Feb. 23, 1965 K. A. OESTERHELD 3,170,834

METHOD OF DRESSING CRUDE ASBESTOS

Filed July 18, 1961

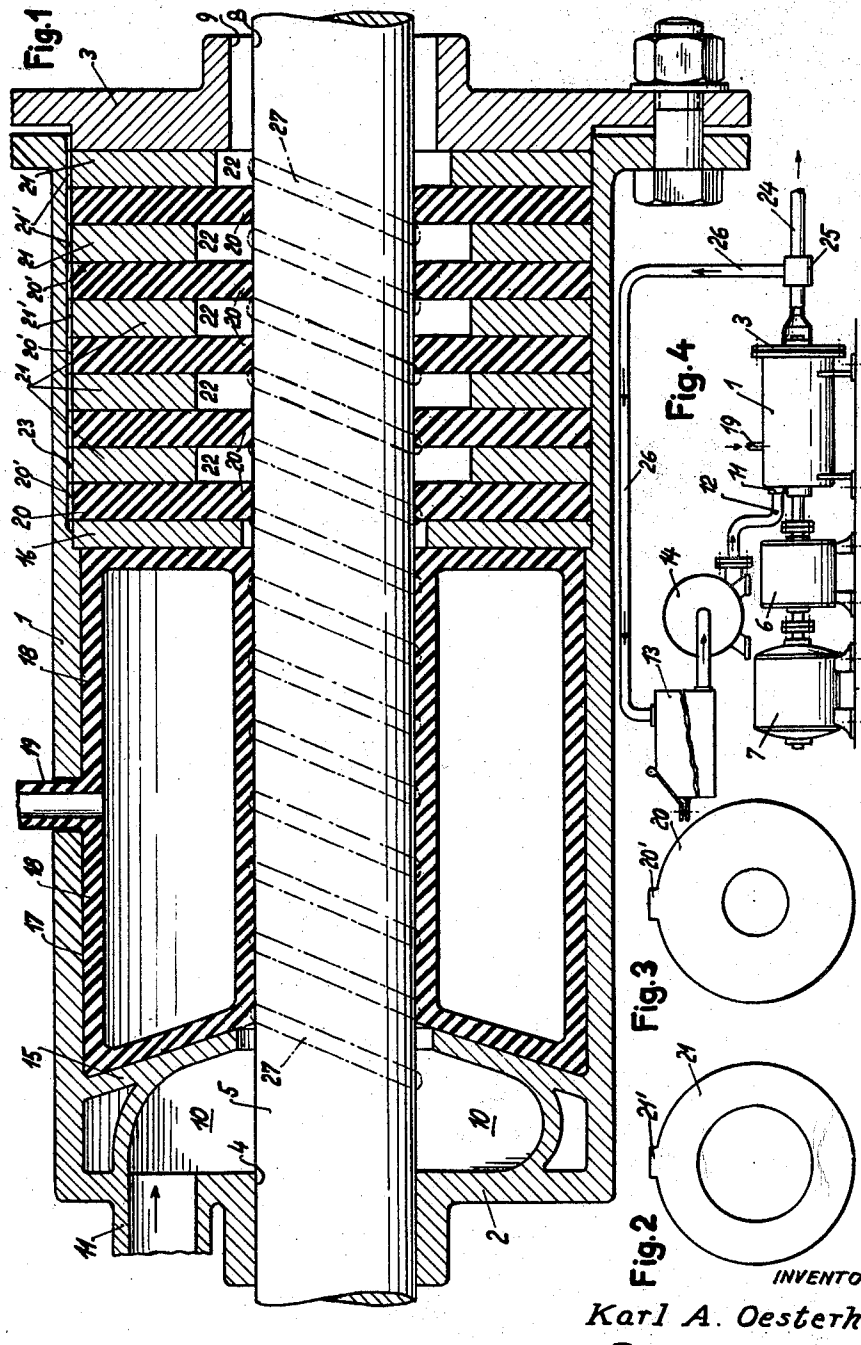


Fig. 1

Fig. 4

Fig. 3

Fig. 2

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United States Patent Office 3,170,834 Patented Feb. 23, 1965

