Feb. 17, 1953 M. D. HEYMAN 2,628,461

MACHINE FOR WASHING MICA PIECES AND THE LIKE

Filed Jan. 10, 1952 2 SHEETS—SHEET 1

Fig. 2.

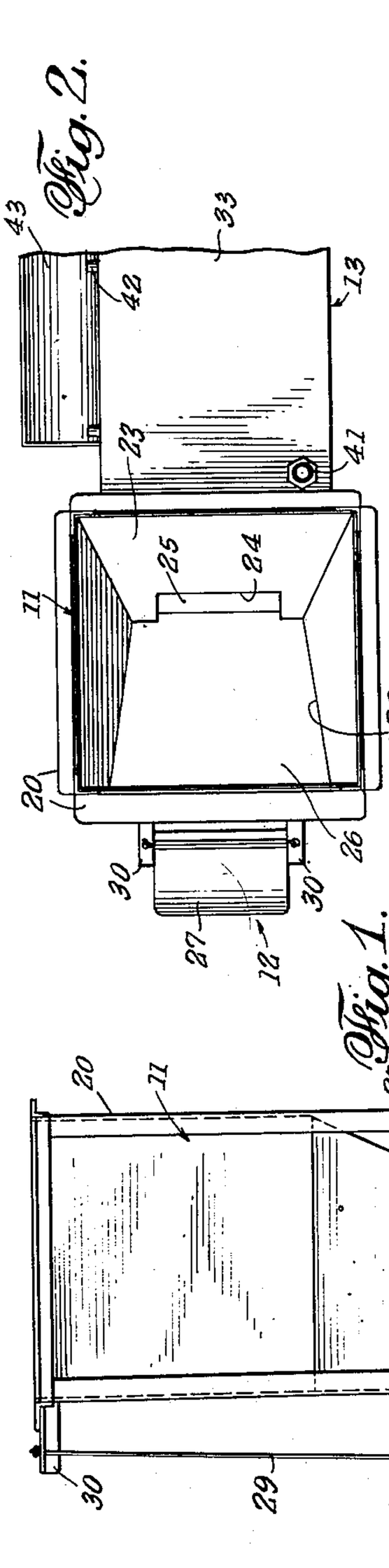

Fig. 1.

INVENTOR.
MOSES D. HEYMAN
BY
Hyman Jackman
ATTORNEY

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Fig. 3.

