Dec. 31, 1929. F. A. METT 1,741,869

PROCESS OF REFINING ASBESTOS ORE

Filed Aug. 23, 1923 2 Sheets-Sheet 1

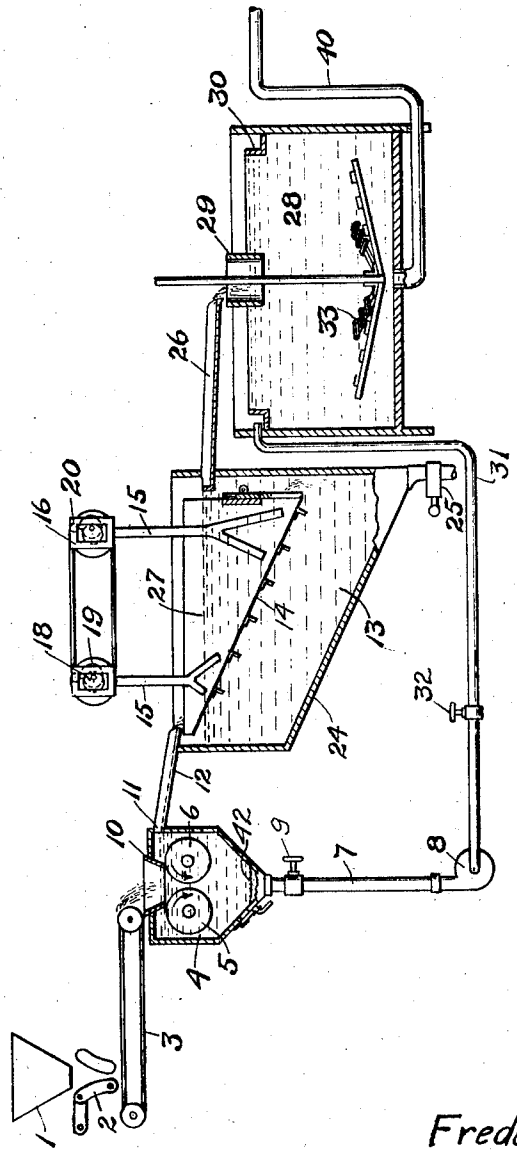


Fig. 1

Frederick A. Mett,
Inventor

By Chas. Silver,
Attorney

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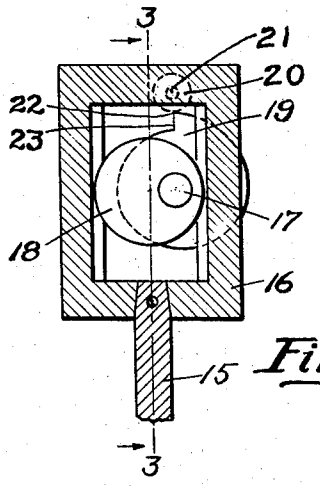


