Nov. 13, 1951 L. G. McLEAN 2,574,493

CLASSIFIER AND SEPARATOR

Filed April 18, 1949 3 Sheets-Sheet 1

Fig. 1

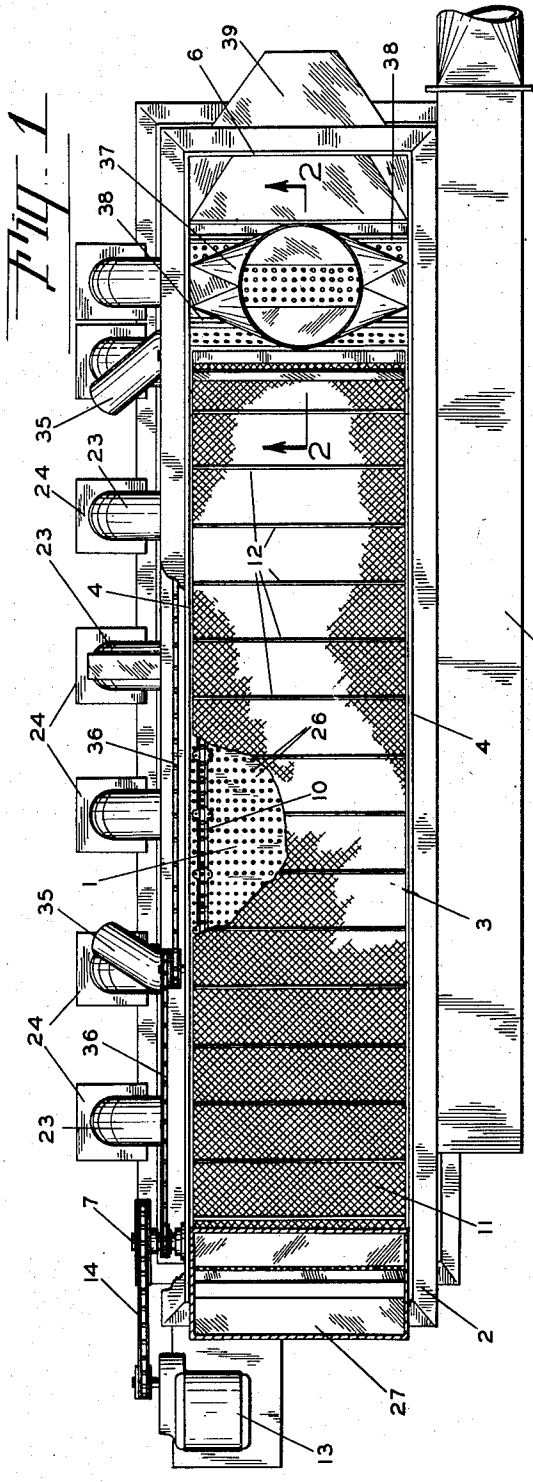


Fig. 3