3,170,834

METHOD OF DRESSING CRUDE ASBESTOS

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Filed July 18, 1961, Ser. No. 124,923
Claims priority, application Germany, July 20, 1960, O 7,532; May 10, 1961, O 8,052; May 15, 1961, O 8,060

1 Claim. (Cl. 162—3)

Asbestos is a raw material occurring at relatively few places throughout the world and its quality differs considerably according to the district where it is to be found. The main factor which determines the quality was hitherto the natural length of the fibres bundled together in the raw state. The price of long-fibred asbestos material is many times that paid for short-fibred asbestos material.

For producing articles from asbestos cement, namely pipes, plates and moulded bodies which must have the strength factors laid down by international standards one was hitherto dependent upon long-fibred asbestos material; short-fibred asbestos material, such as for example material known internationally under the designation "6" and "7," can only be used as filling material if it is added in not too large quantities by weight to high-grade long asbestos fibres.

The dressing of crude asbestos, the individual fibres of which hang together in bundles, was hitherto carried out in pug mills, beater mills, hollow mills, centrifugal mills, so-called disintegrators. Although the asbestos material is subject to robust treatment in the known dressing apparatus, whereby the fibres are destroyed and shortened to a great extent, it is not possible to open up the fibre bundles to such an extent that the fibres are even approximately separated from each other. If the treated crude asbestos and the products made therefrom are carefully examined it will be found that the asbestos fibres still hang together in bundles. This fact, which considerably impairs the strength and uniformity of the structure of the asbestos cement product, is due to insufficient dressing of the crude asbestos material.

In view of the above-mentioned knowledge, the technical problem arises of finding a way of dressing the asbestos material in a more satisfactory manner. It was not possible to carry out the dressing with more vigorously acting means than those hitherto used for the conventional method of dressing, because this would subject the asbestos fibres to still greater danger of being damaged and destroyed than was the case with the methods of dressing hitherto employed.

It is the object of the present invention to provide an efficient method for dressing crude asbestos for the production of asbestos cement products, asbestos spun products, and synthetic compositions containing asbestos for floor coverings and the like, which comprises the steps of suspending in a liquid the crude fibrous material hanging together in bundles, and forcing the fibre-liquid mixture between working surfaces with controllable pressure thereby subjecting the fibres to friction and bending.

It is essential for this method and success attained therewith, that the bundled adhering fibre material is subjected to strong rubbing action and at the same time bent several times in different directions. It has been found in practice that it is possible in this way to increase the volume of a certain quantity of crude asbestos material to double its bulk or to reduce the weight by unit of volume to about half that attainable with the methods of dressing hitherto customary.

The fibre material dressed by the method according to the invention, represents an absolutely uniformly loosened or opened up fibrous mass which, owing to exceptionally high capability of the fibres felting or becoming

matted, corresponds to the ideal state of the fibre material required for producing articles from asbestos cement and which is moreover also excellently suitable for the production of asbestos spun products and asbestos boards.

A test of the asbestos fibres dressed according to the method forming the subject matter of the invention for preparing articles from asbestos cement has unexpectedly shown that it has now become possible to make asbestos cement products which comply with or even exceed the strength factors prescribed by international standards for asbestos cement products without adding longer asbestos fibres that is solely from the asbestos fibres prepared according to the invention which possess at the most the quality of the fibres "6." This means an extraordinarily great technical advance for the asbestos cement industry in that, owing to the saving in expensive long-fibred asbestos material, the costs of production are considerably reduced and in addition the final producets are far more homogeneous than those which were produced from a mixture of long, medium and short-fibred asbestos material.

It is generally known in the asbestos working industry that when dressing crude asbestos the place of origin of the raw material, which is primarily in Russia, Canada, Africa, Australia, Cyprus and Italy, must be taken into consideration because the chemical and crystalline structure, the fibre structure, the fibre length and the tensile strength of the fibres differ very considerably. For this reason asbestos of different origins are individually dressed according to different methods.