Fig. 2

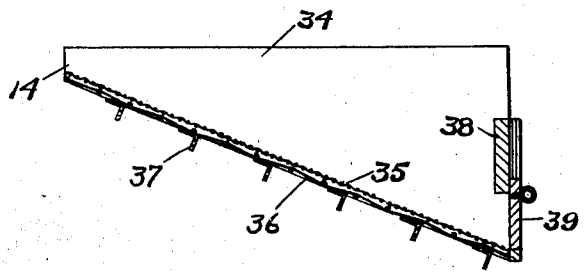


Fig. 4

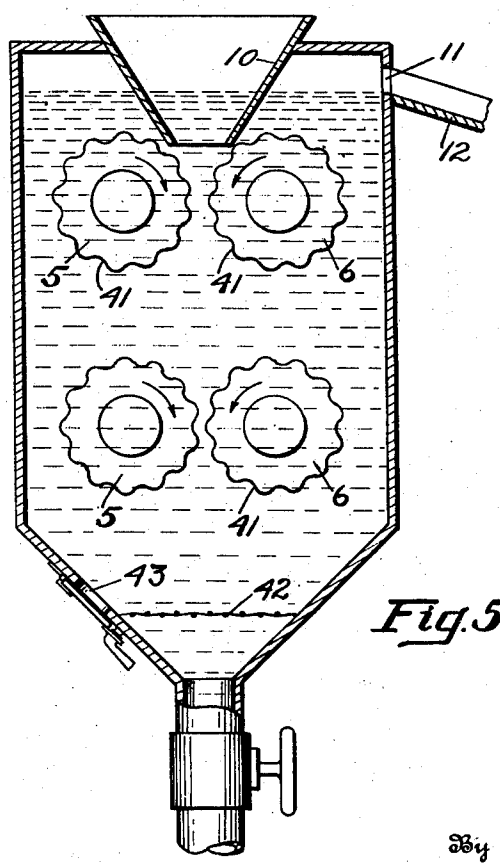


Fig. 5

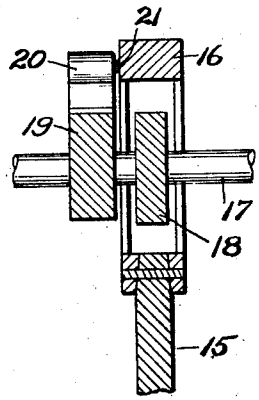


Fig. 3

Frederick A. Mett,
Inventor

By Chas. Silver,
Attorney

Patented Dec. 31, 1929

1,741,869

UNITED STATES PATENT OFFICE

FREDERICK A. METT, OF WOODLAWN, MARYLAND, ASSIGNOR TO POWHATAN MINING CORPORATION, A CORPORATION OF MARYLAND

PROCESS OF REFINING ASBESTOS ORE

Application filed August 23, 1923. Serial No. 659,000.

This invention relates to a process for refining asbestos ore and has special reference to the separation of the gangue from the asbestos fibres without subjecting said fibres to physical injury and destruction. This invention has special application to the treatment of ore containing amphibole asbestos fibres, which are shorter and structurally weaker than the longer chrysotile asbestos fibres, by a process and apparatus that preserve the structure and strength of the fibres to a very high degree and reduce the breakage and crumbling of the fibres to a minimum.

Among the objects of this invention is to provide a process whereby the separation of the asbestos fibres from the gangue is accomplished while the material is submerged in water and the lighter asbestos fibre separated from the heavier gangue by the combined action of a special mechanical treatment and flowing water or other suitable liquid, and to accomplish this separation without subjecting the fibres to excessive strain and breakage and maintaining at a minimum the breakage and destruction of the asbestos fibres.

With the above and other objects in view, the present invention resides in the novel features of process, to be hereinafter more fully described, claimed and illustrated in the accompanying drawing wherein:

Fig. 1 is a diagrammatic illustration, showing the various parts of my apparatus, partly in section.

Fig. 2 is a sectional detailed view of the cam and eccentric construction for imparting the compound reciprocating and jerky motion to the screen.

Fig. 3 is a section along the line 3—3 of Fig. 2.

Fig. 4 is a detailed view, partly in section, of the reciprocating screen.

Fig. 5 is a detailed view, partly in section, illustrating on a larger scale a specific construction of rollers in the disintegrating chamber, as will more fully appear later on.

The apparatus comprises a hopper 1 which leads to a jaw crusher 2 from which the crushed ore is discharged upon the conveyor 3 and then delivered to the disintegrating or shredding chamber or vessel 4 wherein the first steps in the refining process take place. This vessel 4 is provided with a plurality of rollers 5 and 6, which travel in a direction counter to each other as indicated by arrows and have their speeds regulated so that their linear velocities will be different. This may be accomplished by having the rollers of different diameter, by varying the angular velocities of the rollers or by utilizing a combination of these two variable factors. The effect of this difference in the surface linear velocities of these rollers is to cause one of the rollers to travel faster toward the axial plane passing through the axes of these rollers, and the asbestos particles which are drawn in by these rollers, are not only given a gripping action as they are drawn toward the axial plane but also a combined rubbing and drawing action. Although I prefer to use rollers of the same size and travelling at different angular velocities for accomplishing this result, it is to be understood that my invention is not so limited, but that other means may be employed for accomplishing this result within the scope and spirit of this invention.