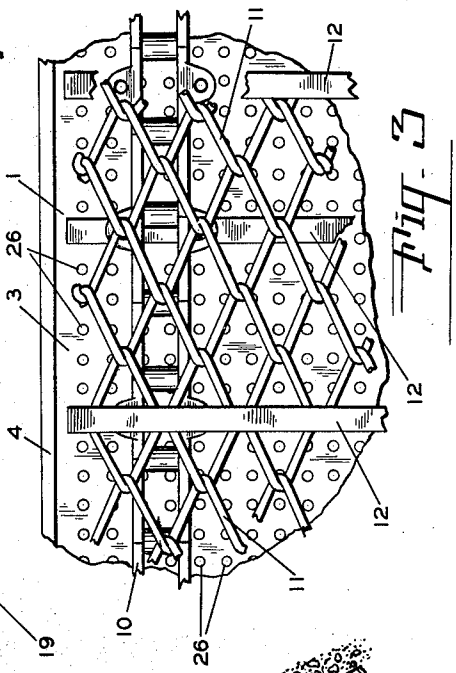
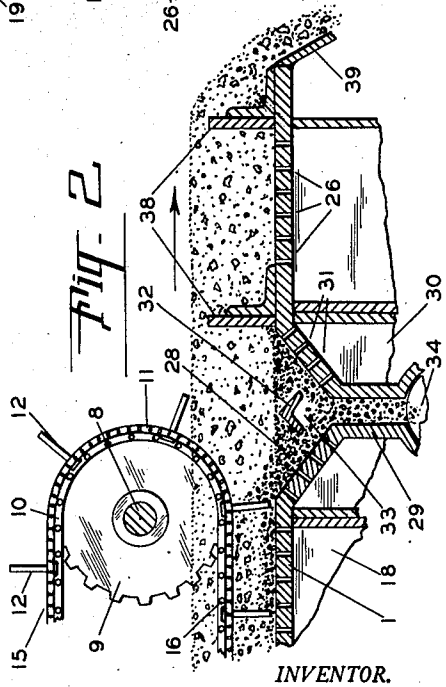


Fig. 2



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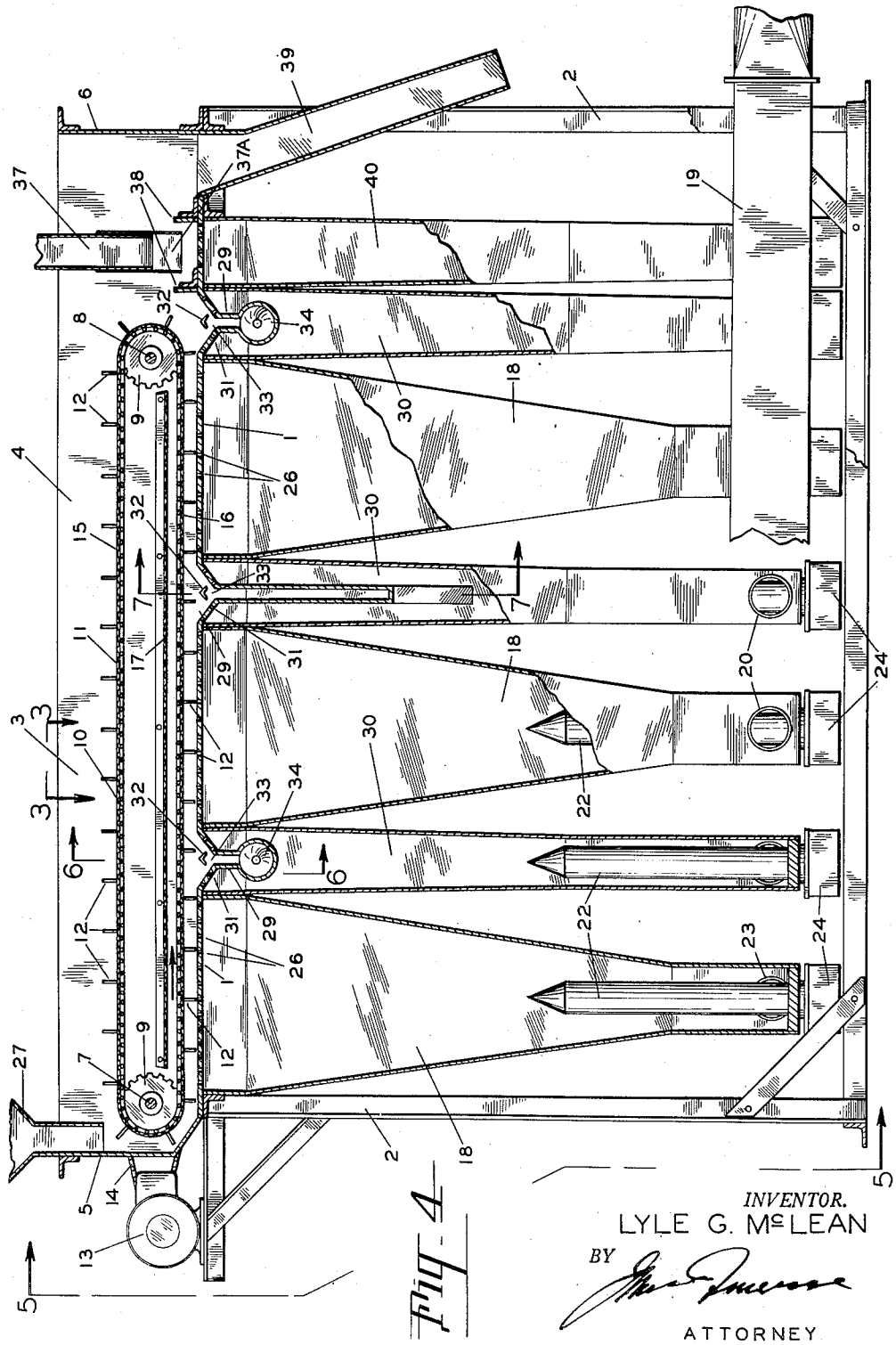