These experiences have been confirmed in carrying out the method of dressing according to the invention in actual practice and it has been found that for the bending and rubbing of the asbestos fibres, which is necessary for satisfactorily opening up the fibre bundles, it is sufficient in the case of crude asbestos with strong fibres, to press the bunched cohering fibre material suspended in a liquid, between rigid working surfaces with controllable feed pressure of the fibre-liquid mixture and friction and flexure of the fibres, while on the other hand it is advisable in the case of crude asbestos with delicate fibres, to feed the fibre-liquid mixture between rigid working elements and elastically yieldable counter elements with adjustable friction and flexure of the fibres. This manner of treatment ensures that each individual fibre is separated from neighbouring fibres without being torn and without changing its structure and natural length.

For effecting the best possible opening up of the fibres it is advantageous to feed the fibre-liquid mixture either in one or more passes through the same depressing apparatus or through different dressing apparatus connected up in series, whereby also in this case the material can be passed several times through one or other of the apparatus.

As a rule it is desired for shortening the period of dressing to exert the most extensive possible friction on the asbestos fibres. For this purpose it is advisable in many cases to add to the fibre-liquid mixture a friction-increasing substance, such as for example sand, finely ground quartz, finely ground asbestos blende, cement or the like or a mixture of several of these substances. The friction-increasing substance or mixture of substances is worked with the dressed fibre material to form the asbestos cement finished products.

In developing this inventive idea the entire quantity of cement required for making the asbestos cement finished products can be added to the fibre-liquid mixture already before the treatment of the fibres. If, for example finely ground quartz or finely ground asbestos cement blende is added to the fibre-liquid mixture when dressing crude asbestos, a considerable saving of cement (about 10% of the quantity of cement required without these filling

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substances) is achieved. This has the effect on the one hand of lowering the cost of the finished products and on the other hand of considerably improving the elasticity of the finished products.

The idea of adding one or several admixture substances to the fibre-liquid mixture from the outset can be utilized with advantage also when adding pigments for colouring the fibre material. The fibre material already thoroughly dyed in the dressing process results in a very uniform colouring in the finished products.

When carrying out the method according to the invention apparatus of different kinds can be employed depending upon the kind of crude asbestos to be dressed. For opening up or breaking up crude asbestos with robust fibers between rigid working surfaces, a device comes into question, for example, in which in a conical housing with a rigid inner working surface a correspondingly conical rigid working body with spiral protrusions on a mechanically driven shaft is so arranged that between the inner working surface of the housing and the surface of the conical working body there is a narrow passage gap in the shape of a hollow truncated cone.

By this arrangement a particularly favourable dressing of the fibre material is attained in that the fibre-liquid mixture in the passage gap, which is preferably made adjustable in width, is first fed with slow peripheral speed which then becomes gradually greater between the closely adjacent rigid working surfaces of the conical housing and the conical working body, thereby undergoing thorough vorticity so that the fibres are subjected to torsional effect.

A continuous bending to and fro and vigorous rubbing of the fibres against the rigid working surfaces can, however, also be attained with a particularly simple dressing apparatus which consists of a stationary pipe coil preferably arranged with a vertically upright longitudinal axis and which can be suitably adapted in length, radius and free passage cross-section, and which is connected up to the delivery side of a feed pump the speed of rotation of which is adjustable. The special advantages of such a dressing apparatus are its constructional simplicity, as it has no rotating driven parts, the reliable operation resulting therefrom and the low rate of mechanical wear. The upright arrangement of the pipe coil presents operational advantages as regards simple emptying and flushing out of the pipe coil.

For the gentle treatment of crude asbestos with delicate fibres between rigid working elements and elastically yieldable counter pressure elements, an apparatus is suitable in which a conical working body composed or having at least a surface layer of rubber or elastically compressible plastic substance is arranged on a shaft mechanically driven with variable speed of rotation and so mounted in a conical housing that its wall surface and the rigid inner working surface of the housing enclose a narrow passage gap in the shape of a hollow truncated cone.

