May 10, 1955 M. D. HEYMAN 2,708,032

MICA FLAKE CLASSIFYING DEVICE AND METHOD

Filed Nov. 24, 1951

Fig. 1.

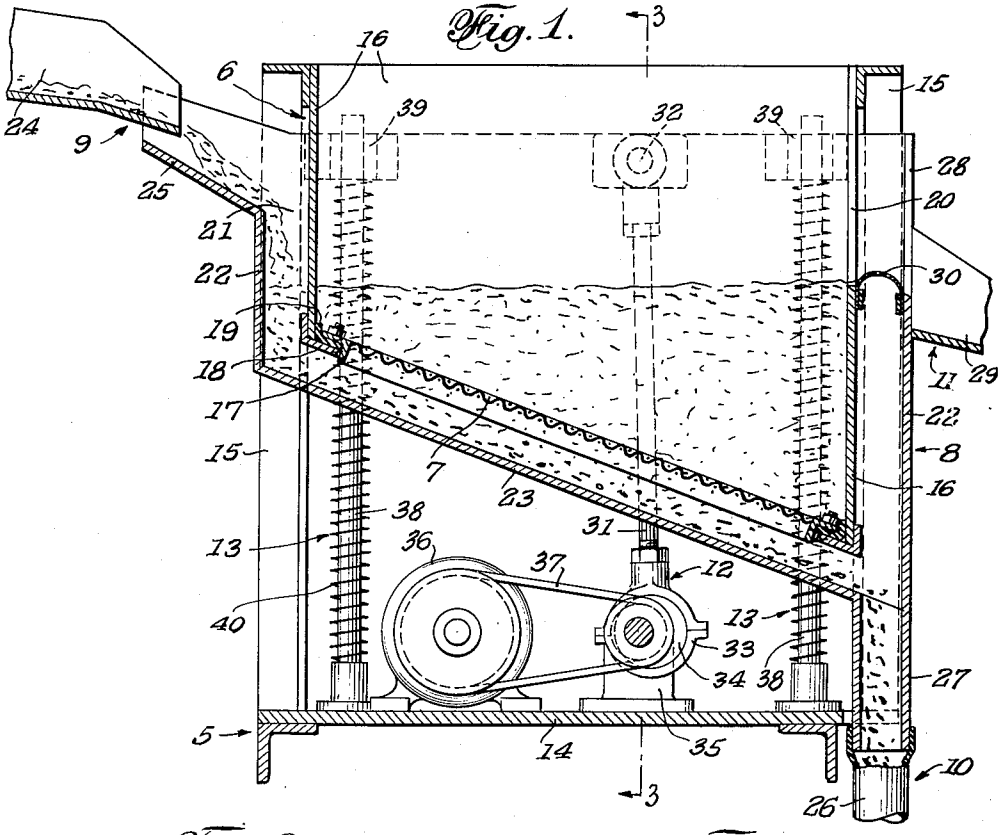


Fig. 2.

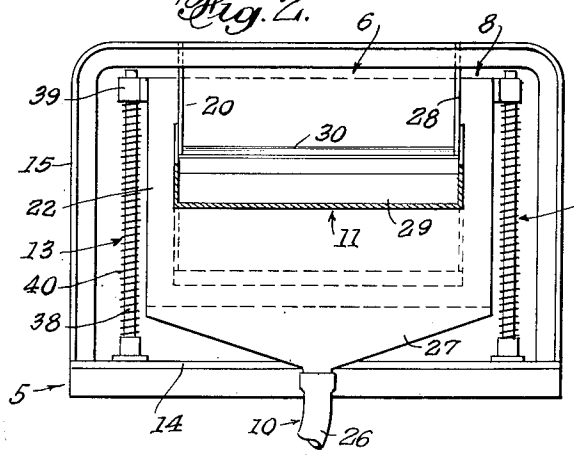
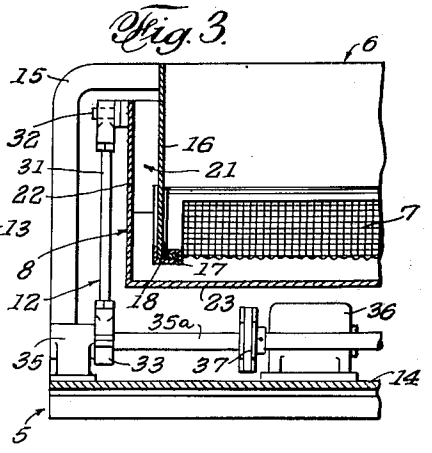


Fig. 3.