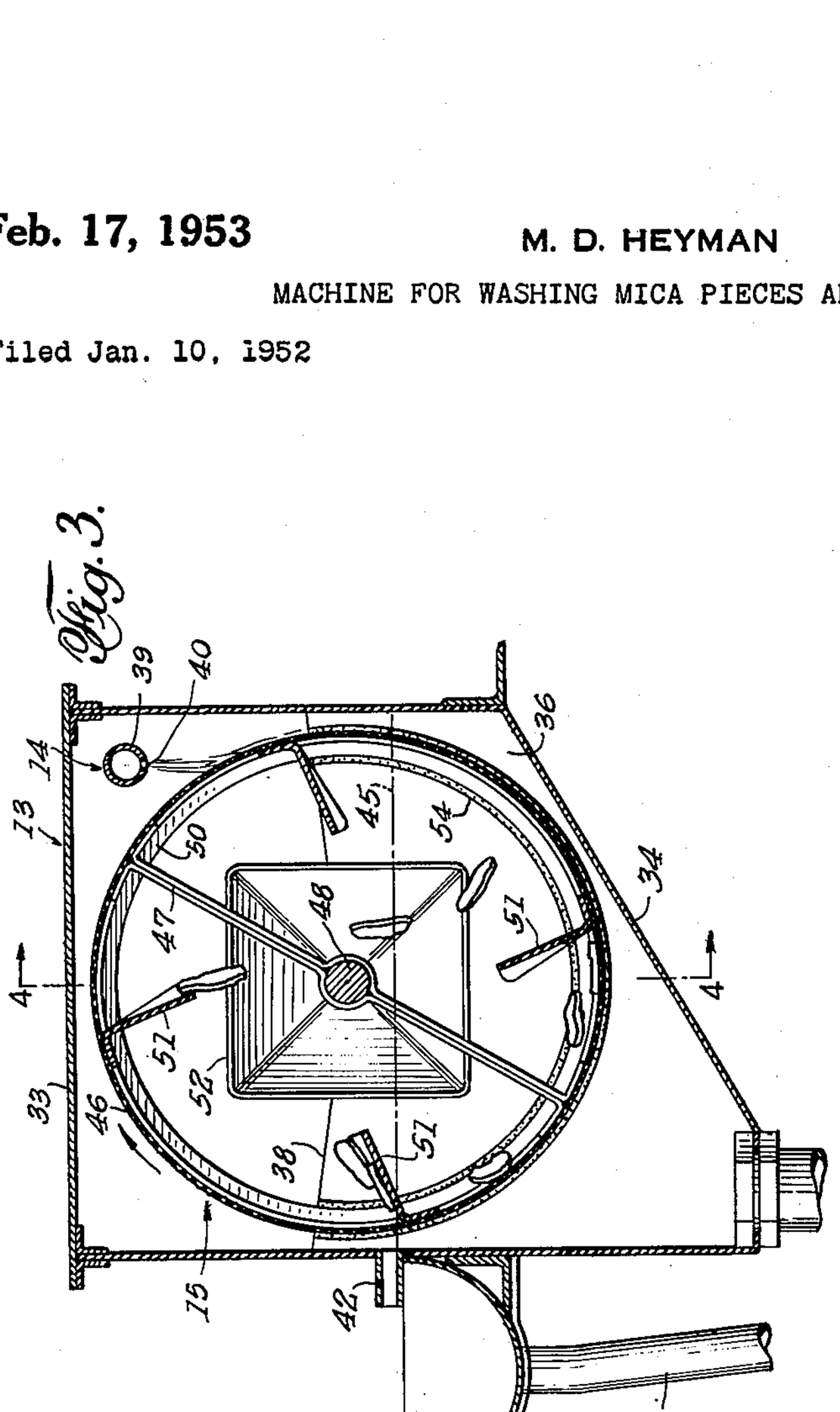


Fig. 4.