Fig. 4

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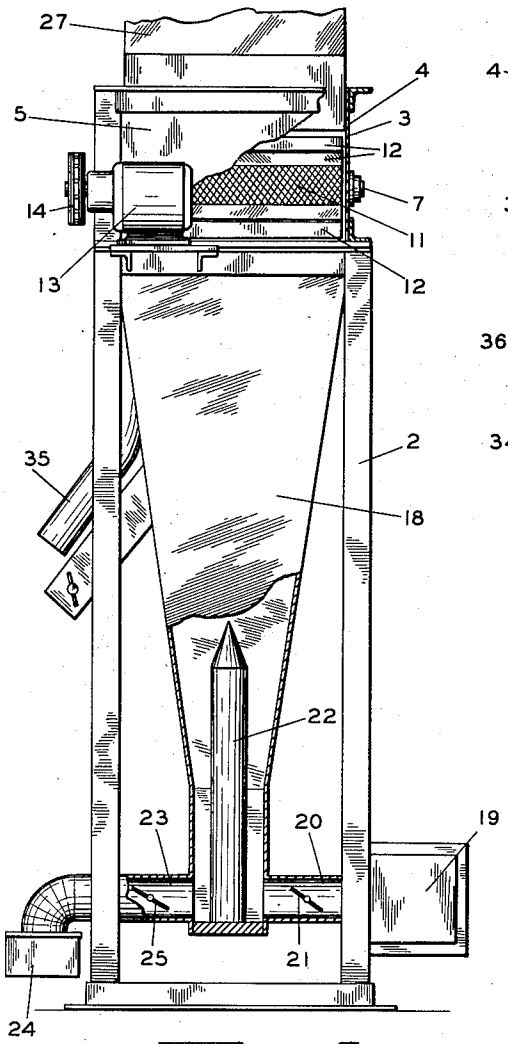


