Jan. 11, 1972 W. K. DONALDSON ET AL 3,634,568

PRODUCTION OF COHERENT BODIES FROM ASBESTOS DISPERSIONS

Filed April 14, 1969 6 Sheets-Sheet 1

Fig. 1.

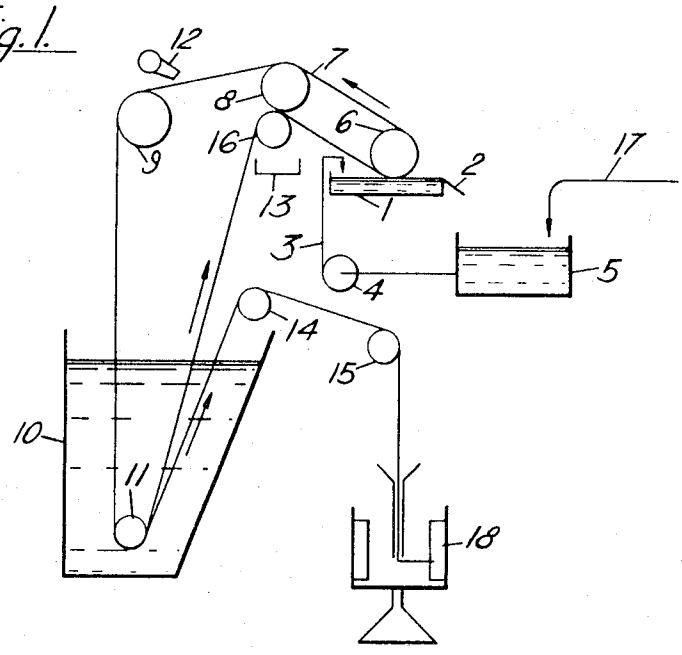
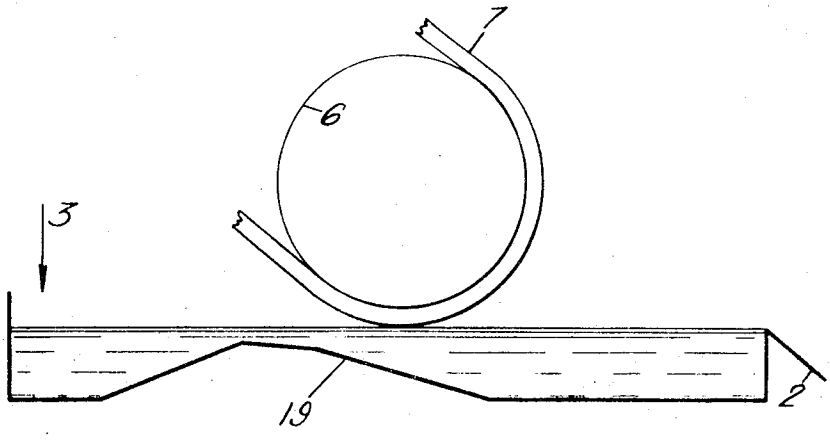


Fig. 2.



Published by AsbestosClaims.Law
asbestosclaims.law/library/23507/1

Fig. 3.

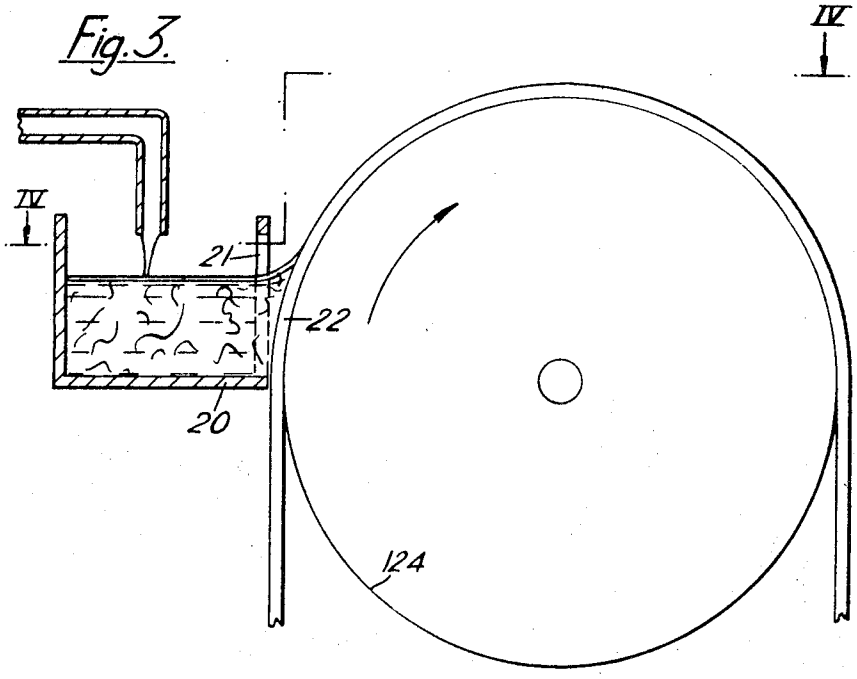
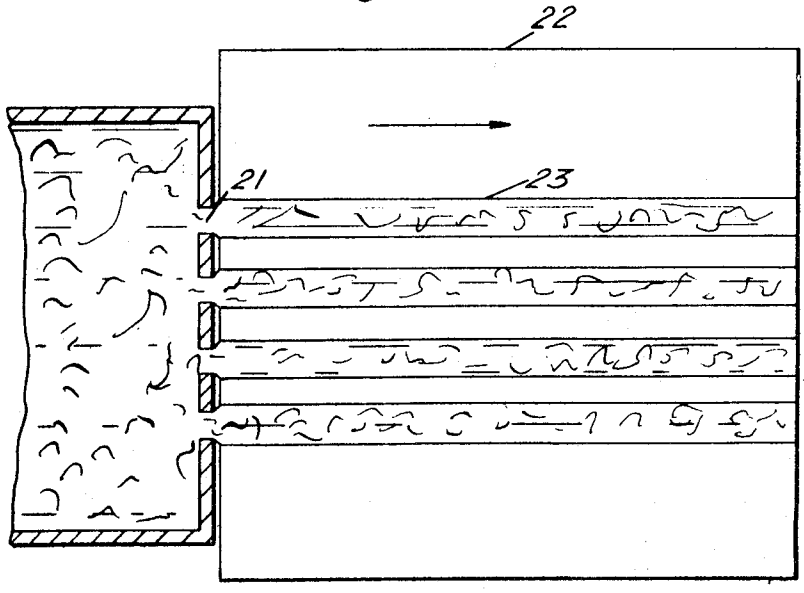


Fig. 4.