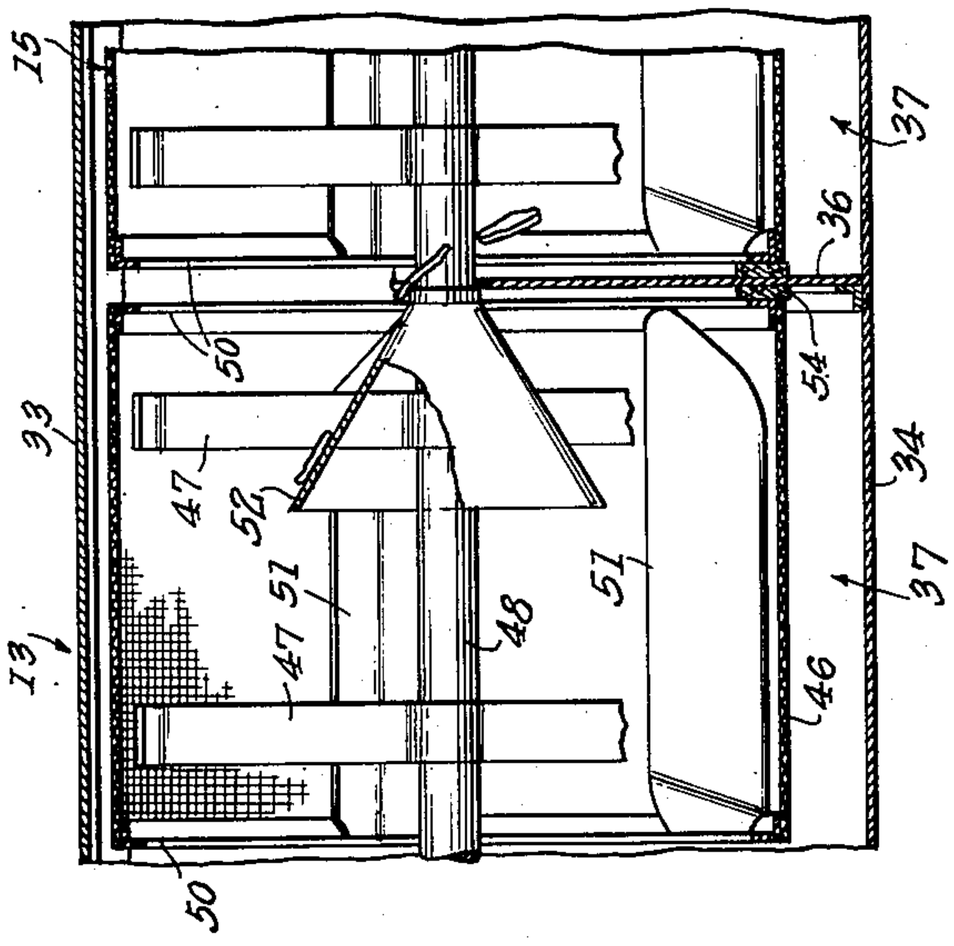
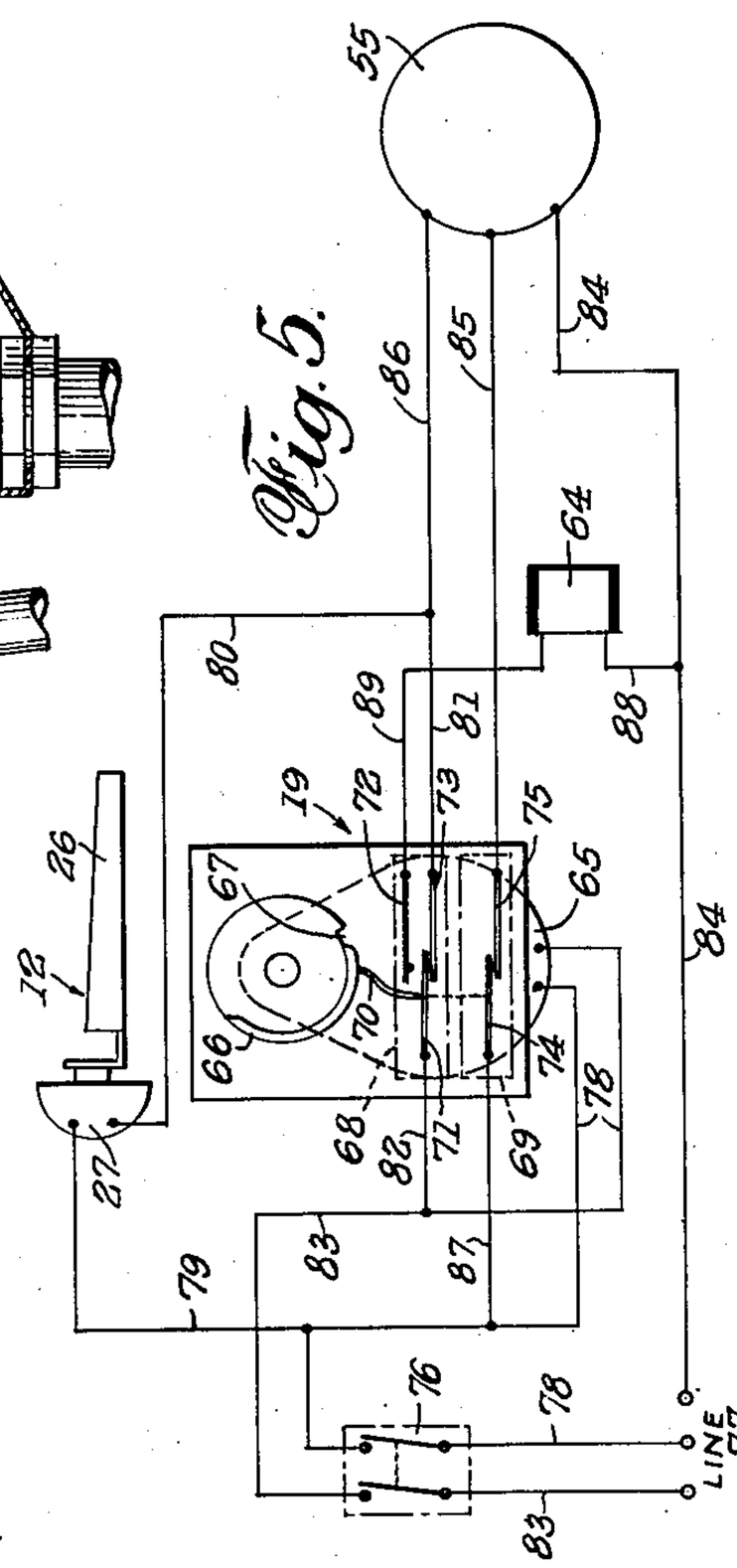


Fig. 5.