Fig. 5

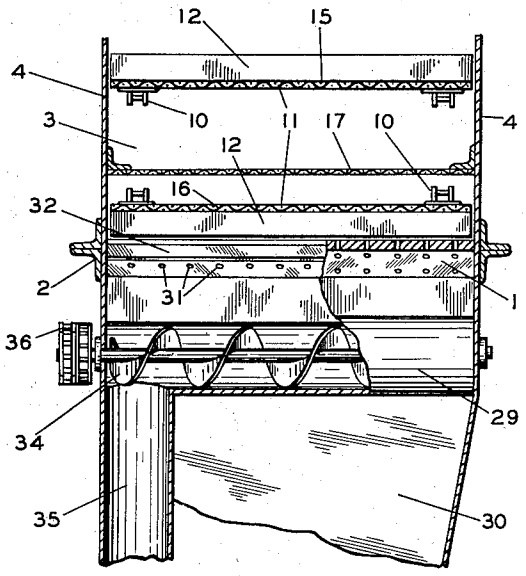


Fig. 6

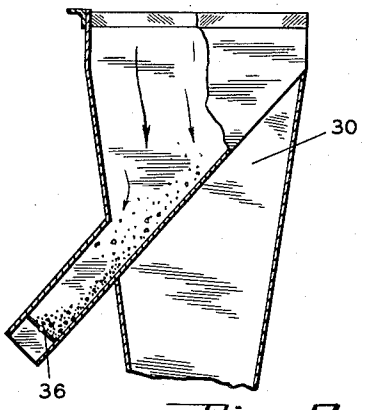


Fig. 7

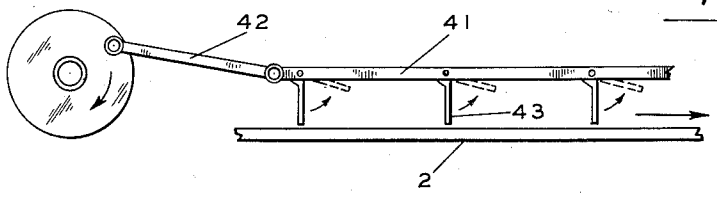


Fig. 8

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Patented Nov. 13, 1951

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UNITED STATES PATENT OFFICE

2,574,493

CLASSIFIER AND SEPARATOR

Lyle Gordon McLean, Warden, Wash.

Application April 18, 1949, Serial No. 88,125

7 Claims. (209—474)

1

This invention relates to classifiers and separators and is particularly adapted for the dry separation of minerals, food products and other industrial separations.

This application relates to improvements over my now pending application, Serial Number 30,439 on Classifiers and Separators.

With my now pending application, as well as this application, I move the material over a perforated plate, the said perforations discharging positive air pressure up through the material which is being flowed and wiped over the said plate. The air pressure being discharged from the openings or nozzles in said plate is diffused by the wipers and screens floating the lighter materials to the top while concentrates gravitate to the bottom.

With this present application I add an improved feature in the discharging of the concentrates or heavier materials into collectors or receivers from the gangue or lighter materials.

The primary object of this invention is in the method of removing the heavier or concentrated material from the light materials after they have been stratified and concentrated.

Another object of this invention is to separate the heavier material from the lighter material while all of the materials are in floatation and in their various stratas and moving on a relatively horizontal plane.

A further object of this invention is to provide a receiving station for the heavier material so constructed as to support the lighter materials above the heavier materials while the heavier materials are being removed from under the said lighter materials.

This is accomplished not only by mechanical means, but also by the controlling of air pressures existing under the materials. The mechanical means consists of a baffle which prevents the light materials from funneling into the receiving station with the heavier materials.

A still further object of my present invention is the provision of means for moving or wiping the heavier or concentrated material towards the receiving or discharge stations for the heavier materials.

With this present application I also provide stationary screens disposed above the moving

2

screen to assist in the moving of the granules of the material relative to one another as the material progresses through the machine, thereby eliminating air pin holes or by-passing of the air, insuring a complete stratification of the material, both the stationary screen and the moving screen act as baffles in the stratification by the air of the material, these screens allowing the material to pass freely therethrough.

A still further object of this invention is to provide means of cleaning the air being forced through the materials so that the perforated plate under the materials will not become clogged.

These and other incidental objects will be apparent in the drawings, specification and claims.

Referring to the drawings:

Figure 1 is a plan view of my new and improved classifier and separator.

Figure 2 is an enlarged sectional view, taken on line 2—2 of Figure 1, indicating the stratification of the heavier material and indicating the removal of the lighter materials.

Figure 3 is a detail fragmentary plan view of a preferred form of baffle screen to be used in connection with my invention, taken on line 3—3 of Figure 4.

Figure 4 is a longitudinal, partially in section, side view of the machine.