PRODUCTION OF COHERENT BODIES FROM ASBESTOS DISPERSIONS

Filed April 14, 1969 6 Sheets-Sheet 3

Fig. 5.

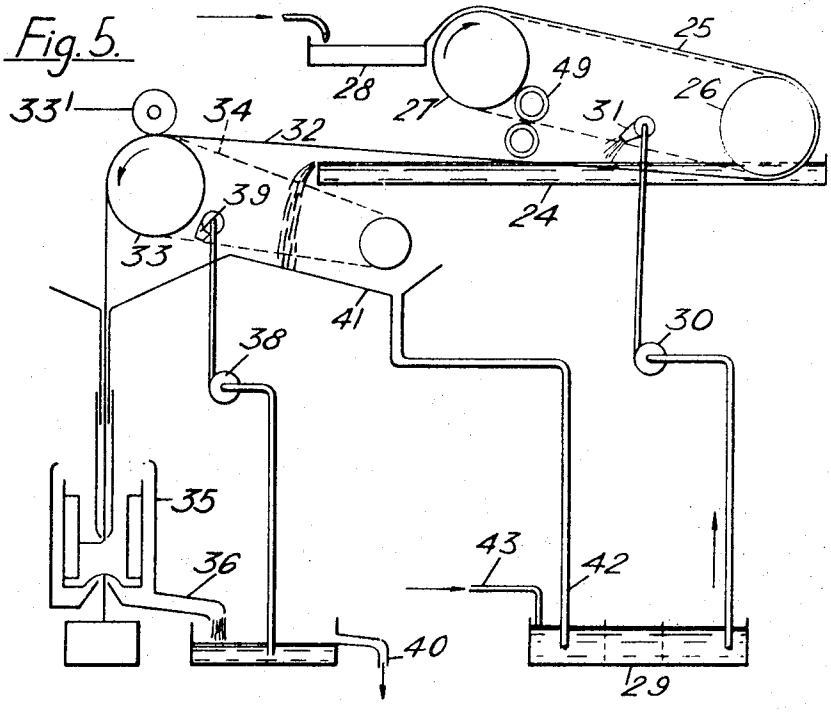


Fig. 6.

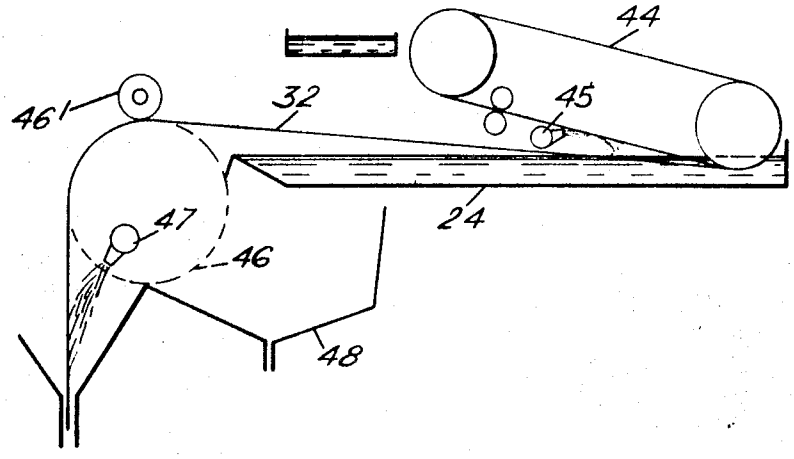


Fig. 7.

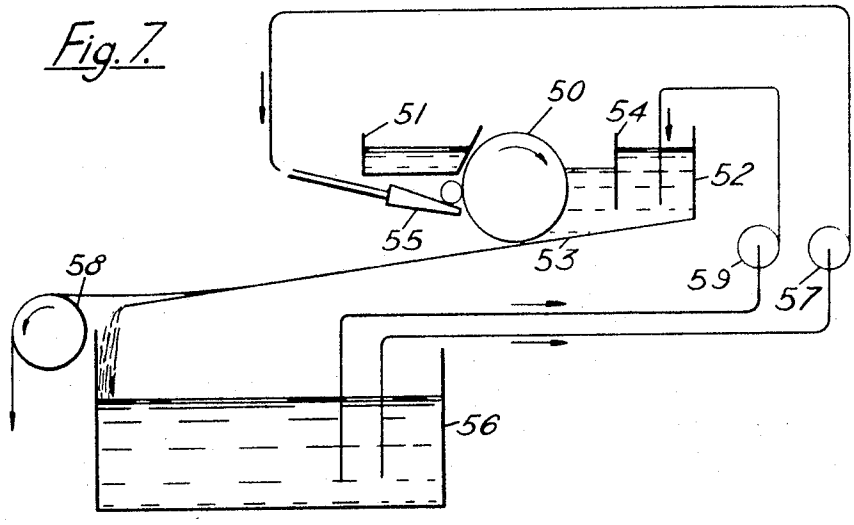


Fig. 9.

