April 21, 1953 L. G. McLEAN 2,635,753

AIR STRATIFIER

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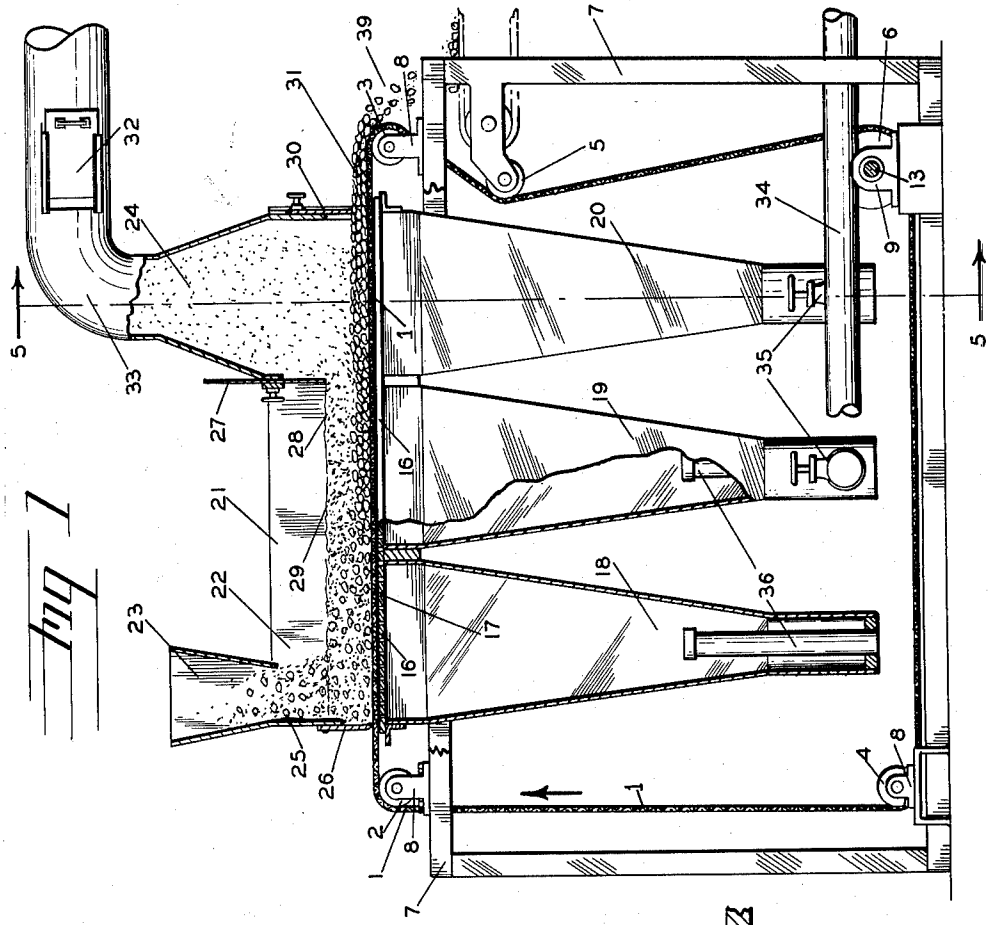