Connected to the bottom of the vessel 4 is the conduit or pipe 7 leading to the pump 8, a valve 9 being supplied to regulate the flow of the water from the pump 8 to the vessel 4. The top of the vessel 4 is preferably provided with a funnel 10 extending close to the rollers 5 and 6 for receiving the crushed ore, and near the top of this vessel there is also provided an opening 11, from which leads a discharge or trough 12 to a separator tank or vessel 13.

Within the tank 13 is a reciprocating screen 14 depending by the side members 15 from blocks or frames 16 supported by the shafts 17. These shafts 17 carry eccentrics 18 which are positioned within the frames 16 and as the shafts 17 revolve the rotation of these eccentrics 18 impart a reciprocating movement to the frames 16 which in turn transmit this reciprocation to the screen 14. The shafts 17 also carry the cams 19 which support the rollers 20 upon the shafts 21 carried by the blocks or frames 16. The rotation of the shafts 17 causes the cams 19 to revolve,

thereby producing an up-and-down motion of the rollers 20, which convey this up-and-down motion to the screen 14 by means of the blocks 16 and side members 15. The upward motion is gradual, but when the uppermost position of the frame 16 is reached the most eccentric portion 22 of the cam 19 passes the roller 20 and the frame 16 drops quickly, due to the abruptness of the face 23 of the cam 19. This results in a jerky movement of the blocks 16 and screen 14.

The shafts carrying the cams and eccentric revolve at 30 to 100 revolutions per minute, the reciprocating distance may be up to a half foot while the drop of the screen may be up to a half foot also.

The vessel 13 is provided with a sloping bottom 24 at the lower portion of which is the discharge valve or gate 25. A trough 26 which determines the overflow lever 27 in the vessel 13 leads from the top of the vessel 13 and discharges into the settling tank 28, preferably near the center and through the pipe or conduit 29. This pipe 29 extends below the overflow level of the settling tank 28 and serves to prevent the material discharged from the trough 26 from immediately flowing out of the tank. The overflow from the tank passes over the launders 30 and out through the pipe or conduit 31 and valve 32 to the pump 8. The tank 28 is preferably provided with a collecting device 33 for gathering the asbestos fibres.

As shown in Fig. 4, the screen 14 is provided with angular side-members 34, which should preferably extend above the overflow level 27 in the vessel 13 when the screen is in its lowermost position. The screen proper consists of wire 35 of from 5 to 40 mesh, supported by a stronger screen or network 36 with the wires about an inch apart and also by angle irons 37. At the deep end of the screen, the end member 38 does not reach to the top of the side-members 34, in order to allow proper clearance for the trough 26 and for the reciprocation of the screen. The width of the screen is very close to that of the vessel 13, but the length is shorter, thus permitting reciprocation from end to end.

In operation, the ore is crushed to the desired size in the crusher 2. The crushing operation produces elongated pieces following the general stratification of asbestos fibres, particularly in the case of anthophyllite or mass-fibre amphibole. The crushed material is then delivered by the conveyor 3 to the vessel 4 wherein an upward stream of water is flowing. The comminuted ore is gripped by the rollers while under water, assuming a substantially longitudinal position with respect to the rollers, and is thus subjected while in a wet condition to a combined drawing and rubbing action, the effect of which is to reduce the material to thinner, elongated pieces; that is, the material is shredded. The rubbing and drawing by the rollers causes a splitting or cleavage action following the grain of the fibres and also either separates the asbestos fibre from the gangue or else disturbs the normal cohesion and adhesion of the substances to each other. The ore after passing between these rollers is brought in contact with the upward stream of water which further tends to separate the asbestos from the gangue and as the overflow of water passes out through the opening 11 to the trough 12 it carries with it by flotation the comminuted asbestos and gangue which are then discharged upon the screen 14. The compound-reciprocating an jerky motion of this screen completes the separation of the fibre from the gangue. The finer particles of gangue pass through the screen 14 and fall to the bottom, while the larger particles gravitate toward the lower end of the inclined screen 14 and pass out through the gate 39 to the bottom of the vessel 13 and may be removed by opening the discharge valve or gate 25. This removal of the gangue through the gate 25 may take place continuously by adjusting the opening. A small quantity of water will trickle out along with the gangue.