INVENTOR.
MOSES D. HEYMAN
BY
Hyman Jackman
ATTORNEY

United States Patent Office

2,708,032

Patented May 10, 1955

2,708,032

MICA FLAKE CLASSIFYING DEVICE AND METHOD

Moses D. Heyman, Woodmere, N. Y., assignor to Integrated Mica Corp., Woodmere, N. Y., a corporation of New York

Application November 24, 1951, Serial No. 257,999

9 Claims. (Cl. 209—17)

This invention relates to a device for selecting from a flow of liquid-borne mica flakes, those flakes that, because of their relative thinness, are best adapted to be incorporated in a sheet of integrated mica. In the sense that the present device serves to pass flakes that are classified as of required thinness and reject flakes that are thicker than a required minimum, the same may be termed a classifier. This application is a continuation-in-part of my pending application entitled Means and Method for Producing a Continuous Sheet of Integrated Mica, Ser. No. 201,020, filed December 15, 1950 which became Patent No. 2,659,412 on November 17, 1953.

Said application discloses disintegrating means for reducing pieces of mica into fine splittings or flakes while the same are immersed in a liquid medium. While the disintegrating means has substantial efficiency, the flakes flowing therefrom in the liquid medium vary in thickness. Some of these flakes are oversize and, if incorporated in a sheet of integrated mica, would impair the uniformity desired throughout such a sheet. Large surface area or size of the flakes is not too material as the same does not impair sheet uniformity to a material degree, but thickness greater than a required minimum of, for instance, four microns, will result in material reduction in sheet uniformity as regards sheet thickness, electrical properties, strength, etc. Moreover, the cohesive forces that cause the flakes to form an integrated sheet, vary inversely as the square of the thickness of the flakes. Consequently, the thinner the flakes the better will be the quality and strength of the integrated sheet formed therefrom.

It is to be understood that the present device is primarily intended to separate mica flakes into an acceptable thin class and a rejected thick class without too much regard to the surface sizes of the flakes. Incidental to the operation, however, the present classifier separates excessively large flakes from the acceptable class to further improve the quality of the sheet that is formed.

Flotation alone, as disclosed in my Pat. No. 2,490,129, has the primary drawback of a large proportion of thin flakes being pulled down in the liquid by the thicker flakes and, thus, removed from the flow. Also, in simple flotation, flakes that are thin enough but of excessively large surface area, will have such high buoyancy that the same will carry on its upper surfaces many flakes that are too thick to, thereby, introduce such undesired flakes into the flow.

The present classifier employs the principle that objects in a liquid medium, if of greater specific gravity than said medium, have inertia causing them to remain inert in the medium. Mica has a specific gravity of 2.8 and all flakes, both thick and thin, will settle in a liquid medium such as water, methyl alcohol, carbon tetrachloride, aromatic solvents such as toluene, xylene, etc., or other suitable evaporative liquid media, and will remain inert therein. However, the thicker flakes will settle downward more rapidly than will the thinner flakes and will have greater inertia or resistance to flotation

when the liquid in which the flakes are immersed is stirred or agitated. The thinner the flakes, the more rapid is their movement toward the surface of the liquid. While some excessively large thin flakes may weigh as much as smaller thicker flakes, they have high buoyancy by reason of their large surface area and will float upwardly, whereas the thicker flakes, lacking such buoyancy, will tend to remain at the bottom.

Accordingly, it is an object of the present invention to provide a mica flake classifying device for removing from a flow of liquid-borne mica flakes or splittings, such flakes, that by reason of their greater inertia, are thicker than a required minimum, so that the flakes remaining in the flow assemble to form an integrated sheet of desired properties.

Another object of the invention is to provide a classifying device, as above, in which the flow of liquid-borne flakes is subjected to regular and repeated upward and downward displacement to urge the thinner and more buoyant flakes progressively upward in the flow.

A further object of the invention is to provide a classifying device of the character indicated in which the above-mentioned up and down displacement takes place in a reciprocating receptacle that receives the flow and in which the flakes are also urged forwardly toward separate outlets for the thinner and the thicker flakes.

A still further object of the invention is to provide mica flake classifying means in which flakes that are floated upwardly are intercepted against resettling among the thicker flakes and in which buoyant flakes of unduly large size are intercepted and prevented from rising in the liquid medium.

A still further object of the invention is to provide a novel method for separating thin from relatively thicker flakes or splittings of mica in a liquid flow by pulsating the liquid to allow the thinner flakes to progressively rise in the flow and, thereby, become separated from the thicker and less buoyant flakes.

The invention further comprises novel details and novel combinations and arrangement of parts hereinafter more fully described and illustrated in the accompanying drawing.