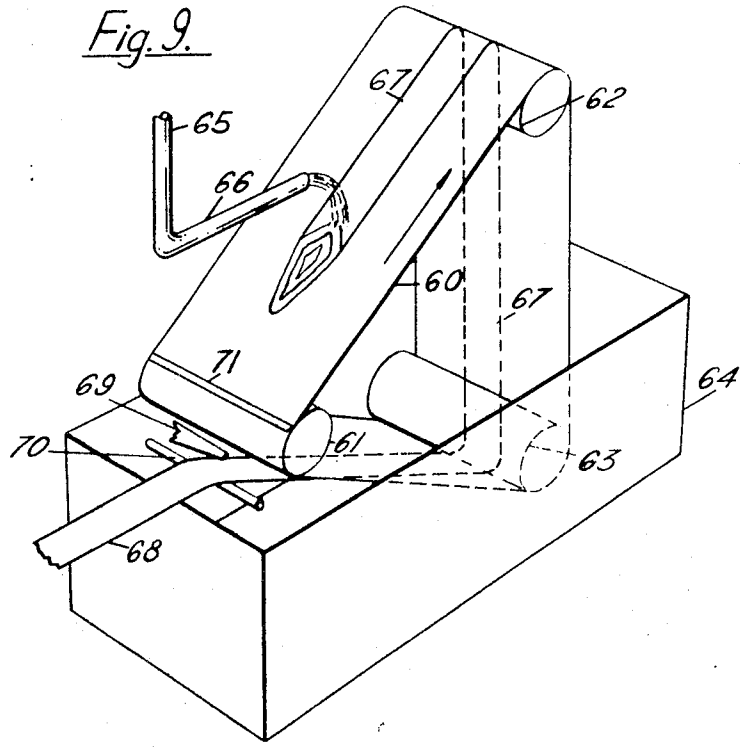
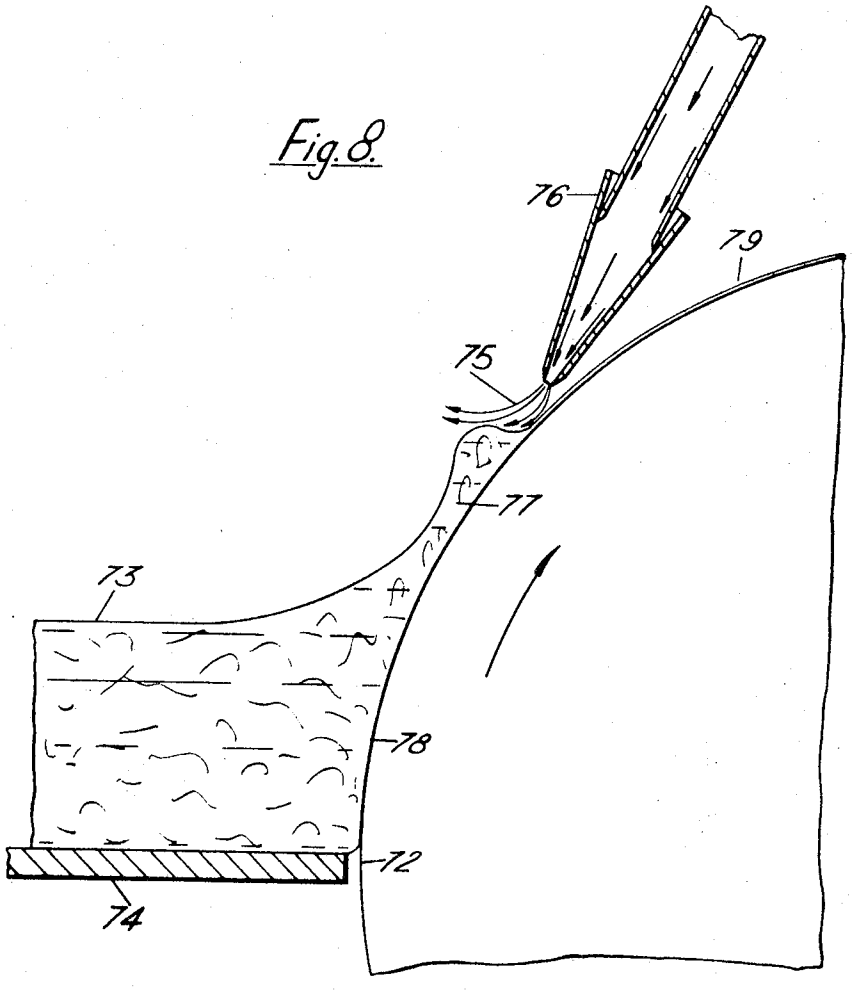


Fig. 8.



Published by AsbestosClaims.Law
asbestosclaims.law/library/23507/5

Fig. 10.

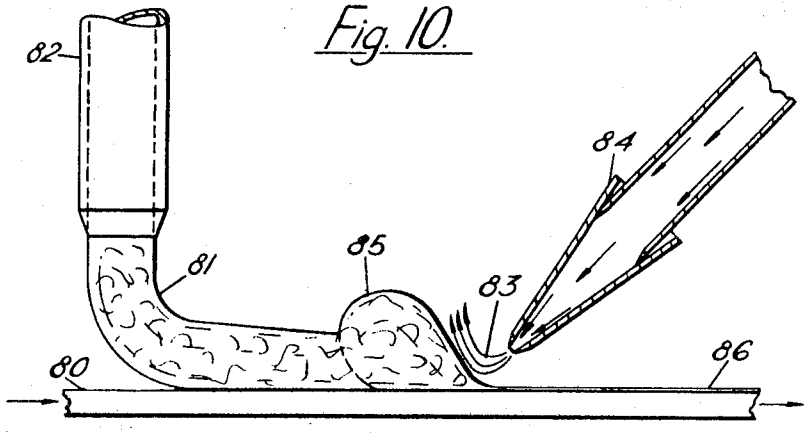
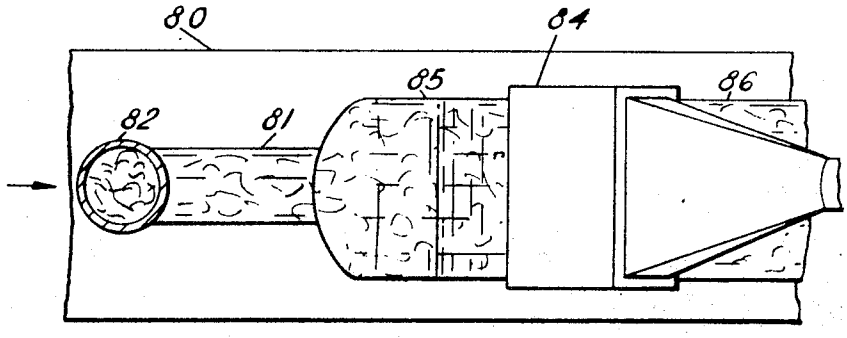


Fig. 11.