Fig. 1

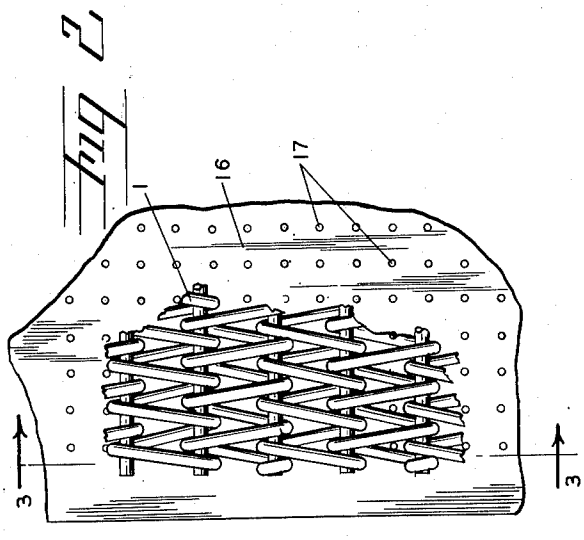


Fig. 2

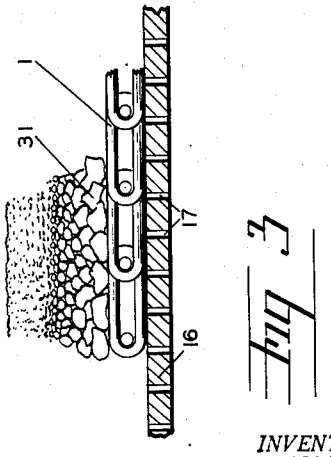


Fig. 3

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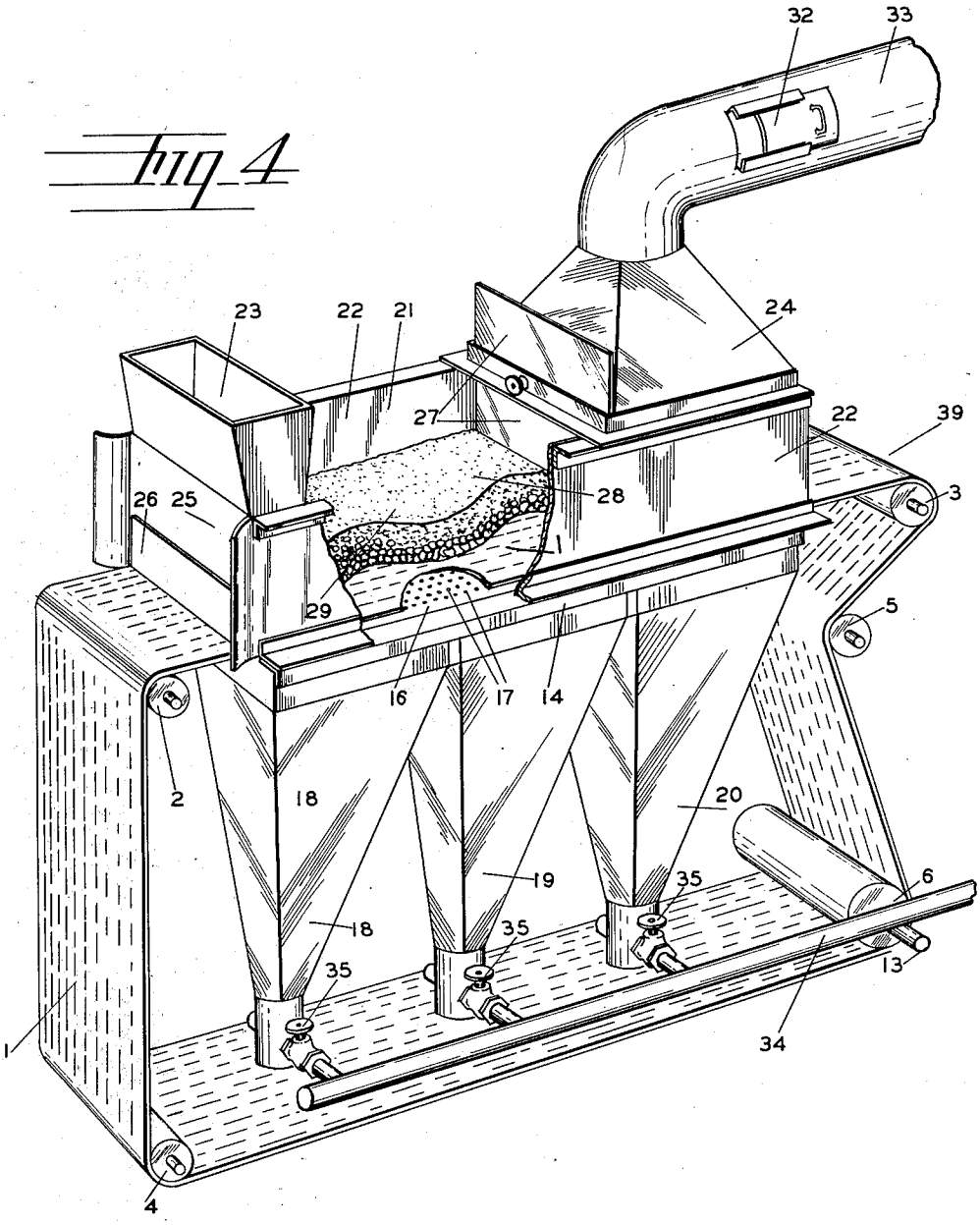
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Fig 4