At the same time a continuous to and fro bending and vigorous friction of the bundles of fibres and of the fibres gradually becoming loosened from the bundles of fibres, are attained in that the fibre-liquid mixture is fed through the passage gap of truncated conical shape between the rigid inner working surface of the conical housing and the elastically yieldable conical wall surface of the correspondingly conical working body with gradually increasing peripheral speed the further the fibre-liquid mixture approaches the end of the conical working body having the large base surface. The fibre-liquid mixture is thoroughly whirled during this feeding movement and as a result the fibre bundles and the individual fibres are repeatedly bent to and fro in different directions and at the same time a torsioning of the fibres is attained while carefully dressing the fibre material, which is extremely favourable for opening up the fibres.

An elastically compressible working body can with advantage be composed of a packet of annular disks of rubber or elastic material clamped on the shaft immediately in contact with each other. For working less sensitive fibres, however, an apparatus is also suitable in which the working body consists of a metal body or a metallic hollow body with a coating of rubber or elastically compressible synthetic material.

In order to increase the frictional effect, the inner working surface of the conical housing may be provided with depressions extending all around.

It is advantageous to coordinate to the conical working body a sleeve which is adjustable and fixable in the longitudinal direction of the shaft in order to vary the width of the passage gap. To enable the adjustment of the conical working body when the dressing apparatus is in operation, a hand-wheel may be screwed onto a screw-threaded section of the shaft outside the housing and, on being operated, moves the sleeve carrying the conical working body backwards and forwards on the shaft.

To ensure reliable working of the dressing apparatus it is advisable to coordinate with the conical working body fixed on the shiftable sleeve, a pressure spring which holds it in its operative position so that it can yield resiliently. If foreign bodies, such as unground clinker, pieces of asbestos blende, stones, pieces of iron or the like get into the passage gap with the fibre-liquid mixture, the conical working body will then yield and the passage gap be temporarily widened so that the foreign body can pass through the gap.

The devices for adjusting the width of the truncated conical passage and for the resilient yielding of the conical working body can with advantage be combined by the arrangement of two sleeves on the shaft, one of which sleeves carries the conical working body and the other sleeve is in operative connection with the hand adjusting wheel, whereby the last-mentioned sleeve has a flange serving as supporting surface for a pressure spring, which pushes forward the conical working body into operative position, and for guiding bolts fixed on a plate holding the conical working body and welded on the shiftable sleeve, said bolts being provided with abuntment nuts on screw threads at their free ends.

In a preferred embodiment of the invention the end of the shaft carrying the shiftable sleeve with the conical working body is exposed and provided with a conical headpiece of hardened steel in the region of the point of the conical housing where the fibre-liquid mixture enters the passage gap. The exposed arrangement of the end of the shaft carrying the elastic working body contributes, on the one hand, to trouble-free working of the dressing apparatus when foreign bodies accidentally get into the truncated conical passage gap and, on the other hand, facilitates the assembly and cleaning of the dressing apparatus. The conical steel headpiece keeps excessively large foreign bodies away from the passage gap and thus protects the dressing apparatus against damage without itself being liable to damage by large foreign bodies.

In order to feed the fibre-liquid mixture to the truncated conical passage gap in a constant uniform stream, the housing may be constructed in the shape of a double cone the apices or small base surfaces of the two cones being placed together, while the one conical part surrounds the conical working body and the other conical part forms a chamber for the fibre-liquid mixture introduced under pressure.

If the crude asbestos material has to be treated particularly carefully in view of the delicacy of the individual fibres, it is advisable to employ an apparatus in which a shaft rotatably mounted inside a cylindrical housing and connected to an adjustable drive, is surrounded by an elastically yieldable lining, capable of being inflated with compressed air, and/or by a packet of annular disks, in which rigid annular disks with a bore diameter which is greater than the diameter of the shaft alternate with annular disks of elastically yieldable material, such as rub-

ber, with a bore diameter which is equal or approximately equal to the diameter of the shaft; the apparatus is provided with regulating elements by which the pressure of the fibre-liquid mixture fed to one end of the housing and the pressure exerted by the elastically yieldable lining can be adapted to each other so that as the shaft rotates the fibre-liquid mixture is forced between the lining and the shaft with the necessary friction effect and the required bending intensity of the fibres. Another possibility of regulating can be attained by driving the shaft of the apparatus through the intermediary of variable speed gear.