Published by AsbestosClaims.Law
asbestosclaims.law/library/23507/6

United States Patent Office 3,634,568 Patented Jan. 11, 1972

3,634,568

PRODUCTION OF COHERENT BODIES FROM ASBESTOS DISPERSIONS

William K. Donaldson, 23 Cringle Drive, Cheadle, Cheshire, England, and Werner Wilke, Schillerstrasse 34, and Hans Fetzer, Emil-Kost-Weg 5, both of Schwabisch Hall, Germany

Continuation-in-part of application Ser. No. 510,246, Nov. 29, 1965. This application Apr. 14, 1969, Ser. No. 839,748

Claims priority, application Great Britain, Dec. 4, 1964, 49,445/64

Int. Cl. B29d 7/02; D02g 3/02; D21h 5/18

U.S. Cl. 264—103 7 Claims

ABSTRACT OF THE DISCLOSURE

Continuous strand products of asbestos are produced by dispersing asbestos in water to provide a fibrous asbestos dispersion of film-forming constitution, then contacting the dispersion with an endless carrier while moving the carrier in a given direction and wetting the carrier with coagulating liquid ahead of the contacting locality. A film of asbestos dispersion is thus entrained by the carrier and coagulates at the face contacting the carrier. The other face of the film is supplied with further coagulating liquid. When the film is fully coagulated it is stripped from the carrier. Preferably the film is then twisted to yarn during its continuing travel. Several narrow strand components can thus be produced by contact entrainment in parallel relation to each other and are then twisted about each other to form the yarn.

This is a continuation-in-part of the now abandoned application Ser. No. 510,246, filed Nov. 29, 1965, under the title Production of Coherent Bodies from Fluids, claiming a right of priority based upon British applications No. 49,445/64, filed Dec. 4, 1964, and No. 19,469/65, filed May 7, 1965 (now both corresponding to British Pat. 1,129,815); and Austrian applications No. A 4,176/66, filed May 3, 1966 and No. A 11,853/66, filed Dec. 23, 1966 (now Austrian Pat. 276,163 and 283,967 respectively).

This invention relates to the production of coherent bodies composed predominantly of asbestos from an aqueous dispersion of asbestos fibers and a reagent by causing the reagent to react with a coagulating liquid to produce a precipitate that binds the fibers. In the known processes the reagent in the dispersion may, for instance, be a soluble soap and the coagulating liquid which the dispersion enters may be a solution in which there are cations of a polyvalent metal or hydrogen or both so that the soluble soap is converted into a water-insoluble soap or a water-insoluble fatty-acid, which is the binding agent. In the invention any reagent and any coagulating liquid which will react to form a binder may be used, but most conveniently the reagent is a sodium soap and the coagulating liquid is a solution of aluminum sulphate or zinc sulphate.

Asbestos dispersions of the kind in question, which are usually of chrysotile asbestos, may be made with either one or more than one dispersing agent. A water-soluble soap used as the reagent for the subsequent coagulation acts also as a dispersing agent. The dispersions tend to be unstable, and begin to coagulate not only on contact with a coagulating liquid but also if they are diluted. A typical dispersion is somewhat viscous, say of the viscosity of cream.

The invention is based on the observation that when such a dispersion and coagulating liquid are so brought into contact with one another that there is an interface between them, a film is formed which can be continuously drawn away from the interface.

According to this invention, dispersion in a pool is subjected to traction by an endless carrier that is wet with the coagulating liquid so that a layer of dispersion is removed, the surface of the layer in contact with the carrier being at least partly coagulated and the opposite surface of the layer being exposed to air and out of contact with any transverse solid surface such as a doctor blade or roller while it remains uncoagulated, some uncoagulated dispersion at this exposed surface of the layer is caused to pass back against the movement of the carrier so as to leave on the carrier a partially coagulated film of dispersion with an exposed face, further coagulating liquid is applied to the exposed face of the film, and the film is stripped from the carrier during or after the application of the further coagulating liquid.

The carrier, it will be seen, must carry a layer of dispersion with it, and for this to be done there must be an interface between the carrier and the pool. The object is to produce a thin uniform film which can subsequently be stripped from the carrier, and it is therefore necessary to prevent excess dispersion from being carried forwards. This excess dispersion may run backwards under the influence of gravity if the surface of the carrier moves upwards away from the pool. The excess dispersion can also be moved backwards by an air blast, and such a blast may be used to assist the action of gravity.

There are various ways of ensuring that an interface continuously exists between the carrier and the pool. Thus, the surface of the carrier may make contact with the upper surface of the pool of the dispersion, or be dipped into the pool.

Particularly advantageously the surface of the carrier may form an upwardly moving end wall of a trough or other vessel that contains the pool. Again the pool may be formed on the surface of the carrier by applying dispersion to that surface. If this is done at a point where the surface is moving upwards, the dispersion tends to run down the carrier but a layer is carried upwards. If an air blast is used to move excess dispersion in the layer against the movement of the carrier, the surface of the carrier may be horizontal or even slightly downwardly inclined at the point where the pool is formed.

In the process according to the invention the film is formed at an interface between the carrier and the pool, and the carrier does not cooperate with any other surface to form a channel which determines the shape of a body of the dispersion. Hence, there is no orifice, or narrow gap between the carrier and another surface, through which the dispersion passes and which could be blocked by small bundles of undispersed fiber or by foreign bodies such as are regularly found in the raw asbestos from which dispersions are formed.

It follows also that the cross-sectional dimensions of the film are formed inter alia by the flow characteristics of the dispersion and the geometry at the interface.

It is found best to restrict the amount of coagulating liquid carried to the interface by the carrier, primarily because any excess of coagulating liquid may run off the carrier into or onto the pool and form clots in the pool.