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Fig 5

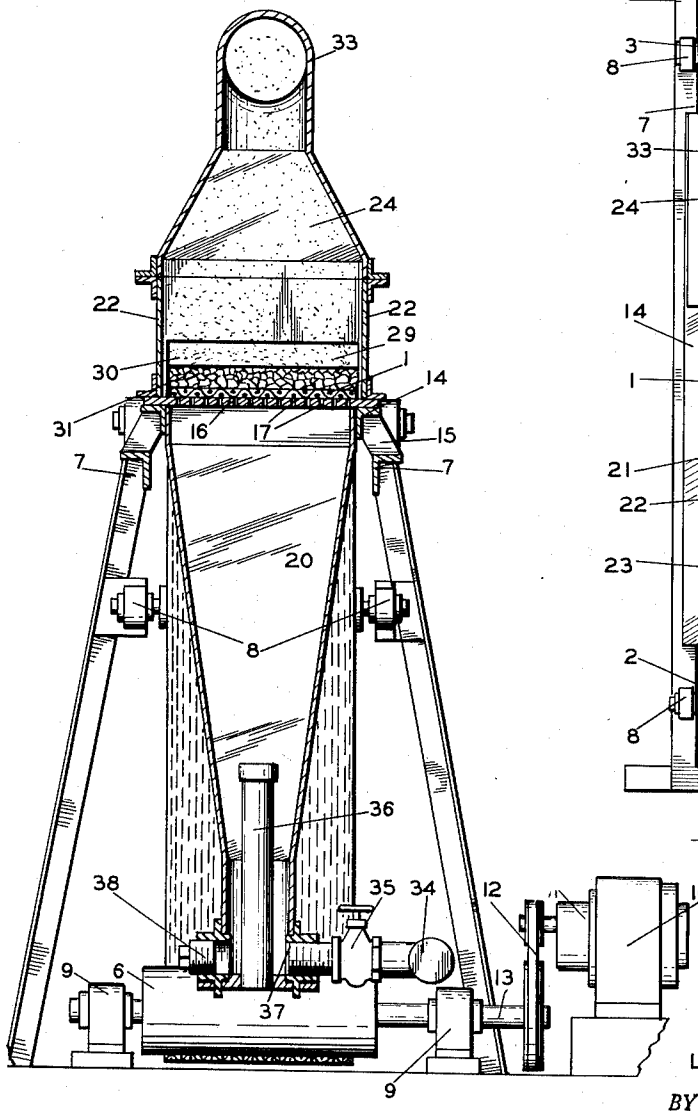
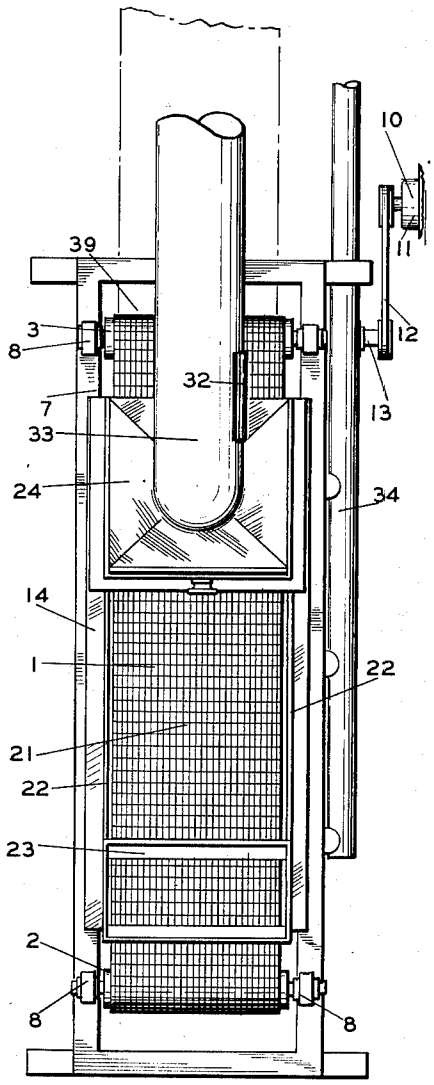