Figure 5 is an end view, partially in section, taken on line 5—5 of Figure 4, looking in the direction indicated.

Figure 6 is an enlarged detail sectional view taken through line 6—6 of Figure 4, illustrating the concentrate receiving station.

Figure 7 is an enlarged detail sectional view taken on line 7—7 of Figure 4 illustrating another preferred form of concentrate receiving station.

Figure 8 is another preferred form of embodiment relative to the wiping arrangement.

Referring more specifically to the drawings:

In carrying out the objects of my present invention I mount a perforated plate 1 horizontally upon suitable framework 2, and within a trough 3. The trough 3 consists of side walls 4, having ends 5 and 6. Cross shafts 7 and 8 have sprockets 9 keyed thereto around which the endless chains 10 are trained. The endless screen

11 is secured to these chains, best illustrated in Figures 3, 2 and 4.

Semi-flexible cross wipers 12 are also secured to the said chain 10 for engaging the surface of the perforated plate 1. The screen and wiper assemblies are driven at a very slow rate of speed by the motor 13 through the chain 14 to the shaft 7.

Disposed between the runs 15 and 16 of the endless screen assembly is a horizontal screen 17 fixedly secured between the side walls 4 of the trough 3. The object of the endless screen 11, the screen 17 and the wipers 12 will be more fully described later on. There may be any number of these screens, as I do not wish to be limited to the number of them.

Located underneath the perforated plate 1 are equalizing air chambers 18 receiving a forced air supply from the supply mainfold 19 by way of the cross manifolds 20. A control valve 21 is located within the manifold 20 to control the amount of air delivered from the supply manifold into the air chambers. A vertically mounted pedestal 22 is located centrally of the air chambers, the object of which is to disburse the air evenly up into the air chambers.

Oppositely disposed from the manifold 20 is a dust discharge manifold 23, the velocity of the air and dust coming into the air chamber causes the dust to enter this manifold, after which it is caught in the container 24. A shut off valve 25 is located within this manifold 23 so that the container 24 can be removed and emptied without interfering with the operation of the air supply into the air chamber. It is very important that the dust and dirt be removed from the air before reaching the perforations 26 of the plate 1, otherwise these perforations would become clogged interfering with the complete and smooth operation of the machine, and permitting continuous operation.

In the operation of the machine sized granulated materials enter the machine by way of the hooper 27. As the materials reach the perforated plate 1 the air passing up through the holes 26 floating the material into its various strata, depending upon the weight of the materials, as the air passes up through the material the lighter material rise to the higher elevation or strata. This is where the screens 11 and 17 come into operation acting as baffles in the path of the rising granulated materials, the material passing up through the screens separating each granule from the other so that pin holes will not be formed in the finer materials or the air being permitted to pass around the coarser material.

Due to the constant rearranging or jostling of the granules or particles by-passing through the mesh of the screens, thereby keeping a constant movement of the said particles relative to one another, insures an even distribution of the air throughout the material being stratified.

In the form of the various strata, as the air rises through the materials, the materials have a tendency to splash into bubbling action. This is further broken up by the action of the screens. In the stratification of dry materials it has been found that when air is applied under and through the material that said material will flow as a liquid, and as the air is lifting the material into its various strata the material will flow in the direction of the arrow, similar to a liquid caused by the forcing down of the new material from the hopper 27, therefore it is not the intention to move the material with the endless screen 17,

but merely to cause a constant movement between the granules insuring an even overall flow of air up through the material causing the floatation of the materials.

When the concentrates, indicated at 28, rest on the perforated plate 1 they are moved in the direction of the arrow over the plate by the wipers 12 underneath the lighter materials towards the receiving stations 29. Located under the stations or receivers 29 are air chambers 30, these chambers receive an air supply from the main manifold 19, the same as the air chambers 18 having their individual control valves associated therewith. The object of the separate air chambers 30 is to control the amount of air passing up through the openings 31 of the plate 1 located within the receiving stations 29 in relation to air chambers 18.

