertically disposed shaft 5 rotatably mounted in two bearings 31. The bearings 31 are mounted by means of lateral trestles 32 to I-rails 33 of a supporting structure. The shaft 5 is driven through the intermediary of a belt pulley 34 only part of which is shown in the drawing and which is connected to a variable speed gear of known construction (not shown). Arranged on the free end of the shaft 5 is a rotor 35 consisting of a metallic hollow body and secured to the shaft 5 by a headpiece 36 of hardened steel. The headpiece 36 is screwed with a threaded shank 36' into a central tapped hole in the shaft 5 and presses by means of an interposed sleeve 37 in axial direction against the body of the rotor 35, so that a hub 38 of an annular disk 39 to which the rotor 35 is fastened by means of screws and which forms the end wall at the broader base of the conical hollow body, bears heavily against a shoulder 5' on the shaft 5.

The rotor 35 is surrounded by a housing. The housing consists of a two-part cylindrical wall, the one part 40 of which has a substantially greater wall thickness than the other part 41. To the two ends of the part 40 of the wall of the housing flanges 42 and 43 are welded. An annular disk 47 is fastened to the upper flange 42 in FIG. 5 by screw bolts 44 and nuts 45 with the interposition of spacers 46 supporting the annular disk, which disk forms the upper end wall of the housing. Connected to the flange 43 of the part 40 of the wall also by screw bolts 44 surrounded by spacers 46 and nuts 45 is a counterflange 48 which is welded to the part 41 of the cylindrical wall of the housing which is of smaller wall thickness and has an end wall 41' firmly connected

6

thereto by welding. A hub 49 fixed in a central bore in the end wall 41' of the housing by welding serves for the reception of a stuffing-box packing 50 composed of a plurality of rings consisting of tallow cords or the like. The section of the shaft 5 positioned in the region of the stuffing-box packing 50 is provided with a bushing 51 protecting this section of the shaft.

Arranged in front of the stuffing-box packing 50 are a sleeve 52 and a packing gland 53, the latter being provided with an outer flange 53' which is connected by screw bolts 54 and nuts 55 to a counterflange 49' on the hub 49. By tightening the bolt nuts 55 the packing gland 53 permits in a known manner to readjust the stuffing-box packing 50 when the passage for the shaft in the stuffing-box packing is no longer entirely leakproof.

The relatively large free annular space between the conical outer wall surface of the rotor 35 and the cylindrical inner surface of the part 40 of the cylindrical wall of the housing is filled by a thick-walled rubber lining 56. The rubber lining is so shaped at its two ends as to form radially projecting collars 56'. The collar 56' situated at the upper end of the lining 56 in FIG. 5 engages in a recess 57 on the inner side of the end wall 47 and in a recess 58 in the end face of the part 40 of the wall of the housing and is tightly clamped between the end wall 47 and the part 40 of the cylindrical wall of the housing. Similarly, the collar 56' at the other end of the rubber lining 56 is held in recesses 58' and 57' in the lower end wall of the part 40 of the cylindrical wall of the housing and in the flange 48 so as to be non-rotatable and axially and radially unshiftable. In this example the rubber lining 56 is additionally secured against axial and radial shifting by a flange 59 on the inner side of the part 40 of the cylindrical wall of the housing and by an internal extension of the flange 48.

The outer wall surface of the rubber lining 56 between the end collars 56' is freely spaced from the inner wall surface of the part 40 of the cylindrical wall and defines, together with this part 40, an elongated narrow annular space 60. The annular space 60 communicates with a compressed-air pipe 61 which is connected to a bore formed in the central region of the part 40 of the wall of the housing. The compressed-air pipe 61 extends from a compressed-air source, e.g. from an air compressor 62, and a manually operable regulating member 63 which is constructed as a check valve is fitted in the compressed-air pipe 61, the operation of which regulating member permits the air pressure acting on the rubber lining 56 to be regulated as desired.