Fig 6



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Fig 8

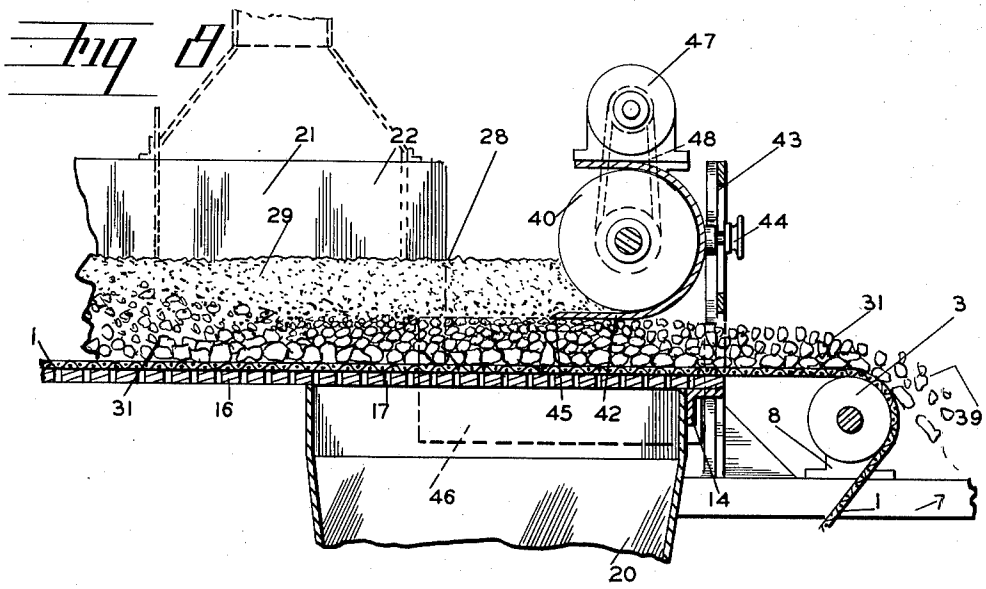


Fig 7

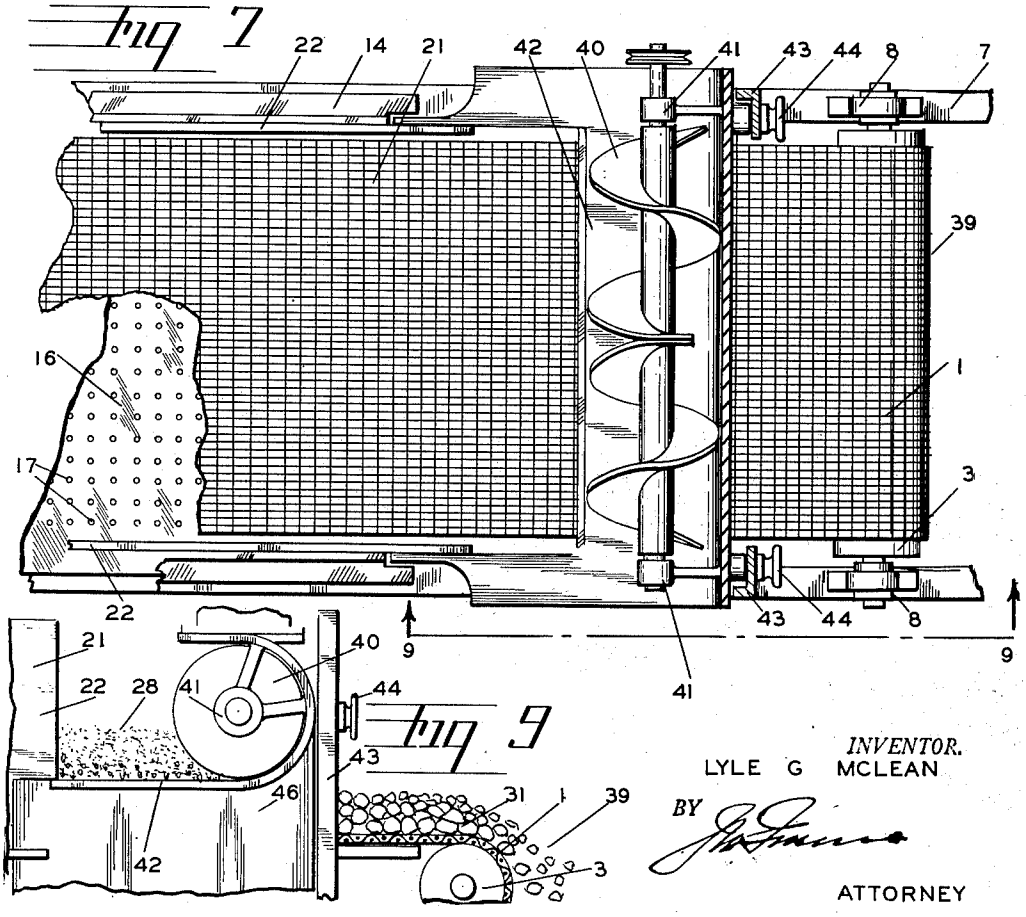


Fig 9

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UNITED STATES PATENT OFFICE

2,635,753

AIR STRATIFIER

Lyle G. McLean, Warden, Wash.

Application June 1, 1948, Serial No. 30,439

8 Claims. (Cl. 209—466)

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With my new and improved classifier and separator, I move the material in a horizontal plane over a perforated level plate, the said perforations discharging positive air pressure up through the material which is being moved over the said plate by a network or open conveyor. The air pressure being discharged from the openings or nozzles in said plate is diffused by and through the conveyor and the material, forcing the lighter materials to the top while concentrates gravitate to the bottom.

The movement of the conveyor eliminates what is known as pin holes or channels forming in the finer materials, thereby preventing the air from escaping through to the atmosphere through said pin holes or channels. In the case of the coarse granular materials, the said conveyor also prevents the air from forcing aside the said coarse particles forming channels to the surface of the materials and escaping. The level movement of the conveyor through the materials insures a uniform and direct lift by the air to the materials, causing a complete and uniform stratification of the materials.

After the floatation and stratification of the materials has been completed I employ two or more methods of separating the lighter materials from the coarse materials. One of my methods is to employ a mechanical conveyor adjustably mounted relative to the various strata of materials to be separated.

Another method of separating the lighter material from the heavier material is by a vacuum hood and conveyor, said vacuum being capable of control above the stratified material. By using both of the above methods three or more strata of material can be separated.

In the design of the jets within my machine, the area of the said jets are less than the total volume of air being delivered to said jets. This provides an even discharge of air over the entire surface of the plate and through the material regardless of the pressures being employed for the separation or stratification of the material.

The primary object of my invention is to classify and separate granulated materials by the floatation of the lighter materials to their respective strata by air passing up through the said materials, the materials being moved relative to one another so as to diffuse the air passing there-

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through, causing the lighter materials to rise to the surface and the heavier materials to concentrate underneath said lighter materials.

Another object of my invention is the designing of a concentrator and classifying machine wherein a continuous flow of material will pass through said machine, said material being stratified and separated by diffused air passing up through the material.

Another object of my invention is the provision of a vacuum lift or conveyor for removing the upper lighter strata of material away from the coarser and heavier materials.

Another object of the invention is the coordination of relative pressure and vacuum ratios between a positive diffused air delivered evenly up through the material, and a vacuum created above the material effecting the separation between the lighter and heavier materials.

Another object of the invention is to increase or decrease diffused air pressures passing up through the materials as they progress through the machine.

Another object of the invention is to control the diffused air pressures passing up through the materials in relation to the amount of vacuum being applied above the materials, effecting the desired strata separation between the lighter materials and the heavier.