The endless carrier may be either a belt or a drum, and in either case it may have a porous or an impermeable surface; moreover, it may be porous throughout and not only on the surface. A carrier with a compressible porous surface carries coagulating liquid to the dispersion readily, and in fact should be compressed by a roller to expel excess coagulating liquid after the film has been stripped. There is no difficulty in stripping the film from a porous carrier that is wet with coagulating liquid, because sol-

uble soap or fatty acid will not enter the pores if they either contain or have their walls wetted with a coagulating liquid. Instead a layer of insoluble soap or fatty acid (and fibers) is formed immediately on the carrier, but no part of this layer penetrates beyond the surface irregularities of the carrier. It is easy to strip off such a layer.

A carrier with an impermeable surface is effective provided that it is uniformly wetted with coagulating liquid.

The carrier may also be a gauze, such as the wire gauze used in a Fourdrinier paper-making machine.

After the removal of excess coagulating liquid, the layer is only partially coagulated. Although sulphate or other coagulating liquid will diffuse into the film from the carrier until this is stripped from the carrier, the applications of further coagulating liquid to the exposed face is required in order rapidly to complete the coagulation necessary to render the film adequately strong for stripping and subsequent handling. Although this further coagulating liquid may be sprayed onto the film, it is preferred to provide it as a bath into which the film is carried. In accordance with the thickness of unreacted dispersion carried away by the film, which in turn depends to some extent upon the viscosity of the dispersion, the length of the bath of coagulating liquid through which the film is carried to complete the reaction of the dispersion on it may be from 1 to 20 feet.

The film is stripped from the carrier at some convenient point in its run, which may be outside the bath of coagulating liquid or in that bath. Stripping in the bath presents the advantage that coagulating liquid can act on the inner surface of the film as this film is stripped, and thus assist in ensuring that the reagent in the film of the dispersion reacts completely. The stripped film may be led to a draw-off wheel.

Once a skin has been formed on the exposed surface of the film the cross-sectional dimensions are essentially determined. Even so it is desirable that after being stripped the film should not come into contact with any transverse surface until coagulation is complete. If there is uncoagulated dispersion inside a coagulated outer skin of the film at a time when the film is subjected to any pressure such as may be exerted by passage in contact with a scraper blade or over a roller, the uncoagulated dispersion tends to move backwards inside the film and to form a bubble, which bursts and breaks the film.

The film may be stripped from the carrier by hand at the start of the process, but may break in the course of continuous operation. The following film may then adhere to the carrier. Although it may be in turn stripped by hand, automatic stripping is desirable. This may be effected by a jet of fluid, which is preferably coagulating liquid, directed at the carrier. This jet may flow throughout the whole operation. When the leading edge of the partially coagulated film has been lifted from the moving carrier, stripping of the film continues as the carrier moves past the jet. The film so removed swims about in the coagulant bath and is readily picked out by the operative and linked to a draw-off wheel. If there is continuous flow of the coagulating liquid through the bath towards a weir and a draw-off wheel is placed at the weir, the free end of the film may be carried to and over the weir to be caught by the draw-off wheel automatically.

After the excess dispersion has been removed, the film composed partially of coagulated dispersion and partially of unreacted dispersion may be up to about half a millimeter thick. The stripped film is wet, and it may, if desired, be dried before or after reaching the draw-off wheel. An important final product of the invention is yarn, which may be formed by spinning a film, two or more narrow films, or a strip or strips slit from a wide film. The film or strip may be twisted or spun wet, or may be dried, either by mere exposure to air or by heat. The final thickness of the film, is dried flat, may be say, one-hundredth or two-hundredths of a millimeter.

The carrier may vary very considerably in width, from for example 1 millimeter in order to produce a fine yarn to 1000 or more millimeters in order to produce a paper-like product. A number of parallel narrow films may be formed on a single carrier.

As an example, the dispersion may be made with the use of two dispersing agents, namely a water-soluble soap and another anionic surface-active dispersing agent, and may have the following composition by weight:

	Parts
Tap water of hardness of about 30 p.p.m. expressed as calcium carbonate (at 60° C.)	1100
Chrysotile asbestos (Grade A)	20
Sodium dodecyl benzene sulphonate	1.2
Soap (sodium salts of mixed long-chain fatty acid, average water content 20%)	8
Aluminum sulphate	0.7

The coagulating liquid may be a 5% solution of zinc sulphate in water. We find that a continuous film can be formed from such a dispersion and coagulating liquid at a rate of 20 meters per minute.

The dispersion may contain other particles or fibers, which may be colloidally or non-colloidally dispersed. Examples are particles of polymers or graphite and glass fibers. These particles or fibers become part of the film, either by reaction or by mechanical entrainment. Emulsions and latices, for example of rubber, may also be present and become part of the film.

The invention may be carried out in various forms of apparatus, some of which are shown diagrammatically in the accompanying drawings, in which:

FIG. 1 shows one form of apparatus;

FIG. 2 shows one form of vessel that may be used to hold the dispersion;

FIG. 3 shows part of another apparatus in elevation;

FIG. 4 is a section on the line IV—IV in FIG. 3;

FIGS. 5, 6 and 7 show three further forms of apparatus;

FIG. 8 illustrates the use of an air blast;

FIG. 9 shows another form of apparatus; and

FIG. 10 is an elevation and

FIG. 11 is a plan of yet another form of apparatus.

In the apparatus shown in FIG. 1, a pool of dispersion is maintained in a vessel **1** having an overflow weir **2** at one end, fresh dispersion being pumped in at the other end through a pipe **3** by a pump **4** from a reservoir **5** so that there is a continuous flow through the vessel. A roller **6** around which a porous endless belt **7**, wet with coagulating liquid, runs is disposed so that as the belt passes beneath the roller its surface makes contact with the surface of the pool. Over the area of contact between the belt and the pool the belt exerts traction on the dispersion, and it carries a layer of dispersion out of the pool. Some of this layer runs backwards into the pool to leave a film on the upper surface of the belt as this runs upwards from the roller **6** to pass round a roller **8**. The belt then travels approximately horizontally to run round another roller **9** from which it travels downwards to enter a bath of coagulating liquid in a tank **10** in the bottom of which there is a further roller **11** round which the belt runs to travel out of the tank. It is found that in the downward run of the belt unreacted dispersion on the belt may move downwards and create irregularities in the film. It may therefore be advantageous to spray coagulating liquid onto the film through a nozzle **12** at a point where the belt is running horizontally, in order to increase the amount of reaction that takes place before the film becomes vertical.