INVENTOR.
MOSES D. HEYMAN
BY
Hyman Jackman
ATTORNEY

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UNITED STATES PATENT OFFICE

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MACHINE FOR WASHING MICA PIECES AND THE LIKE

Moses D. Heyman, Woodmere, N. Y.

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9 Claims. (Cl. 51—164)

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This invention relates to a machine for washing pieces of mica to rid the same of dirt, stones, and other extraneous matter to ready said mica pieces for splitting into flake form as in splitting or disintegrating devices disclosed in my Patents Nos. 2,405,576 and 2,490,129, and in my pending application Ser. No. 164,333, filed May 26, 1950.

An object of the present invention is to provide a mica piece washing machine that is wholly automatic in its cycle of operation and wherein the wash water is automatically replaced at predetermined intervals to insure a clean product at the output of the machine.

Another object of the invention is to provide a mica piece washing machine that moves the pieces through an aligned series of baths in a manner that minimizes flaking of the pieces or otherwise subjecting them to abrasion that may tend to break them up. Such breaking or flaking would entail losses of material which the present invention seeks to obviate.

A further object of the invention is to provide, in a machine as indicated, novel means for raising the mica pieces out of the baths and gently dropping them back into the baths edge first, repeating such raising and dropping many times, and simultaneously moving the pieces from the inlet to the outlet of the machine. In this manner, the wash water in the successive baths wash among the edges of the lamina of said pieces with greater efficiency than if the pieces were dropped on one of their faces.

Another object of the invention is to provide novel means to transport the mica pieces successively from one bath to the next adjacent bath, and successively raising and dropping the pieces, as mentioned, while keeping the water in the several baths separate. In this manner, the mica pieces move through successively cleaner baths until they are ultimately washed in relatively clean water.

My invention also has for its objects to provide novel combinations and arrangements of parts and novel details of construction which will more fully appear in the course of the following description which has basis on the illustrated embodiment and, while now preferred, is intended as by way of example.

In the drawings:

Fig. 1 is a side elevational view, partly in longitudinal section, of a washing machine according to the present invention.

Fig. 2 is a top plan view of the left hand portion of Fig. 1.

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Fig. 3 is an enlarged cross-sectional view as taken on line 3—3 of Fig. 1.

Fig. 4 is a vertical sectional view as taken on line 4—4 of Fig. 3.

Fig. 5 is a diagrammatic view showing the electrical means of the machine.

The machine that is illustrated comprises generally, a frame 10, a mica-piece receiving hopper 11 located in an elevated position in said frame, means 12 for feeding mica pieces from said hopper in a substantially continuous stream, a compartmented tank 13 provided with a water inlet 14 supported by the frame and extending to one side of the hopper 11 and the feed means 12, a series of open-sided perforated drums 15 in sloping aligned arrangement and disposed within said tank, a drive 16 for slowly revolving said drums to wash and forwardly feed the pieces of mica fed thereinto by feed means 12, a set of dump valves 17 for emptying the compartments of tank 13, timer-controlled means 19 for operating the feed means 12, drive means 16 and said valves 17 to stop said feed and drive while said valves are open, and to restore the feed and drive while said valves are closed, and a sump receptacle 19*a* to receive the discharge of valves 17.

Frame 10 is suitably fabricated to have an upper extension 20 that supports hopper 11, and a generally longitudinal extension 21 that supports tank 13 and drums 15. Receptacle 19*a* is shown as independently supported although provision in the frame may be made to support the same.

Hopper 11 is shown with an open top so that, from time to time, batches of mica pieces may be deposited thereinto. The bottom 22 of the hopper is also open and wall 23, on the side toward tank 13, has a bottom notch or opening 24. Said notch is controlled as by a sliding gate 25 which is adapted to adjust the effective or feed size of said notch. The open bottom 22 of the hopper is arranged on a downward slope toward tank 13.

Feed means 12 comprises a sloping pan or tray 26 disposed immediately below but spaced from the hopper bottom 22, an electrical vibrator 27 connected at 28 to tray 26, and suspension cords or wires 29 connected, at the top, to brackets 30 extending from frame extension 20, and, at the bottom, to a point 31 on the vibrator. The suspension is such that the weight of the vibrator substantially balances the weight of the tray and the contents 32 of the hopper. In this manner, the vibration imparted to the tray 26 is not dampened and the mica pieces progress down the slope

of said tray toward the lowermost end from which they drop off into the first of the series of drums 15.