Another object of the invention is to remove intermediate strata of material by a direct adjustable mechanical means.

Another object of the invention is the combination of the vacuum strata removal and two or more mechanical means for removing the various strata of material.

Summing up the above statements and objects, it must be borne in mind that as the materials are moved over the jets of air they become fluid in action, due to the even diffused distribution of air lifting the material to its various strata depending on the weight of the materials in said strata, in other words the entire material is floating in a fluid body over the said diffused air throughout its progress through the machine, thereby it becomes very easy to separate the strata one from the other by both vacuum and mechanical means.

Referring to the drawings:

Figure 1 is a side sectional view of my new and

improved classifier and separator, parts broken away for convenience of illustration.

Figure 2 is a fragmentary enlarged detail of the air discharge holes, together with the special conveyor agitating screen.

Figure 3 is a sectional view, taken on line 3—3 of Figure 2.

Figure 4 is a perspective view of the separator, parts broken away for convenience of illustration, the frame of the machine being completely removed therefrom.

Figure 5 is an end sectional view taken on line 5—5 of Figure 1. This view includes the driving motor.

Figure 6 is a plan view of my new and improved classifier and separator.

Figure 7 is a detail fragmentary plan view of another preferred method of removing the finer materials from the concentrates.

Figure 8 is a cross sectional view taken vertically and longitudinally of the conveyor shown in Figure 7.

Figure 9 is a fragmentary view in elevation taken on line 9—9 of Figure 7, illustrating the mechanical structure.

Referring more specifically to the drawings:

My new and improved classifier and separator consists of an endless network conveyor 1, trained about the rollers 2, 3, 4, 5 and 6. These rollers are journalled to the frame 7 of the machine by bearings 8 and 9. The roller 6 is driven by the motor 10 through the reduction gear 11, belt 12, through the cross shaft 13, journalled within the bearings 9.

A sub-frame 14 is supported upon the main frame 7 by the legs 15, best illustrated in Figure 5. Horizontally mounted upon the sub-frame 14 is a level perforated plate 16, having perforations 17 therethrough permitting air to pass through said plate from the air nozzles 18, 19 and 20, which will be more fully described later.

Mounted upon the frame 14 and above the plate 16 is a trough 21, along which is conveyed the materials to be classified and separated. This trough consists of side walls 22 having a hopper 23 for distributing the materials on to the conveyor belt 1 on its one end, and having a vacuum nozzle 24 mounted upon its opposite or delivery end (Figs. 1, 4 and 5). The trough is closed at its receiving end by the end plate 25 and the flexible closure door 26, which allows the conveyor belt 1 to pass thereunder, best illustrated in Figures 1 and 4.

I have provided an adjustable vacuum maintaining plate 27 at the entrance to the vacuum nozzle 24, the object of this plate is to maintain a vacuum closure between the surface 28 of the materials and the nozzle 24, the vacuum removing the lighter materials 29 from the heavier materials as the said materials are conveyed through the machine. A second adjustable plate 30 is provided adajcent the discharge end of the conveyor 1, which maintains a vacuum seal above the concentrates 31 adjacent the vacuum nozzle 24, allowing the separation between the finer materials 29 and the concentrates 31.

The objects of the plates 27 and 30 is primarily intended to maintain the vacuum seal between the surface of the finer materials 29 before entering the nozzle 24 from above the concentrates 31.

A control valve 32 is provided in the vacuum pipe 33 for controlling the amount of vacuum existing at the intake end of the nozzle 24, different materials requiring various amounts of vacuum. An air supply line 34 delivers air to the control valves 35, which delivers air into the air nozzles 18, 19 and 20. Located in the bottom of the said nozzles are pillars or spindles 36. As the air enters the side of the nozzles through the openings 37 and strike the said pillar a whirling action is imparted to the air distributing the air more evenly over the underside of the perforated plate 16, breaking up the air currents.

Referring to Figure 5, I have provided a clean out plug 38 for removing the materials which ordinarily get in the nozzle through the openings 17 of the perforated plate 16.