In FIG. 5 the rubber lining 56 is shown in a condition in which it is not yet subject to the action of compressed air. In this case a section 64' of the inner wall surface 64 of the rubber lining 56 which is of conical shape to conform to the conicalness of the outer wall surface of the rotor 35 is positioned opposite to the outer wall surface of the rotor 35 at a free distance therefrom. The narrow conical annular gap x facilitates setting the dressing apparatus going in so far as not too great a resistance counteracts the stream of the fiber-liquid mixture. As soon as the fiber-liquid mixture is imparted the desired flow corresponding to a helical course, compressed air is admitted into the annular space 60. This causes the rubber lining 56 to be curved inwardly and to be pressed with the conical section 64' of its inner wall surface against the outer wall surface of the rotor 35 without leaving a gap. Regulating the amount of the compressed air acting on the rubber lining 56 permits the bearing pressure of the lining against the rotor 35 to be varied as desired and to be regulated in such a manner as is required in view of the hydraulic pressure with which the fiber-liquid mixture is forced by the pump 14 through the dressing apparatus and in view of the speed of the shaft 5 required to open up the crude asbestos material in the best possible manner.

The fiber-liquid mixture is, in a similar manner as in

the dressing apparatus according to FIG. 1, sucked by the motor-driven feed pump 14 out of a storage container 13 and conveyed through the pipe conduit 12 which is connected by a flanged joining piece 90 to a connection piece 91 welded to the upper end wall 47 of the housing and provided with a flange 91', into the dressing apparatus at the upper end thereof. After the fiber-liquid mixture has been forced through between the conical inner wall surface of the rubber lining 56 blown up inwardly by compressed air and the conical outer wall surface of the rotor 35 rotated by the shaft 5, it passes into a chamber 84 of the housing constituted by the parts 47, 40, 41 and 41', which chamber is situated below the great base circle of the conical rotor 35 closed by the annular disk 39. The fiber-liquid mixture then leaves the chamber 84 through a lateral connection piece 65 on the housing to flow either through the pipe conduit 24 to a further processing station or through the two-way cock 25 and the pipe conduit 26 back to the storage container 13.

The conical section 64' of the inner wall surface of the rubber lining 56, which constitutes the working surface of the rubber lining, is subjected during the operation of the dressing apparatus to unavoidable abrasion wear. Therefore, a device is provided by means of which the shaft 5 can be readjusted in axial direction in accordance with the respective degree of wear of the rubber lining.

The readjusting device consists of a threaded spindle 66 which is screwed into a tapped hole in a plate 67. The plate 67 is welded to a plate 68 disposed perpendicularly to the plate 67 and having a longitudinal rib 68', which plate 68 in turn is screwed to a plate 69 welded to a rail 33 of the supporting structure. A handwheel 70 is fixed and a locking lever 71 screwed on the free end of the spindle 66. When, by operating the handwheel 70, the shaft 5 has been brought into a position in which the conical section 64' of the inner wall surface 64 of the rubber lining 56 not yet acted upon by compressed air has the proper spacing from the outer wall surface of the conical rotor 35, the locking lever 71 is screwed upwardly against the plate 67 and thereby the shaft 5 locked in its adjusted position.

The threaded spindle 66 is connected to the shaft 5 by a ring 72 which is fixed on the lower end of the shaft 5 by a cylindrical head screw 73. Accommodated in an enlarged section of the bore in the connecting ring 72 are the outer edges of the two races of a thrust ball bearing 74 and the outer edge of a stepped spacer 75 by means of which the ball bearing 74 is supported against a shoulder 66' on the threaded spindle 66. A castle nut 76 screwed on the upper threaded section of the spindle 66 of reduced diameter holds, with the aid of an annular disk 77, the ball bearing 74 and the spacer 75 in position on the spindle 66 so that they are axially unshiftable. Formed in the enlarged section of the bore in the connecting ring 72 in a place below the radially projecting portion of the spacer 75 is an annular groove in which a spring ring 78 is inserted which fixes the ball bearing 74 and the spacer 75 on the connecting ring 72.

The lower half of the connecting ring 72 is surrounded by a cylindrical housing 79 which is welded to the plate 67 and to the longitudinal rib 68' of the plate 68. A felt sealing ring 80 inserted in the housing 79 prevents dirt and moisture from getting to the parts of the adjusting device mounted within the connecting ring 72.