Cross baffles or shields triangular in cross section 32 are located transversely above the throats or mouths 33 of the receiving stations, and the object of the cross baffle is to assist in preventing the lighter materials from running into the throats 33 which are V-shaped in cross section while passing over the stations 29. The flowing of the lighter materials into the receiving stations is further prevented by increasing the air pressure under the receiving stations tending to raise the lighter materials slightly at this point, while the heavier materials are being wiped off the plate and from under said lighter materials into the receiving chambers 29. This action is best illustrated in Figure 2 and carries out the primary object of this invention. It is to be noted that the apexes of the shields are flush with the bottom wall permitting the wipers to pass thereover.

I illustrate a screw conveyor 34 for carrying the material out of the receiving chamber into chutes 35, best illustrated in Figures 2, 4 and 6. I also show another form of carrying the materials from the receiving stations in Figure 7 where no screw conveyors are used, but merely a hopper and spout having a valve control 36. The screw conveyors 34 are driven from the shaft 7 by a system of driving chains 36 best illustrated in Figure 1.

As in my present pending application, I illustrate a vacuum nozzle 37 for removing the upper lighter stratas of material. I provide adjustable separation gates 38 for controlling the depth of stratification of materials overflowing into the discharge spout 39. An air chamber 40 is located under the vacuum nozzle 37 and is for the purpose of maintaining stratification of the materials while the lighter materials are being removed by the nozzle 37. The nozzle 37 also has an adjustable tip 37A for lifting the desired strata of materials.

Referring to Figure 8, I illustrate another preferred form of wiper and screen movement, wherein the screen 41 is moved by the connecting rod 42 pushing the material in the direction of the arrow over the perforated plate 2. I merely wish to disclose this method of moving the screen and wipers 43 as an alternate method of moving the concentrates along the perforated plate.

Although certain specific embodiments of the invention have been shown and described, it is obvious that many modifications thereof are possible. The invention, therefore, is not to be restricted except in so far as is necessitated by the prior art and by the spirit of the appended claims.

What I claim is:

1. A classifier and separator comprising a trough having a substantially horizontally disposed bottom wall that is perforated substantially throughout its entire area, a supply station for supplying material to the trough, receivers longitudinally spaced beyond said supply station and beneath said trough and having mouths opening through said bottom wall to remove a portion of the material therefrom, a foraminous conveyor operatively mounted longitudinally in the trough for advancing the material from the supply station along the bottom of the trough and past at least some of said receivers, means beneath the trough for supplying air under pressure to the trough and directing the air substantially vertically up through the conveyor and the material to float the material and cause the material particles to stratify according to their weight, wiper members transversely of the conveyor and extending substantially to said bottom plate for moving the heavier bottom strata along the bottom plate to said mouths, shields mounted transversely across and partially covering the open mouths of the receivers to support and pass over said mouths the stratified top layer of lighter particles while the heavier particles stratified as the bottom layer flow under the shields into the receiver mouths, and means beyond said receivers for removing said stratified top layer from the trough.

2. A classifier and separator comprising a trough having a substantially horizontally disposed bottom wall that is perforated substantially throughout its entire area, a supply station at one end of the trough for supplying material to the trough, longitudinally spaced substantially vertical receivers depending from the bottom of the trough and having wide mouths opening through the bottom wall to remove a portion of the material therefrom, the walls of said mouths being perforated; an endless foraminous conveyor operatively mounted longitudinally in the trough for receiving the material from the supply station and conveying it onto the bottom of the trough, wipers carried transversely by the conveyor for moving the material through the trough, means disposed below the bottom of the trough and extending the length thereof for supplying air under pressure to the trough and mouths for directing the air substantially vertically through the conveyor and the material to float the material and cause the material particles to stratify according to their weight, shields mounted transversely across the center of the mouths of the receivers and cooperating with the air passing up through said walls to support and pass over the receiver mouths the stratified top layer of lighter particles while the heavier particles stratified as the bottom layer flow under the shields into the receiver mouths, and means beyond said receivers for removing said stratified top layer of the material.