I will now describe the operation of my new and improved classifing and separating machine. The materials are entered through the hopper 23 on to the network conveyor 1, which is travelling in the direction of the arrow, driven by the motor 10. Air is supplied from the supply line 34 through the valves 35 into the nozzles 18, 19 and 20 up through the holes 17 of the plate 16, through the conveyor 1, up through the materials, floating the lighter materials to the top as indicated best at 28 and concentrating the heavier materials 31 on the conveyor (best illustrated in Figure 1), under the vacuum nozzle 24 and the delivery end of the conveyor at 39.

As the materials travel under the vacuum nozzle 24, the lighter materials are removed from the surface of the concentrates 31 by vacuum. The amount of vacuum will depend upon the type of material being separated and this is controlled by the by-pass valve 32. The valves 35 delivering air into the nozzles 18, 19 and 20 may be adjusted at various openings delivering the required pressures through the said nozzles and through the perforated plate 16 and the materials. This gives a control on the amount of air pressure applied for the floatation of the lighter materials which may be varied during the progress of the movement of the conveyor belt 1 and the material through the trough 21. For instance the pressure developed within the nozzles 18, 19 and 20 may differ either increasing or decreasing the velocity of the air being discharged through the openings or nozzles 17 of the plate 16, as the materials are conveyed through the machines. An adjustment between the ratio of vacuum and pressure through the plate 10 may be made by adjusting the valve 32 in the vacuum line and the valves 35 in the pressure supply line 34 leading to the nozzle 20.

The pressure nozzle 20 is carefully adjusted relative to the vacuum existing in the nozzle 24, said adjustments providing for different requirements for the separation of the finer materials from the concentrates 31 under the nozzle 24. As the conveyor belt 1 travels over the perforated plate it moves the materials in such a manner as to maintain an even flow of diffused air pressure up through the materials creating a fluid condition of the said materials permitting the carrying out of an even classification of the lighter materials from the concentrates, preventing pin holes in the material and channeling of the air.

It is to be particularly noted that the conveyor moving in a horizontal plane guides the stratified material forward relative to the discharge end of the conveyor and, as the material is moved forwardly, it is evenly stratified. The material being level, it functions to diffuse the air and the material is thereby more efficiently stratified. The blanket or bed of material aids in the diffusion of the air, and an even air pressure is obtained, with the air giving a direct lift to the

particles and the material being moved in relation to the stratification thereof.

Referring to Figures 7, 8 and 9, I have illustrated another preferred method of separating the lighter materials from the concentrates consisting of a screw conveyor 40 mounted within bearings 41 supported by the scoop or separator. The scoop or lip 42 is supported by the brackets 43 and is adjustable for elevation by the hand wheels 44 which holds said lip at the desired elevation. This comprises the separating feature of the scoop and is adjustable up and down relative to the finer materials 29 and the concentrates 31, best illustrated in Figure 8. This system of separating the different strata of material is admirably adapted to various types of materials.

It will be noted in Figure 7 that the conveyor screw will deliver materials from the center of the machine outwardly in both directions, which is a feature of the conveyor itself. The walls 46 form part of the trough 42 and is for the purpose of guiding the concentrates 31 along their predetermined path through the trough 21 to the final discharge point 39. I have provided suitable driving means, as the motor 47 for driving the conveyor 40 through the belt 48.

Referring to Figure 8, I have illustrated in broken line position the vacuum head 24 being used in combination with the screw conveyor for separating the various strata of materials. The vacuum head takes away the lightest material, while the screw conveyor removes the intermediate strata, and lastly the conveyor 1 delivers the heavy concentrates 31 from the machine.

Reviewing the operation, and restating the primary object of my invention, is the creation of a fluid condition to a moving stream of materials so that the said materials may be stratified and separated. This is accomplished by floating the material on diffused air by mechanical action, namely moving about of the material over air nozzles, eliminating the by-passing of the air up through the material into the atmosphere without first being completely diffused under the material giving a complete air lifting action to the material. This is the feature that is new in my system of operation, and that heretofore has not been accomplished to my knowledge in other machines, even though they used air up through the material.