The film is stripped from the belt as the latter begins its upward run in the tank **10** and travels for some distance through the bath unsupported by the belt. On leaving the bath it passes over a draw-off roller **14** from which it travels over a further roller **15** to a pot-spinning device **18**.

The belt travels onwards and out of the tank, carrying coagulating liquid with it. On leaving the tank **10** the belt

7 passes through a nip between the roller 8 and a roller 16 to remove some but of course not all of the liquid it carries, and then back to the pool of dispersion. The liquid removed is caught by a trough 13. The belt may be engaged by a brush to clear away any fibers from it that have not been removed from it on the stripping of the film.

For the reason given above, the depth of the bath of coagulating liquid in the tank 10 and the speed of the belt should be so correlated that the film does not come into contact with the draw-off roller or any other hard surface until it is coagulated throughout its thickness.

For successful continuous operation it is necessary that a dispersion of constant concentration and a coagulating liquid of constant concentration shall be brought into contact at the surface of the belt, that is to say, at the interface between the belt and the pool. Some of the coagulating liquid may diffuse into the pool of dispersion. Moreover, there may be some dilution of the dispersion by reaction products as a result of the reaction. The dispersion will not remain stable if its concentration varies to any great extent, and if the concentration does vary it is necessary continuously to replace the dispersion at the area of contact by fresh dispersion. This is done in the apparatus shown in FIG. 1 by causing the dispersion continuously to flow through the pool in a circulatory system, and restoring its concentration in the course of the circulation. In the course of this concentration any undesired reaction products should be neutralized. Conveniently a main supply of dispersion entering the reservoir through a pipe 17 may be rather more concentrated than is desired in the pool so that when it is mixed with the somewhat diluted dispersion flowing over the weir 2, a dispersion of the proper concentration is formed.

When the process is carried on in an apparatus of the kind shown in FIG. 1 the fibers are predominantly oriented in the direction of movement of the belt. Although this gives high strength in one direction it also gives low extensibility. In order to produce a film with more random orientation the dispersion should be decelerating on arriving at the area of contact. Such deceleration may be produced by appropriately shaping the vessel that holds the pool. For example, as shown in FIG. 2, the base of a vessel that contains the pool of dispersion may slope downwards as shown at 19 beneath the roller 6 so that over the area of contact the dispersion is decelerating. It is then desirable that the actual velocity at the area of contact should be very much the same as that of the belt 7. Again the dispersion may be passed through the vessel parallel to the axis of the roller 6 so that the fibers will be predominantly oriented transversely to the belt 7.

When the carrier is a porous belt, as in the apparatus shown in FIGS. 1 and 2, it absorbs excess solution, that is to say undesired reaction products, from the film. Thus the risk of dilution of the dispersion or accumulation of undesired products at the area of contact of the belt with the pool is low, and it may be unnecessary continuously to replace the dispersion there by fresh dispersion. The belt is preferably composite, comprising a non-porous backing and a layer of compressible absorbent sponge or other porous material.

In the apparatus shown in FIGS. 3 and 4, a pool of dispersion is maintained in a trough 20 having an end which is formed with vertical slots 21. The carrier is a belt 22 that runs round a drum 124. The slotted end of the trough 20 is placed against a curved, upwardly moving, part of the carrier 22 so that it forms a tangent, approximately at the bottom of the slots 21. The dispersion flows through each slot and across the intervening gap towards the carrier to be carried upwards as layers 23, which tend to spread out sideways as shown. Excess dispersion runs backwards, to leave films each of width greater than the width of the slot by an amount depending on the height of the free surface of the dispersion above the level where the slot structure forms a tangent to the carrier. The carrier 22 should be close enough to the end of trough 20, and run upwards at a speed high enough, to ensure that any dispersion tending to run downwards from the base of the trough is picked up and carried away by the carrier before it can do so. The carrier on leaving the drum runs downwards into a bath of the coagualting liquid.

Dispersion is delivered to the trough at a constant rate, and should be removed as film at exactly the same rate.

The slots shown in FIGS. 3 and 4 are particularly suitable when the object is to produce a number of narrow films to be twisted together to form yarn. If a wide film is required, the end of such a trough as that shown at 20 may be wholly open. Its side walls may be curved to match the path of the carrier, and preferably are upwardly divergent.

It will also be appreciated that the carrier cooperating with a trough that has either an open or a slotted end may be a drum.

In one apparatus with a slotted trough, there were nine slots, each 4 mm. wide, to produce nine films. The slots started at the bottom of the trough 20 and extended upwards for 52 mm. The slotted wall of the trough was flat and formed an angle of 97° with the base. The base was located in a horizontal plane close to the horizontal axis of a sponge-covered drum 180 mm. in diameter. Dispersion was fed continuously into the trough, and in operation it stabilized at a depth of 25 mm. There were nine strips of film each about 6 mm. wide before being stripped from the carrier.

FIG. 5 shows an apparatus of somewhat different and simpler layout. The bath of coagulating liquid is in a shallow horizontal tank 24 instead of a vertical tank as shown in FIG. 1. A gauze belt carrier 25 is used and runs round only two rollers 26 and 27 and picks up dispersion from a trough 28 that resembles the trough 20. There is a reservoir 29 of coagulating liquid from which a pump 30 draws liquid continuously and delivers it to a nozzle 31 from which this liquid passes as a jet onto the upper side of the lower run of the belt 25, thus performing two functions. The first is to clear the belt of any fibers it may be carrying, and the second is to strip the film, shown at 32, from the belt both initially and if it should break. The belt passes between two rollers 49 for the removal of excess liquid. The stripped film travels through the coagulating liquid in the tank 24 to a draw-off roller 33 over which a perforated belt 34 passes. From the belt the film 32 travels downwards to a pot-spinning device 35. The spinning imparts tension to the film, and it is undesirable that this tension should be applied to the film at any point when this is not fully coagulated. Accordingly a small nip roller 33' is provided to engage the film on the roller 33. Liquid runs down with the film to the pot-spinning device 35, assisting to strip the film from the roller 33, and flows from the device 35 through a pipe 36 into a tank 37. A pump 38 draws from this tank to deliver liquid to and through a nozzle 39 to strip the film if necessary. Excess liquid runs from the tank 37 to waste through an overflow 40.