The foregoing objects of the invention and others that will become apparent in the course of the following description are realized in the preferred embodiment on which said description is based. It is to be understood, however, that the illustrated form of the invention is to be considered as by way of example only.

In the drawing:

Fig. 1 is a vertical sectional view of a mica flake classifying device according to the present invention.

Fig. 2 is an end elevational view as seen from the right of Fig. 1 and drawn to a reduced scale.

Fig. 3 is a fragmentary sectional view as taken on the line 3—3 of Fig. 1 and drawn to the scale of Fig. 2.

The illustrated classifier comprises, generally, a fixed support 5, screen means 6 fixedly carried by said support and provided with a screen 7 across the bottom thereof, a receptacle 8 within which screen means 6 is positioned, an inlet 9 to said receptacle for a flow of liquid-borne mica flakes, an outlet 10 from the receptacle for part of said flow, an outlet 11 for flow passing from the receptacle through the screen means 6, means 12, carried by support 5 and connected to receptacle 8, to reciprocate the latter, and means 13, also carried by the support, for guiding the receptacle during reciprocation thereof.

The support 5 comprises a suitable base 14 and preferably upstanding frames 15 that fixedly mount screen means 6 in spaced relation to and above the base.

Screen means 6 is shown as a rectangular vertically disposed tube 16 that has a sloping lower end across which is disposed a sloping screen 7. In order that said screen

may be readily replaced should different mesh sizes be desired, the same is mounted in a frame 17 and said frame separably engaged with a ledge 18 provided around the bottom of tube 16. In practice, a gasket 19 is interposed between frame 17 and ledge 18. Screen means 6 is so disposed in relation to the flow of liquid and flakes that said flow can enter tube 16 only in an upward direction through screen 7. An exit opening 20 is provided in the wall of tube 16 that is opposite the highest edge of the sloping screen. As will be seen from Fig. 1, the lowest point of said opening is somewhat above the highest edge of the screen.

Receptacle 8 is larger in its horizontal rectangular form than tube 16 and surrounds said tube with ample clearance for flow in the space 21 between tube 16 and tubular walls 22 of the receptacle. The bottom 23 of the receptacle is sloped at substantially the same angle as screen 7 and is spaced below said screen. The top of the receptacle is spaced below the top of screen means 6 and clear of frames 15, thereby, enabling said receptacle to be reciprocated up and down relative to fixed screen means 6.

Inlet 9 comprises a chute 24 that discharges into a trough extension 25 provided on the upper end of receptacle 8 and it will be evident that a flow of liquid-borne mica flakes enters space 21 and falls onto sloping bottom 23.

At the opposite end of the receptacle and from the lowermost point thereof, outlet 10 extends downwardly. The same receives and passes flow that traverses the entire extent of sloping bottom 23. Said outlet comprises a flexible conduit 26 connected to a gradually restricted lower extension 27 of the receptacle.

At said opposite end, in substantial register with exit opening 20, the receptacle is provided with an opening 28 and, forward of said opening, there is provided a discharge chute 29 to comprise outlet 11. The space between openings 20 and 28 is bridged by a flexible jumper element 30 so that flow through opening 20 is guided to opening 28 and thence to chute 29. It will be clear that element 30 allows reciprocation of the receptacle relative to fixed screen means 6. Since outlet 11 is above the highest end of screen 7, only liquid and flakes that pass upwardly through said screen flow through said outlet.

The means 12 for reciprocating receptacle 8 is shown as a pair of pitman rods 31 pivotally connected at 32 to each side of tube 22, at their upper ends, and each provided with a strap 33, at its lower end, for engagement with an eccentric 34 on a shaft 35*a*. Said shaft in bearing brackets 35 on base 14 is driven by an electric motor 36 and a suitable connecting drive 37 between said motor and shaft. It is evident that the means 12 shown will rapidly reciprocate receptacle 8 a distance according to twice the eccentricity of the eccentrics 34.

The guiding means 13 is shown as four upright posts 38 on base 14 and extending through guide brackets 39 affixed to receptacle 8. Cushioning springs 40 around said posts smoothen the reciprocating movement of the receptacle.

In operation:

Upon each upward movement of receptacle 8, the bottom thereof upwardly carries the entire mass of liquid and flakes in the receptacle and, upon downward movement of the receptacle, the liquid will be restored to the initial low position. During such movement, the thicker inert flakes will move up and down with the liquid and, except that they will move with the flow along the slope of said bottom, will have no, or very little, relative movement to the liquid. In other words, the thick, non-buoyant flakes retain their relative positions in the liquid and move therewith toward and out through outlet 10.