When the materials have become fluid, the ideal condition exists for removing the various strata of material, first by a vacuum for the lighter materials, then by the mechanical means, which I have discussed consisting of the screw conveyor and the network conveyor, although I do not wish to be limited to the exact mechanical means illustrated, as other methods may be employed still coming within the scope of my claims.

What I claim is:

1. A combined classifier and material separator, comprising a frame, a perforated plate horizontally supported on the frame, a foraminous conveyor movable horizontally over the surface of the perforated plate, a hopper on said frame for depositing a layer of material on said conveyor, a suction chamber on said frame and spaced from said hopper longitudinally of said conveyor and disposed completely across and perpendicular to said conveyor for removing the upper portion of said material layer, means on said frame for confining the layer of material to be treated on the conveyor between the hopper and the suction chamber, and means supported by said frame for supplying air under pressure substantially perpendicular to and through the perforations of said plate and through the material to agitate and stratify the various elements of the material while in movement between the hopper and the suction chamber.

2. The combination of claim 1, wherein said suction chamber movably supports on its respective transverse walls a pair of vertical plates disposed transversely above the conveyor, and means for securing said plates on said chamber walls in selective positions of elevation relative to said conveyor.

3. A combined classifier and material separator comprising a frame, a perforated plate horizontally supported on the frame, a foraminous conveyor operatively mounted on the frame and having a horizontal flight, said flight being superposed on the plate and movable longitudinally thereof and having a loading end and opposite discharge end, a hopper for depositing material on the loading end of the flight, means spaced from the loading end of the flight and disposed adjacent to the discharge end of the flight for removing the upper strata of the material layer with the lower heavier strata of the layer being dumped off the discharge end of the flight, means for confining the material on the conveyor between the loading and discharge ends thereof, a plurality of longitudinally spaced air suppliers mounted beneath and perpendicular to the plate for supplying air under pressure vertically through the plate and through the layer of material to agitate and uniformly stratify the various elements of the material while it is moved by the conveyor from the hopper to the discharge end of the flight, and control means for each of said air suppliers for individually regulating the air supplied thereby.

4. The combination of claim 3, wherein said means for removing the upper strata comprises a suction chamber mounted on said frame for vertical adjustment relative to said conveyor, one of said air suppliers being vertically aligned with the chamber for cooperation with said suction means in removing the upper strata.

5. A dry floatation classifier and separator, comprising a frame, a perforated plate horizontally supported on the frame, a foraminous conveyor movable horizontally over the surface of the perforated plate and having a loading end and a discharge end, a hopper for depositing material on said conveyor adjacent the loading end thereof, means on said frame for confining the material to be treated on the conveyor between the hopper and the discharge end of said conveyor, means supported by said frame beneath said plate for supplying air under pressure substantially perpendicular to and up through the perforations of said plate and through said conveyor and the material to agitate and stratify the various elements of the material while in movement between the hopper and the discharge end, and means above said plate and conveyor adjacent the discharge end thereof and disposed completely thereacross between said confining means for removing the upper portion of the stratified material.

6. The combination of claim 5, wherein said material removing means includes a scoop disposed transversely above the discharge end of the conveyor flight and having a lead edge facing the hopper and opposed to the longitudinal

path of the movement of the conveyor flight for scooping off the upper portion of the material as the material is moved by the conveyor, and a screw conveyor rotatably journalled in the scope and having reversely spiralled ends to discharge the scooped material from both sides of the frame.

7. The combination of claim 6, wherein said scoop is mounted on the frame for vertical adjustment relative to the conveyor flight and means is provided for adjusting said scoop.

8. A dry floatation classifier and separator, as defined in claim 5, wherein said means for removing the upper portion of the material comprises vacuum means.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
590,538	Davis	Sept. 21, 1897
830,989	Gillon et al.	Sept. 11, 1906
1,291,137	Reed	Jan. 14, 1919
2,275,849	Fraser	Mar. 10, 1942
2,310,894	Brusset	Feb. 9, 1943
2,332,183	Stump	Oct. 19, 1943
2,382,122	Wiegand	Aug. 14, 1945

FOREIGN PATENTS

Number	Country	Date
455,219	Great Britain	Oct. 12, 1936