

July 27, 1926.

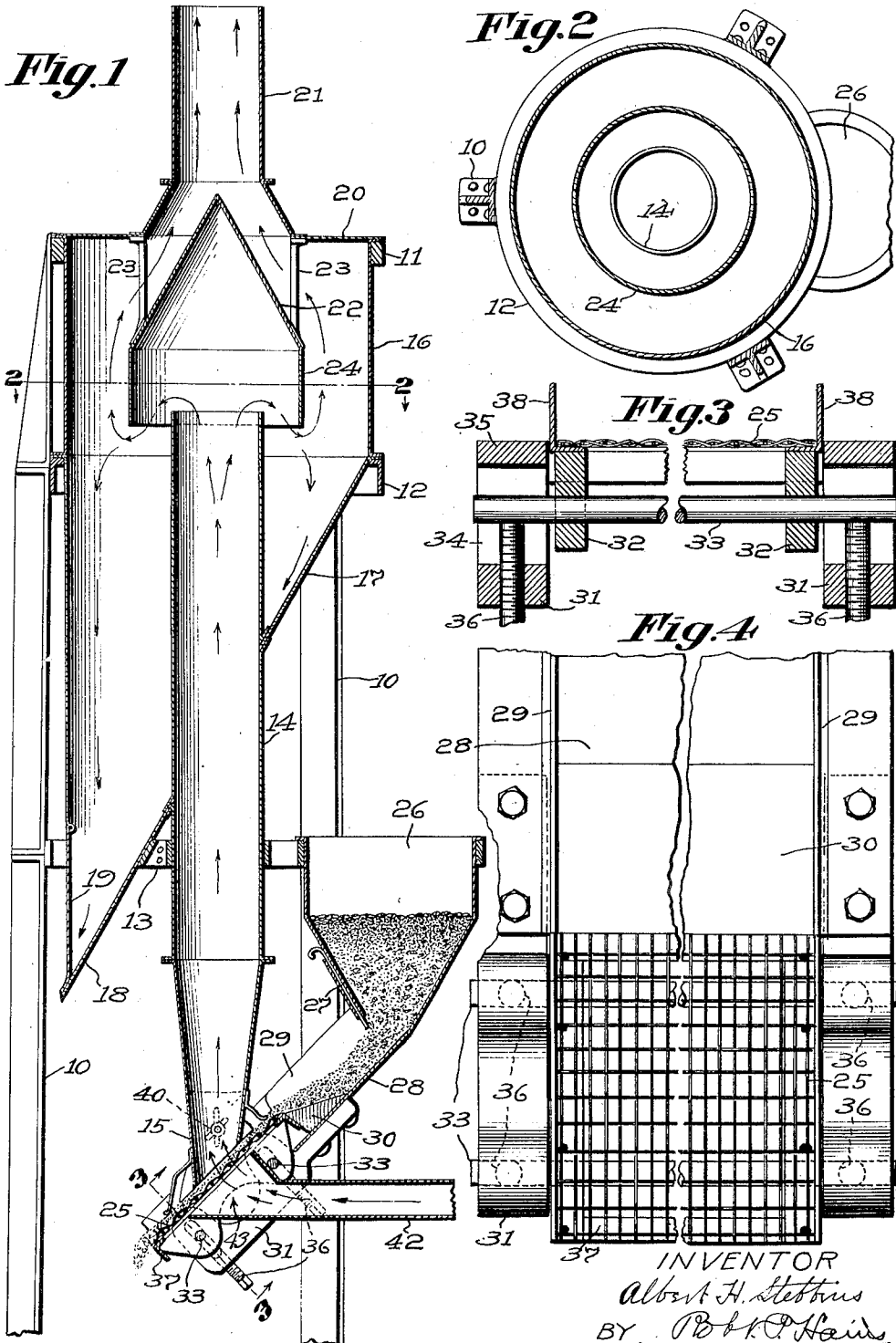
1,593,729

A. H. STEBBINS

CLASSIFIER

Filed Dec. 20, 1924

2 Sheets-Sheet 1



INVENTOR  
Albert H. Stebbins  
BY *Robert P. Hains*  
ATTORNEY

**July 27 , 1926.**

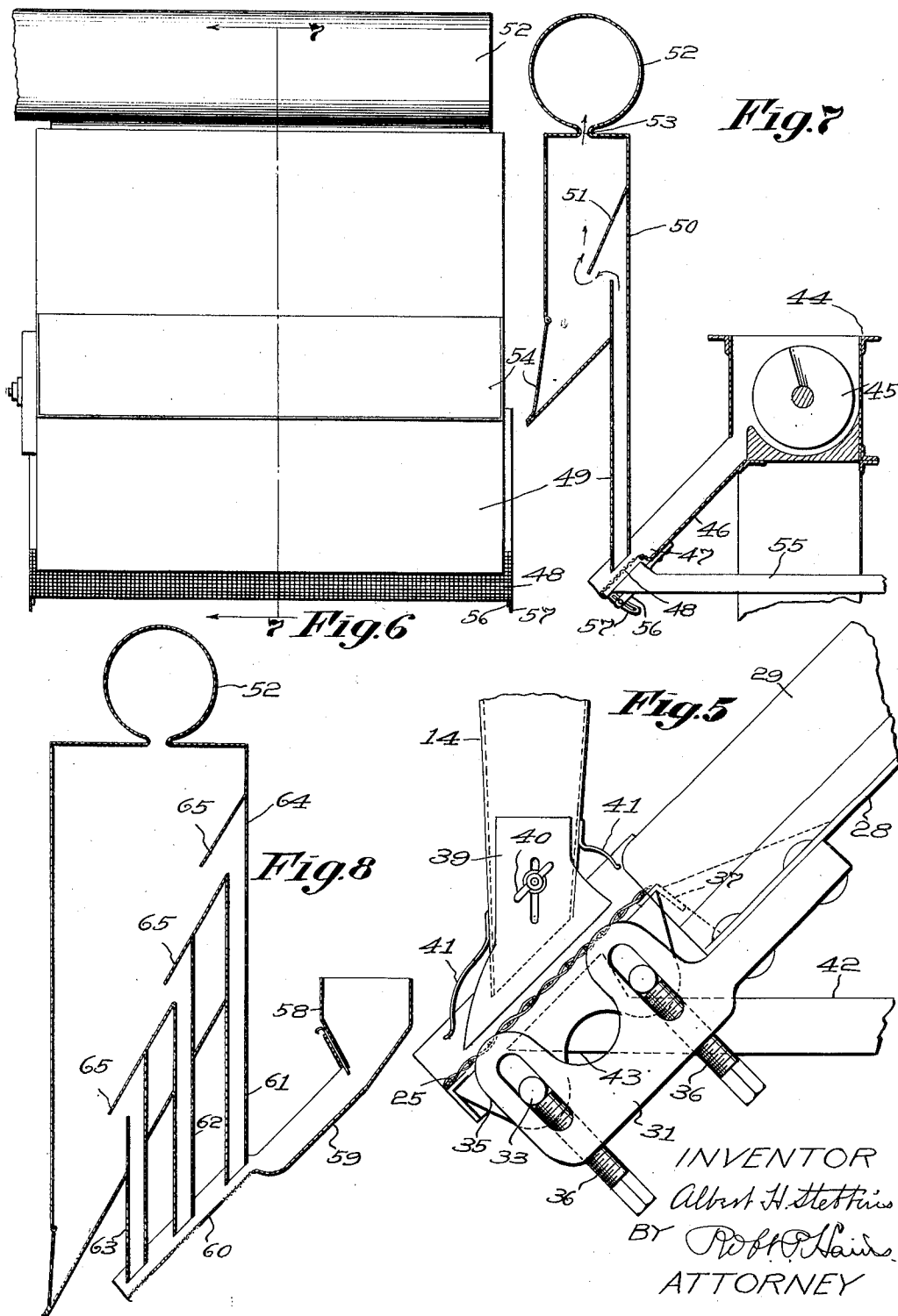
**1,593,729**

A. H. STEBBINS

CLASSIFIER

Filed Dec. 20, 1924

2 Sheets-Sheet 2



## UNITED STATES PATENT OFFICE.

ALBERT H. STEBBINS, OF LOS ANGELES, CALIFORNIA.

## CLASSIFIER.

Application filed December 20, 1924. Serial No. 757,172.