Coagulating liquid continuously flows out of the tank 24 and through the belt 34 into a hopper 41, from which it is returned through a pipe 42 to the reservoir 29. Fresh coagulating liquid is supplied to the reservoir 28 through a pipe 43.

If instead of a gauze belt a compressible porous belt such as that shown in FIG. 1 is used, the jets must be course be otherwise arranged. This different arrangement is shown in FIG. 6, in which there is a porous belt 44 stripped by coagulating liquid delivered through a nozzle 45. In this figure the film 32 passes over a perforated draw-off wheel 46 and is stripped by a jet from an internal nozzle 47. The application of spinning tension to the film before it reaches the wheel 46 is prevented by a nip roller 46'. The wheel is washed by coagulating liquid leaving the tank 24 and flowing into a hopper 48.

FIG. 7 shows an apparatus in which the carrier is a

drum **50** that picks up dispersion from a trough **51** and forms one wall of a container **52** for coagulating liquid. The bottom of this container is formed by a chute **53**, and the drum **50** nearly comes into contact with this chute. A baffle **54** is provided in the container **52** to separate that part of the container to which coagulating liquid is supplied from the drum, so that there is a quiet pool of liquid close to the drum. The dispersion at the exposed face of the film reacts with liquid in this pool, and more liquid runs continuously down the chute **53** in contact with the film.

A jet of stripping liquid is supplied through a nozzle **55**, being drawn from a reservoir **56** by a pump **57**. This jet clears the drum if there is any breakage and yet the film is fed forwards, passing down the chute **53**.

By the time the stripped film reached the end of the chute **53** the coagulation is complete. The film passes over a draw-off wheel **58** and excess coagulating liquid flows over the end of the chute into the reservoir **56**. From this reservoir the liquid is pumped by a pump **59** to the container **52**, as well as by the pump **57** to the nozzle **55**.

It will be understood that there may be several nozzles **55** delivering stripping jets if desired.

FIG. 8 shows part of an apparatus in which the pool is maintained in a trough similar to the troughs shown in FIGS. 3 to 7. In this apparatus a current of air is used to assist the action of gravity in causing excess dispersion carried away from the pool to return to the pool. A carrier **72** wet with coagulating liquid moves upwards past a pool of dispersion **73** in a trough **74**. In this figure the very thin, partially coagulated, layer at the surface of the carrier is shown at **78** and the layer drawn upwards at **77**. A jet of air **75** issuing from a nozzle **76** is directed against the layer **77** of dispersion on the carrier so that excess coagulating liquid is returned to the pool **73** at the surface of the layer **77** and only a limited amount passes forward with the carrier **72** to form a thin **79**, which is subsequently coagulated completely before or after being stripped from the carrier.

FIG. 9 shows an apparatus in which the dispersion is formed into a pool on the surface of a carrier. This carrier is an impermeable belt **60** which runs round three rollers **61**, **62** and **63**, the last being immersed in a bath of coagulating liquid in a tank **64**. The carrier **60** runs upwards from the roller **61** to the roller **62** and in the course of the upward run receives dispersion fed at a constant rate through a pipe **65** that terminates in a spout **66**. The dispersion forms a pool on the carrier **60**, which carries a layer away from the underside of the pool. Some of this layer runs backwards to the pool, and some spreads itself out to form a film **67**. This film is carried into the coagulating liquid in the tank **64**. The coagulated film, shown at **68**, is stripped by a jet of coagulating liquid delivered through nozzle **69** and drawn off over a roller **70**. Excess coagulant is removed from the carrier **60** by a scraper **71**.

The apparatus shown in FIGS. 10 and 11 is similar to that in FIG. 9 except that the action of gravity in causing some of the layer to move backwards and spreading the layer crosswise the carrier is replaced by the action of a current of air. A carrier **80** wetted with coagulating liquid is moving in an approximately horizontal plane. It receives a stream **81** of dispersion issuing from a spout **82**. This stream is carried along as a layer, and it is struck by a jet of air **83** issuing from a nozzle **84**. This jet blows the upper part of the layer backwards so that the layer increases in depth and spreads sideways, forming a pool **85** of greater depth than the layer. Uncoagulated dispersion is carried forwards, with the layer of coagulated dispersion that is in contact with the surface of the carrier, as a film **86**. The pool **85** is stable in that the mass of fibers removed in the film **86** in unit time equal the mass of fibers which is fed onto the carrier **80** by the stream **81**. The carrier **80** subsequently carries the film **86** to a bath of coagulating liquid.

In all the apparatus excess coagulating liquid may be removed from the carrier in various ways, for example by being scraped by a blade or blades. If the carrier is of gauze, it may pass through the nip between two rollers one of which has a porous compressible surface. Again excess liquid may be removed from a gauze carrier by suction. Again, if a gauze or impermeable carrier travels slowly enough, natural drainage may be adequate and no special steps need be taken to remove coagulating liquid from it before it again comes into contact with the pool of dispersion.