3. A classifier and separator comprising a trough having a horizontally disposed bottom wall that is perforated substantially throughout its entire area, a hopper at one end of the trough for supplying material to the trough, longitudinally spaced vertical receivers depending from the bottom of the trough and having V-shaped mouths opening through the bottom wall to remove a portion of the material therefrom, an endless foraminous conveyor operatively mounted longitudinally in the trough for receiving the material from the hopper and conveying it onto the bottom of the trough, wipers carried transversely by the conveyor and extending substantially into contact with said bottom wall for moving the heavier material through the trough, means disposed below the bottom of the trough and extending the length thereof for supplying air under pressure to the trough and mouths for directing the air vertically through the conveyor and the material to float the material and cause the material particles to stratify according to their weight, shields triangular in cross section mounted transversely across the center of the mouths of the receivers, the walls of the shields slanting in a direction opposite to the incline of the mouth walls, said mouth walls being perforated to permit air under pressure to converge relative to said shields, whereby the lighter particles forming the stratified top layer are supported by the shields and pass over the mouths of the receivers while the heavier particles forming the stratified bottom layer flow under the edges of the walls of the shields into the receiver mouths, the upper portions of the shields being in the same horizontal plane as the bottom wall so that the edges of the wipers can freely pass thereover, and means beyond said receivers for removing the top layer of the material.

4. A classifier and separator comprising a trough having a horizontally disposed bottom wall that is perforated substantially throughout its entire area, a hopper at one end of the trough for supplying material to the trough, longitudinally spaced vertical receivers depending from the bottom of the trough and having V-shaped mouths opening through the bottom wall to remove a portion of the material therefrom, an endless foraminous conveyor operatively mounted longitudinally in the trough for receiving the material from the hopper and conveying it onto the bottom of the trough and having spaced upper and lower flights, wipers carried transversely by the conveyor for moving the material through the trough and agitating the material, means disposed below the bottom wall and extending the length thereof for supplying air under pressure to the trough and directing the air vertically through the conveyor and material to float the material and cause the material particles to stratify according to their weight, a foraminous screen mounted across said trough between the flights of the conveyor and retarding the passage of the air to prevent rapid exhaustion thereof, shields triangular in cross section mounted transversely across the center of the mouths of the receivers, the walls of the shields slanting in a direction opposite to the incline of the walls of the mouths, said mouth walls being perforated to permit air under pressure to converge relative to the shields whereby the stratified top layer of lighter particles is supported by said shields and pass over the receiver mouths while the heavier particles stratified as the bottom layer flow under the edges of the shield walls into the receiver mouths, and means beyond said receivers for removing the top layer of the material.

5. A classifier and separator as defined in claim 1, wherein said air supplying means includes means directing air up through said receiver mouths.

6. A classifier and separator as defined in claim 2 wherein said air supplying means includes separate means for directing air up through said bottom plate and through said mouth walls respectively.

7. A classifier and separator as defined in claim 3 wherein said air supplying means includes separate supplying means for each of said receiver mouths and for the areas of said bottom plate between said receiver mouths respectively.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
895,363	Greenway	Aug. 4, 1908
1,534,846	Fraser et al.	Apr. 21, 1925
1,822,840	Davis	Sept. 8, 1931
1,831,524	Clark	Nov. 10, 1931
2,007,190	Fraser	July 9, 1935
2,074,977	Bird et al.	Mar. 23, 1937
2,086,584	Stump	July 13, 1937
2,275,849	Fraser	Mar. 10, 1942
2,303,367	Kendall et al.	Dec. 1, 1942
2,332,183	Stump	Oct. 19, 1943
2,445,251	Tessin	July 13, 1948

FOREIGN PATENTS

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