For limiting the axial adjustability of the shaft 5, two slide rings 81 are arranged on the shaft which bear against different sides of the two bearings 31. Each slide ring 81 has an opening 82 which is in the form of an oblong hole and in which the cylindrical head 83' of a cylindrical head screw 83 screwed into the shaft is positioned. When the head 83' of the cylindrical head screw 83 butts against the one end or the other end of the opening 82 in the slide ring 81, the shaft 5 has reached during its adjusting movement its extremely advanced position or its extremely retracted position.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive.

I claim:

1. An apparatus for dressing crude asbestos separated from the source rock and being in the form of fibrous bundles suspended in a liquid, comprising a housing, an inlet on said housing for admitting the fiber-liquid mixture into said housing, an outlet on said housing for discharging the fiber-liquid mixture from said housing, a motor-driven shaft rotatably mounted within said housing, a rigid working surface on said shaft, a lining of elastically yielding material inflatable with compressed air in said housing fixedly held on the wall of said housing and closely engaging said working surface on said shaft when in fully inflated condition, a regulable feed pump for forcing with a controllable hydraulic pressure the fiber-liquid mixture admitted through said inlet into said housing in a circulating flow between said rigid working surface on said shaft and a counterfriction surface of said lining while subjecting the fibers to friction and continuously bending them in constantly varying directions, and for conveying the fiber-liquid mixture to said outlet on said housing, a compressed-air pipe for subjecting said lining to the action of compressed air, and a regulating member fitted in said compressed-air pipe and permitting, when operated, the bearing pressure of said lining surrounding said working surface on said shaft to be adjusted to the frictional effect and the intensity of bending the fibers which result in completely opening up the fibers.

2. An apparatus as claimed in claim 1, wherein the rigid working surface on the shaft is constituted by the surface of the shaft.

3. An apparatus as claimed in claim 1, wherein the rigid working surface on the shaft is constituted by the outer wall surface of a rotor which is mounted on the shaft.

4. An apparatus as claimed in claim 1, wherein the inflatable lining consists of rubber.

5. An apparatus as claimed in claim 2, wherein the housing is cylindrical, a removable partition wall is provided in the housing the inflatable lining is in the form of an annular tube and is inserted in the housing so as to engage with its outer wall surface the inner surface of the wall of the cylindrical housing and a connecting piece is provided on the inflatable lining for the connection of the compressed-air pipe, which connecting piece extends through a bore in the wall of the housing.

6. An apparatus as claimed in claim 5, wherein at least one helical flat rib is provided on the shaft, the inflatable lining in the form of an annular tube surrounds the shaft with a smooth inner wall surface, a packet of annular disks is arranged in the housing on the downstream side of the inflatable lining, the packet of annular disks is composed of rigid annular disks with a bore diameter greater than the diameter of the shaft and yieldable annular disks of elastic material with a bore diameter approximately equal to the diameter of the shaft, the rigid annular disks are arranged so as to alternate with the yieldable annular disks thereby to form annular chambers, a cover closes the housing on one side and presses against the packet of annular disks, screw bolts are provided to connect the cover to the housing and nuts are screwed on the screw bolts and permit the bearing pressure of the walls of the holes in the yieldable annular disks against the shaft to be regulated by appropriately tightening the nuts on the screw bolts.

7. An apparatus as claimed in claim 6, wherein the yieldable annular disks consist of rubber.

8. An apparatus as claimed in claim 3, wherein the inflatable lining is in the form of a thick-walled solid annular body with collars at both ends, the housing has a cylindrical wall composed to two wall sections of dif-

ferent wall thicknesses, two flanges are formed on the two ends of the wall section of increased wall thickness, one flange is formed on the wall section of smaller wall thickness which forms an extension of the wall section of increased wall thickness and two end walls close the housing at the two ends thereof, the inflatable lining being clamped with its end collars within the section of the cylindrical wall of the housing of increased wall thickness between the flange on the one end of the wall section of increased wall thickness and the end wall at one end of the housing and between the flange on the other end of the wall section of increased wall thickness and the flange on the wall section of smaller wall thickness.

9. An apparatus as claimed in claim 8, wherein the

rotor has a conical outer surface and only a section of the smooth inner wall surface of the inflatable lining inserted in the housing is of conical shape to conform to the conical outer surface of the rotor surrounded by the lining.

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