The asbestos fibres float to the surface of the water or liquid in the vessel 14 and pass off substantially as a blanket into the trough 26 and are delivered through the pipe or conduit 29 to the settling tank 28. In this tank, the asbestos is washed and settles to the bottom and is withdrawn through the pipe 40. The wash water flows over the launders 30 and off into the pipe 31 and to the pump 8 and may be reused, if desired, for the treatment of the asbestos ore in the vessel 4.

The process may be practiced continuously or discontinuously. as desired.

In Fig. 5, I have shown two sets of rollers in the disintegrating chamber or vessel 4 wherein the bulk of the shredding of the ore takes place. The lower rollers are spaced closer to each other than the upper rollers, thereby providing stage-shredding of the ore. The material which passes through the upper rollers is comparatively large, but on passing through the lower rollers is reduced to the desired size. By means of stage-shredding, the tendency for destruction and breaking of the asbestos fibres is materially decreased. It is to be understood that instead of using two sets of rollers, I may employ three sets, or even more.

In my preferred construction, I provide the rollers 5 and 6 with grooves 41, which assist in the drawing and feeding action and give a better grip or bite on the ore, and since these grooves are longitudinal, they also guide the elongated particles of ore into a longitudinal position. Instead of arcuate grooves I may employ grooves having other configurations or may substitute ribs.

In operating with rollers of the same size

and of a diameter of 10 to 12 inches, the faster moving roller may be run at a speed of 100–300 revolutions per minute with the slower roller moving at 50–250 revolutions per minute, the difference in speeds between the rollers being 25–100 revolutions per minute. If desired, pairs of rollers placed horizontally may be used within the vessel 4, with or without corresponding pairs of lower rollers for stage-shredding. Ordinarily, the rollers are from 1 to 2 feet long, and extend almost to the ends of the vessel. The funnel 10 extends close to the upper rollers so that the incoming ore will be immediately drawn between the rollers instead of being carried off by the overflow water.

I prefer to provide the vessel 4 with a screen 42 in order to prevent the larger particles of gangue and ore from accumulating at the bottom of this vessel and thus interfere with the flow of the incoming water. Also, by providing this screen, the particles of gangue and other ore which would tend to deposit upon the bottom of the vessel 4 are more effectively floated and forced upward by the rising stream of water. A gate 43 may also be provided for removing any objectionable accumulation of larger particles of gangue or ore upon the screen 42.

This process and apparatus is applicable to the treatment of weathered or unweathered asbestos ore. With very weathered ore, the treatment by the rollers may under certain conditions be dispensed with, because the mass is very crumbly and the gangue separates very easily from the fibres. With unweathered or hard ore, the rollers are always used. Also, in the treatment of certain ores, instead of using rollers for the drawing and rubbing action, I may employ closely-spaced surfaces, moving relative to each other; for example, with a planetary motion imparted either vertically or horizontally.

The asbestos resulting from this treatment is substantially pure and acid-proof and possesses practically the same strength as in its native condition. Also, the lengths of a very large proportion of the fibres very closely approach that of the original fibres and I obtain a large quantity of fibres of 1 to 2 inches. It has very high dielectric properties and may be advantageously employed for insulators with binders or cements, in molded or other suitable forms.

Throughout the description and claims the expression "gangue" is used to include sand, dirt, rock and other foreign substances associated with the asbestos in the ore.

The present invention is not limited to the specific details set forth in the foregoing examples which should be construed as illustrative and not by way of limitation, and in view of the numerous modifications which may be effected therein without departing from the spirit and scope of this invention, it is desired that only such limitations be imposed as are indicated in the appended claims.

I claim as my invention:

1. In a process of refining asbestos, subjecting comminuted asbestos ore while in a non-solvent liquid to a combined drawing and rubbing action.

2. The method of separating asbestos fibre from rock and associated impurities which comprises submerging the mineral in water, passing the mineral through rubbing and crushing means in a continuous current of water of submergence to break up the friable elements and separate the integral fibres and separating the lighter constituents by flotation and the heavier constituents by sedimentation.

In testimony whereof I affix my signature.

FREDERICK A. METT.