Tank 13, as mentioned, is arranged to slope downwardly toward the end of the machine away from the hopper. Said tank is provided with a cover 33, with a sloping bottom 34, with end walls 35, and with a set of uniformly spaced partitions 36 which divide the tank into a plurality of similar and aligned compartments 37. End walls 35 and partitions 36 do not extend to the cover 33 but only to the approximate middle of the tank, the upper edges of said walls and partitions being indicated at 38 in Fig. 3. The upper portion of the tank is, therefore, continuous and serves to enclose the upper portions of drums 15. The present machine is shown with six compartments 37 with a drum in each compartment, although the number of compartments may vary.

Water inlet 14 comprises a longitudinally disposed pipe 39 in the upper part of tank 13 along one side thereof. Said pipe is provided with perforations 40 through which clean water, or any other suitable cleaning liquid, is admitted into the compartments 37. Any suitable water source or liquid supply may be connected to said pipe at nipple 41. In the operation of the machine, the flow from pipe 39 is continuous.

It is desired to limit the height of water in compartments 37 to a level below the tops of partitions 36 and walls 35. To this end, overflow pipes 42 are provided for each compartment at a suitable height above the bottom of tank 13 and below partition edges 38, as best seen in Fig. 3, and a trough 43 is positioned beneath said overflow pipes to receive their discharge. Trough 43 is disposed on a slope and a drain pipe 44, at the lower end thereof, empties into receptacle 19a. Thus, although water is being continuously admitted into compartments 37, the level 45 in each compartment is maintained.

Each drum 15 comprises a perforated cylindrical wall 46 that may advantageously be made of a screen mesh of suitable gauge to retain the mica pieces and pass foreign particles dislodged therefrom during the washing process. Each drum is provided with one or more radial arms 47 to connect wall 46 to a shaft 48 extending longitudinally through both ends of tank 13 and supported, at said ends, in bearings 49 affixed to frame 10. Each drum wall 46 is stiffened by a circular angle member 50 at the inner edges of said walls. In this manner, all of the drums are carried by a common shaft, adjacent drums are separated by partitions 36, and the open ends of said drums are in communication above the upper edges 38 of said partitions.

Each drum, carried by the inner face of cylindrical wall 46 and by angle members 50, is provided with a plurality of vanes or fins 51 that extend across the interior and are disposed at an angle that is tangential to a circle generated around the center of shaft 48. Said vanes may be radial, if desired, the angle that is formed by each vane and the drum wall providing a pocket for mica pieces and enabling said vanes to raise said pieces from the bottom of the drum and then drop them, edge first, back into the water from which the vanes had lifted them. The tangential disposition of the vanes is preferred because, as seen in Fig. 3, the mica pieces are retained on the vanes until they have reached a high point above the water level 45. The drop of the mica pieces, therefore, is quite great and a good washing action results from the momentum of the pieces moving down through the water edge first. The different positions of the mica pieces as a vane raises them, as they fall from said vane, and as they cut edge first through the water, is illustrated in Fig. 3.

It will be recalled that the line of drums is on a downward slope. Therefore, it will be evident that each time a piece of mica is raised and then dropped, it will progress in a direction toward the low end of the drum. The mica piece is raised and dropped many times during its progress toward the low end of the drum and, therefore, said piece will be subjected to many washing immersions.

At the outlet end of each drum there is provided a cone 52 which, in this case is shown as of square configuration, although its cross-sectional shape may be of different polygonal form. Said cone tapers toward the outlet end of the drum at which point it is affixed to shaft 48. As pieces of mica progress toward the cone while they are alternately raised and dropped, said pieces will eventually fall upon the surface of said cone. When a mica piece falls on the high or large part of the cone, it will slide downward on its sloping face. However, since the cone is slowly rotating with the drum, said piece, most likely, will be dropped back into the bath before it has an opportunity to slide the entire length of the cone. Said piece will again be raised by one of the vanes 51 and, since it has progressed forward, said vane will now drop it on an intermediate part of the cone. Now, the piece may slide down off the small end of the cone and over the partition 36 into the next adjacent drum. Fig. 4 shows such transfer of the pieces from one drum to another.