In passing between the rotating shaft and the elastically yieldable lining the bundles of fibres are subjected to vigorous friction, adjustable in intensity, and at the same time the fibres are bent continuously to and fro, due to the fact that, on the one hand, the liquid pressure producing the feed movement and, on the other hand, a transverse force component act on the rotating shaft.

If the apparatus consists of two functional parts arranged one behind the other, the fibre bundles already partly loosened in the first functional part are subjected to repeated friction or rubbing owing to the fact that they are forced between the inner edge of the hole of each rubber disk and the shaft, whereby the fibres are bent, in that, on entering the annular chambers bordered by the bores of the rigid annular disks, the fibres turn upwards.

To make the repeated bending of the fibres necessary for opening up the fibres in a perfect manner, particularly intensive, the shaft can be provided with one or more helically wound flat ribs on the section clamped by the elastically yieldable counter pressure elements. The object of these ribs is not, however, to force the fibre-liquid mixture through the apparatus; the feeding movement is effected, as has already been mentioned, by the inflow pressure in every case. The helically wound ribs actually serve for bending the fibres into a second plane as they pass between the shaft and the elastically yieldable counter pressure elements.

Apparatus suitable for carrying out the method of dressing raw asbestos according to the invention are illustrated by way of example in the accompanying drawings, in which:

FIG. 1 is a longitudinal section through a first form of construction of a dressing apparatus with two different groups of rigid working elements and elastic counter pressure elements;

FIGS. 2 and 3 are elevational views, on a smaller scale, of details of the apparatus illustrated in FIG. 1;

FIG. 4 is a diagrammatic view of the arrangement of a plant in which the fibre material is circulated several times through the dressing apparatus.

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 fibre-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 check valve (not shown in the drawing), 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 fibre-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 fibre bundles passing between the shaft **5** and the elastically yieldable body **18** are divided up into separate fibers in a gentle manner by friction and the individual separated fibres 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 fibres 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 fibres continually change their direction of travel.

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 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 fibre-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 fibres are subject to strong friction. On entering the annular chamber **22** adjoining the first rubber disk **20**, the fibres turning upwards are bent and relieved in the annular chamber **22**. The fibre-liquid mixture pressing forward

conveys the fibres with the liquid surrounding them past the next rubber disk **20** into the annular chamber **22** following it, whereby the fibres 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 fibre-liquid mixture is again forced into the dressing apparatus by the feed pump **14**. Thus the fibre-liquid mixture can be fed once or in repeated circulation through the dressing apparatus until the fibre 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 bending the fibres when they slide over the ribs in their forward movement under the feed pressure.

Depending upon the kind and quality of the asbestos material to be dressed, it may possibly be sufficient to equip the dressing apparatus only with one or other of the functional parts of the combined dressing apparatus described above.

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.

The method and dressing apparatus according to the invention can be employed not only for opening up crude asbestos but also for dressing or preparing other natural or synthetic fiber materials.

I claim:

A method of dressing adhered asbestos natural state fibres from the source rock and retaining the natural length of said fibres comprising the steps of suspending unseparated natural state asbestos fibres in a liquid, forcing the suspended fibres under hydraulic pressure to traverse an elongated helical path extending as a spaced curve of a length greatly in excess of the greatest length of the natural asbestos fibres, subjecting the suspended fibres to continuous frictional pressure between elastically yieldable counter-pressure forces exerted to apply friction to the fibres and these counter-pressure forces also defining the helical path of travel and subjecting the fibres to repeated bending transversely of the length of the fibres by the exertion of oppositely directed compressive forces at intermittent intervals along the path of travel to permit the fibres to bend transversely of the force imposed helical path and forcibly return them thereto by repeated exertion of the last mentioned compressive forces, the helical path subjecting the fibres to transverse bending in constantly varying directions and at various points relative to the length of the fibres.

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