The mentioned upward bodily displacement of the liquid expresses the liquid and the thinner, less inert, and more buoyant flakes upward through screen 7. Upon downward movement of the body of liquid, said thinner flakes remain in their upper floated positions from which they settle downward so slowly that the next upward displacement of the liquid only raises them still further. Thus, the successive pulsations intermittently urge the thin flakes progressively higher until they reach the surface of the liquid.

Because the bottom 23 is sloped, the upward displacement of the flakes is also in a direction toward outlet 11, the actual direction of movement of the flakes being substantially at right angles to the angle of slope of said bottom. It is clear, therefore, that the upper portion of the liquid and the flakes floating therein, at each upward pulsation, is displaced outwardly through outlet 11.

While screen 7 intercepts unduly large-surfaced flakes, its primary function is to intercept flakes that have moved therepast against downward movement. Insofar as classifying the flakes into thick and thin groups, screen 7 has no function and, even if omitted, the pulsations of bottom 23 would move the thinner flakes upwardly in the liquid reciprocating in tube 16 for ultimate discharge through outlet 11.

It is intended that the thicker flakes passing out through outlet 10 not be wasted but subjected to further splitting. The above-mentioned application discloses how this may be accomplished and how the further split flakes may be returned to the flow entering the classifier at inlet 9. In any case, outlet 10 is sufficiently restricted to allow the level in receptacle 8 to build up so that the flow is divided between outlets 10 and 11.

While I have disclosed what I now regard as the preferred form of my invention, the same is, of course, subject to modification without departing from the spirit and scope of my invention. Therefore, I desire to retain to myself such modifications and variations that may fall under the definitions of the appended claims.

Having thus described my invention, what I claim and desire to obtain by Letters Patent, is:

1. A device for separating the thinner from the thicker flakes in a flow of liquid-borne flakes, said device comprising a receptacle for receiving said flow and having a bottom and an outlet from said bottom, an open-bottomed tubular member within the receptacle and having an outlet above the lower end thereof, and means to reciprocate said receptacle relative to the tubular member to bodily reciprocate the liquid and flakes therein to intermittently displace the thinner flakes upwardly in the liquid in the tubular member and outwardly from the outlet of said tubular member, the thicker flakes flowing outward through the outlet in the bottom of the receptacle.

2. A device according to claim 1: a screen across the bottom of said tubular member and through which the thinner flakes pass during upward displacement of the liquid.

3. A device according to claim 1: said receptacle bottom being disposed at a downward angle toward the outlet therein, said bottom and the liquid therein, during reciprocation of the receptacle, displacing the flakes in the liquid at an upward and forward angle substantially normal to the angle of the bottom.

4. A device according to claim 1: said receptacle bottom being disposed at a downward angle toward the outlet therein, said bottom and the liquid therein, during reciprocation of the receptacle, displacing the flakes in the liquid at an upward and forward angle substantially normal to the angle of the bottom, and a screen across the bottom of the tubular member and arranged substantially parallel to said sloping bottom to pass flakes upwardly displaced by said bottom.

5. A classifying device of the character described comprising a fixed support, a bottom-open tube fixedly carried by said support, a receptacle surrounding the tube and provided with an upper inlet and a lower outlet, a common outlet from both the tube and receptacle located opposite the inlet and elevated relative to the lower outlet, and means mounted on the support and connected

to the receptacle to reciprocate the latter to reciprocate flake-included liquid entering the receptacle through said inlet, the lighter flakes in the liquid being progressively moved during said reciprocation of the liquid upwardly toward said elevated outlet, and the heavier flakes remaining with the liquid moving toward the lower outlet.

6. A classifier device according to claim 5: said receptacle being provided with a sloping bottom disposed at a downward angle toward the lower outlet and imparting to the lighter flakes a directional movement at an angle toward the elevated outlet.

7. A classifier device according to claim 5: said receptacle being provided with a sloping bottom disposed at a downward angle toward the lower outlet and imparting to the lighter flakes a directional movement at an angle toward the elevated outlet, and a screen across the bottom of the rectangular tube to pass relatively smaller thinner flakes and intercept relatively larger thinner flakes.

8. A method for separating the thinner from the thicker flakes of a flow of liquid-borne mica flakes that consists in conducting said flow in a forward and downward direction while alternately raising and lowering the same to raise the less inert thinner flakes progressively toward the top of the liquid of the flow, utilizing the raising and lowering of the flow to progress said thinner flakes forwardly while the same rise in the liquid, drawing off the

forward portion of the top of the liquid and the thinner flakes floating therein, and simultaneously drawing off the forward portion of the bottom of the flow and the more inert thicker flakes therein.

9. A method according to claim 8: screening the flakes that rise toward the top of the liquid to intercept unduly large-surfaced flakes.

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