In practice, it has been found that, at the slope of the drums shown, a piece of mica averages twenty edge first immersions in each bath of the compartments 37 and, with the six drums shown, is washed some one hundred twenty times in successively cleaner baths. Since the drums are rotated quite slowly—four or less revolutions per minute—the time of travel of a piece of mica dropping from tray 26 and ultimately being discharged from exit chute 53 is approximately one-half hour. Thus, although the mica pieces are continually travelling toward exit chute 53 and being simultaneously thoroughly washed, there is no turbulence nor agitation that may tend to break or flake the pieces.

It will be realized that the water in the first or left hand compartment 37 receives and collects most of the foreign matter in the mica pieces, that in the successive compartments the water becomes less dirtied, and that in the last or right hand compartment the water is quite clean since little or no foreign matter remains in or on the pieces of mica. Consequently, the mica pieces are being washed in successively cleaner baths as they move through the machine.

Rubber or like gaskets 54 are provided between the ends of the drums 15 and the walls 35 and partitions 36, and water from said drums and mica pieces cannot pass from the drums into the compartments 37 past said gaskets. Foreign matter washed out of the mica can pass through the drum perforations into the bottom of the compartments but said sealing gaskets prevent the mica pieces from passing between the drum ends and said walls and partitions.

The drive 16 is applied to shaft 48 and, in this case, is shown as an electric motor 55 that, through the medium of a speed reducer 56 and

a coupling 57, on the output shaft of said reducer, rotates shaft 48 and the drums carried thereby at a low rate of speed, as above indicated.

The dump valves 17 are connected to the lowermost portion of tank 13, one for each compartment 37, said valves being disposed above sump receptacle 19*a* so as to discharge thereinto. Each valve 17 is provided with an operating handle or lever 58.

The means 18 comprises a longitudinally disposed member 59 that constitutes a common connection for valve levers 58, an air cylinder 60 having its piston rod 61 connected to an end of member 59, a pressure air inlet connection 62, a valve 63 for controlling flow of air from said connection to the opposite ends of air cylinder 60, and a solenoid 64 for operating said valve. During the normal closed position of valves 17, the solenoid is not energized and valve 63 is positioned to admit pressure air to the right end of cylinder 60, thus retracting member 59. Energization of the solenoid moves valve 63 to admit air to the left end of said cylinder to project member 59 and open said valves simultaneously. The valves 17 are quite large and the action of cylinder 60 quite sudden, thereby causing a quick dumping of the contents of compartments 37 with a resultant scavenging of the walls of said compartments.

The timer means 19 is shown in Fig. 5. The same comprises a continuously-operating synchronous motor 65 that drives a circular cam 66 provided with a peripheral notch 67, and a pair of switches 68 and 69 controlled by said cam by means of an actuator 70. One side of switch 68 is provided with a contact 71 and the opposite side with contacts 72 and 73. The peripheral face of cam 66, by means of actuator 70, normally holds contacts 71 and 73 engaged and, when said actuator enters notch 67, contact 71 moves from contact 73 to engage contact 72. Switch 69 is provided with contacts 74 and 75 that are engaged when actuator 70 rides the circular periphery of said cam and are separated when the actuator enters notch 67.

A master switch 76 controls electric current from two phases of a three-phase power line 77 to vibrator 27, motor 55 and solenoid 64 under control of timer means 19. Lines 78 connect timer motor 65 to line 77. Lines 79, 80, 81, 82 and 83 connect vibrator 27 with two phases of said line through switch contacts 71 and 73; motor 55 is provided with three-phases current through lines 84, 85, 78, 82 and 83 and engaged contacts 71 and 73, and 74 and 75; and solenoid 64 is provided with current through lines 84, 88, 89, 82 and 83 only when contacts 71 and 72 are engaged which is when actuator 70 enters cam notch 67.

In practice, timer cam is driven at one revolution in ten minutes and the notch 67 is proportioned to comprise some fifteen seconds of this time. It will be clear that vibrator 27 and motor 55 are operated to carry out the initial feed and the washing operations of the machine during the time that the actuator 70 rides the periphery of cam 66 and, that when said actuator enters notch 67, the vibrator and motor circuits are opened while the circuit to the solenoid is closed. Thus, for about fifteen seconds, the feed of mica pieces from the hopper and rotation of drums 15 stop as the means 18 opens dump valves 17 to discharge the dirtied water from tank compartments 37. During this period, incoming water from pipe 39 continues to flow to flush out the compartments with clean water while, at the same time, washing a portion of the drum wall 46. Since the drums stop rotating every ten minutes, said drum wall will be washed quite well because the drums stop with different portions of said walls in the path of the incoming water. When the cam face again moves actuator 70, normal operation of the machine is restored and tank compartments 37 fill with water to levels 45, excess continuing to overflow into sump receptacle 19*a*. When said receptacle is to be emptied, a valve 90 is opened.