As described above, the invention affords the production of asbestos yarn by spinning or twisting the film strip or the several strips of coagulated asbestos dispersion after they have been stripped from the moving carrier surface. In the above-described embodiments illustrated in FIGS. 1 and 5, such twisting of the strips is effected by continuously passing the strips to a pot-spinning device (**18** in FIG. 1, **35** in FIG. 5) at the end of the strip travel. Each rotation of the spinning pot imparts one turn of twist to the material being spun. For example, a pot speed of 3000 r.p.m., at the above-mentioned delivery rate of 28 m./min., would result in twisting yarn about 100 times per running meter. As to the twisting effected by pot-spinning, reference may be had to (1) Eber Midgley, Technical Terms in the Textile Trade, vol. II, published 1932 by Emmott & Co. Limited, London (page 207); (2) George E. Linton, The Modern Textile Dictionary, published 1954 by Duell, Sloan and Pearce, New York (pages 510 and 628); (3) McGraw-Hill Encyclopedia of Science and Technology, 1960 (page 618); or also to the copending application of Wilke et al., Ser. No. 681,050, filed Oct. 23, 1967, now U.S. Patent 3,475,894.

We are aware that, in retrospect, the production of a film strip upon a moving carrier according to the invention may be found to be comparable to similar method steps known in the manufacture of products from organic and non-fibrous substances, such as rubber and plastics, dissolved or emulsified in organic solvents. Heretofore, however, the industries and persons dealing with asbestos production techniques have been unaware of the useful potentiality inherent in the tendency of aqueous asbestos-fiber dispersions to form, on contact with a coagulant-wetted surface, a coherent film capable of being stripped as a whole from the carrier. Also remarkable in this respect is the high production rate attainable by the invention, such as the above-mentioned rate of 20 m./min. achieved with a dispersion although it contained 55 times more water than asbestos fibers, for example. While a dispersion or emulsion of an organic liquid in a solvent will tend to form a film of fully homogeneous constitution when a structure wetted with coagulant is dipped into such a liquid, no such homogeneity can be obtained if a carrier surface wetted with coagulant is passed through a dispersion of asbestos fibers, i.e. an inorganic non-dissolved material. Hence, it should be expected that at best a layer of unoriented fibers will be deposited and that such a layer will exhibit only slight coherence and not be directly suitable for further fabrication. It is a surprising phenomenon, applied to advantage by the present invention, that a contact-entrainment deposition of films can also be successfully and advantageously carried out with aqueous asbestos dispersions and will result in high quality strands of uniformly oriented fibers imparting to the film the mechanical strength and coherence required for stripping the film and spinning it to yarn.

We claim:

1. The process of producing a continuous coherent body of asbestos which comprises the steps of dispersing asbestos in water which contains a dispersant to provide an unshaped fibrous-asbestos dispersion of a creamy viscous and film-forming constitution; shaping a continuously travelling film from the dispersion by contacting the still shapeless asbestos dispersion in a pool thereof with an endless carrier so as to provide a carrier-pool interface,

wetting the carrier with coagulating liquid ahead of the contacting locality, moving the carrier in a given travel direction and thereby removing a shaped layer of asbestos dispersion by traction from the pool to form on the carrier a film partly coagulated at the face contacting the carrier; maintaining the other face of the film out of contact with any transverse solid surface while it remains uncoagulated, applying further coagulating liquid to said other face of the traveling film; and stripping the coagulated film from the carrier.

2. The process of producing a continuous coherent body of asbestos which comprises the steps of dispersing asbestos in water containing water-soluble dispersant to provide a fibrous-asbestos dispersion of creamy-viscous film-forming constitution; shaping a continuously travelling film from the shapeless dispersion by contacting the asbestos dispersion in a pool thereof with an endless carrier, wetting the carrier with coagulating dispersant-precipitating liquid ahead of the contacting locality, moving the carrier in a given travel direction to subject a layer of asbestos dispersion to traction so as to carry the layer out of the pool by the carrier and form thereupon a film partly coagulated at the face contacting the wetted carrier; applying further coagulating liquid to the other face of the travelling film for completing the coagulation; stripping the coagulated film from the carrier and then twisting the still travelling film so as to convert the asbestos dispersion to yarn in continuous operation.

3. The process according to claim 2, wherein said step of contacting the asbestos dispersion with said carrier comprises simultaneously contacting said carrier at a multiplicity of mutually spaced localities of the pool so that a corresponding multiplicity of parallel films are formed on said carrier; and after removal of said films from said carrier twisting them together to form said yarn from the dispersion in said continuous operation.

4. The process of producing asbestos material which comprises the steps of preparing an unshaped creamy-viscous, film-forming dispersion of asbestos fibers in dispersant-containing water, shaping a travelling film strip from a pool of the still shapeless dispersion by subjecting a portion of the dispersion in the pool to traction by contact with a moving body surface wetted with dispersant-precipitating liquid so as to precipitate the dispersant

and thereby coagulate the film-strip at the body-contacting side, thereafter subjecting the other side of the travelling strip to dispersant-precipitating liquid to complete the coagulation, and separating the resulting coagulated strip material from the body surface.

5. The process according to claim 4, which comprises continuing the travel of the separated film strip and pot-spinning it at the end of the travel to convert the asbestos dispersion to yarn in uninterrupted operation.

6. The process according to claim 4, for producing yarn from asbestos fiber material wherein a container having a slot contains said pool of asbestos dispersion, the steps of shaping said dispersant-containing dispersion of asbestos fibers to said travelling film strip by issuing said dispersion out of said container slot, contacting the issuing strip of dispersion at the slot with the surface of said moving body wetted with dispersant-precipitating coagulant, rotating the body surface past the slot so as to exert traction upon and carry away the issuing film strip, passing the body surface with the strip through a dispersion-precipitating coagulant bath, separating the coagulated film strip from the carrier and then twisting the still travelling film strip to yarn in continuous operation.

7. The process according to claim 2, which comprises shaping said dispersion to separate and parallel film strips by passing it through respective openings from said pool of dispersion onto said carrier, and after separation from said carrier surface twisting the film strips together to form the yarn.

References Cited

UNITED STATES PATENTS

2,578,941	12/1951	Novak et al.	57—156
2,972,221	2/1961	Wilke et al.	57—164

FOREIGN PATENTS

352,681	7/1931	Great Britain	264—183

ROBERT F. WHITE, Primary Examiner

J. R. THURLOW, Assistant Examiner

U.S. Cl. X.R.

28—72; 57—164; 162—155; 264—108, 147, 183, 215

Published by AsbestosClaims.Law

asbestosclaims.law/library/23507/11