It will be realized that the timing cycle of means 19 may be varied, as desired.

While I have described what I now regard as the preferred form of my invention, the same, of course, may be modified within the spirit and scope of my invention. Therefore, I desire to reserve to myself such variations and modifications of my invention that may fall within the scope of the appended claims.

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

1. In a washing machine for mica pieces and like materials, a liquid-containing tank compartment having end walls, a rotating open-sided perforated drum positioned in said compartment with the open ends thereof adjacent said end walls, the axis of said drum being disposed at an angle to the horizontal, a sealing gasket between said walls and the respective ends of the drum, blade means within the drum to raise pieces of material, during rotation of the drum, out of the liquid in said compartment and arranged to drop said raised pieces edge first back into said liquid and, during each such raising and dropping, moving said pieces from the higher end of the drum in a direction toward the lower end thereof, and tapered means connected to rotate with the drum to receive the pieces and slidingly transport them out of the lower end of the drum.

2. In a washing machine according to claim 1: said blade means comprising plural uniformly spaced and inwardly diected blades extending in a direction tangent to a circle generated around the axis of rotation of the drum.

3. In a washing machine according to claim 1: said tapered means comprising a cone of polygonal cross-section with the apex end substantially at the lower end of the drum and the opposite larger end in an intermediate part of the interior of the drum, and a drive shaft mounting both the drum and said cone.

4. In a washing machine according to claim 1: overflow means for said liquid in a wall of said compartment and disposed at a level below the axial center of the drum, and said end walls of the compartment extending above said level and terminating substantially below the top of the drum.

5. In a washing machine for pieces of mica and like material and having a wash tank divided into compartments, there being a rotating open-ended drum in each compartment, and each drum being provided with means for raising and then dropping pieces of material in the drum, said drums being in end to end alignment, the improvement that comprises a polygonal conical member mounted to rotate with the drum and disposed to present surfaces sloping downward toward one end of the drum for receiving dropping pieces and slidingly guide them beyond the said end of the drum into the drum next adjacent.

6. A machine for washing mica pieces and like material comprising a tank having partitions di-

viding the same into a series of aligned liquid-containing compartments, an open-sided perforated drum in each compartment, a sealing gasket between each partition and the adjacent open ends of each respective drum, a drive to rotate said drums, said drums being on a common axis and said axis being disposed at an angle to the horizontal, means to feed mica pieces into the most elevated of said drums, a chute to discharge pieces of material falling thereon from the lowermost of said drums, blade means within each drum to raise pieces of material out of the liquid in each respective drum and compartment and arranged to drop said raised pieces edge first back into said liquid and, during each such raising and dropping, moving said pieces nearer the lower ends of the respective drums, and tapered means at the center of and at the lower end of each drum to transfer said pieces from one drum to the next adjacent lower drum above the partitions between the drums and from the lowermost drum to the discharge chute.

7. A washing machine for pieces of mica and like materials comprising, in combination, a hopper for said pieces, means to feed a continuous stream of pieces from said hopper, an aligned series of open-ended perforated drums disposed on an axis sloping downward from said feeding means and receptive of the pieces fed from the hopper, a drive to slowly rotate said drums on said axis, a compartmented tank in each compartment of which is disposed one of said series of drums, means providing a constant supply of liquid to said compartments and, through the drum perforations, to the interiors

of the drums, means in each drum to alternately raise pieces of material therein and drop them back edge first into the liquid while simultaneously moving said pieces along the drum in the direction of its slope, means within each drum to transfer said pieces from one drum into the next adjacent lower drum of the series, a chute to receive and discharge the pieces transferred from the lowermost drum of the series, a dump valve connected to empty each compartment of the tank, and means to open all of said dump valves and simultaneously stop the piece-feeding means and the drum-driving means.

8. A combination according to claim 7: the last-mention-means comprising electrical timer means including a synchronous motor and switch means controlled by said synchronous motor.

9. A combination according to claim 8: the electrical timer means further including a cam driven by the synchronous motor and operatively engaged with the switch means to time the operation thereof.

MOSES D. HEYMAN.

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