This invention relates to a construction in which classification is effected by passing air upwardly through the materials being treated to pick up the lighter particles.

Two different types of classifiers or separators are well known and extensively used. One of these types is the ordinary screen in which the fine particles pass through the mesh of the screen surface and escape from the larger particles. The other type utilizes air currents to carry off the fine particles while leaving the heavier particles.

The present invention is directed to a simple construction employing features of both types of classifiers above mentioned, and in its preferred embodiment employs a screen surface over which the materials to be treated are passed in a substantially uniform stream, and air is passed upwardly through the screen surface and materials thereupon to carry off the lighter materials while leaving the heavier materials. In this manner all materials passing over the screen surface are subjected to the action of the rising air currents and the fine particles are completely removed.

By passing air upwardly through the screen surface and materials thereupon in accordance with the present invention, classification of the materials is effected without shaking or vibrating the screen surface and in this manner the screen surface is relieved from the strain to which it is commonly subjected in the ordinary vibratory screen. Furthermore, since the lifting effect of the rising air helps to support the materials upon the screen surface, the weight upon the screen surface is relieved and relatively fine wires may therefore be employed in constructing the same. The action of the air serves also to prevent clogging of the screen surface as the rising air currents help to lift the particles that lodge in the mesh of the screen.

Important features of the present invention reside in means for feeding the materials in a continuous stream beneath the mouth of the suction pipe; a screen surface for supporting the materials so that air may pass upwardly through the surface and materials; means for adjustably supporting the screen surface; means for removing the heavier particles from the air within the suction pipe, and in other features which will appear from the following description, when read in connection with the drawings

which illustrate good practical forms of the invention.

In the drawings:—

Fig. 1 is a vertical sectional view through a classifier constructed in accordance with the present invention;

Fig. 2 is a horizontal sectional view taken on the line 2—2 of Fig. 1;

Fig. 3, on an enlarged scale, is a sectional view taken on the line 3—3 of Fig. 1;

Fig. 4 is an enlarged plan view looking toward the inclined chute that delivers materials to the screen surface;

Fig. 5 is an enlarged side view of the lower portion of Fig. 1, one side wall being omitted to show the screen surface;

Fig. 6 is a front elevation of a modification of the invention;

Fig. 7 is a sectional view taken on the line 7—7 of Fig. 6; and

Fig. 8 is a side view of a further modification of the invention.

In the embodiment of the invention shown in Fig. 1 the various parts are supported by a frame consisting of uprights 10 which are rigidly secured to the supporting rings 11, 12 and 13. Mounted centrally within the frame thus formed is a suction pipe 14, the lower end of which is provided with a nozzle 15. The materials to be treated are caused to pass under the lower or suction end of the pipe 14, and air is drawn upwardly through this pipe so that the rising air currents will pick up the lighter particles, but will leave the larger and heavier particles. A suction fan or any other suitable means, not shown, may be provided for drawing air upwardly through the pipe 14 and, if desired, all particles picked up by the rising air currents may be carried by the air to the suction fan, or other suction producing means, but in most cases it is desirable to remove the larger particles picked up by the air. To this end, in the construction shown in Fig. 1, a settling chamber 16 is provided, into which the upper end of the pipe 14 extends, and this settling chamber has a sloping floor 17 upon which the materials that settle out of the air will slide downwardly towards the discharge spout 18, which is normally closed by the swinging door 19, this door being constructed so that it will swing outwardly to permit the materials to escape from the settling chamber, but will prevent air from entering through this opening. The upper

end of the settling chamber is closed by a cover plate 20 and a conduit 21 leads from the upper end of the settling chamber to the fan or other suction means. It is desirable to provide means within the settling chamber 16 to check the flow of air through this chamber, to thereby promote settling of the heavier materials, and to this end, in the construction shown, a cone-shaped hood 22 is provided which is supported over the upper end of the suction pipe 14 by rods 23, and this hood preferably has a downwardly extending cylindrical portion 24 which encircles the upper end of the pipe 14. The arrangement is such that the material laden air makes a sharp bend, as indicated by the arrows, as it passes around the lower edge of the cylinder 24. The rapid movement of the air about the lower end of the hood tends to throw the heavier particles downwardly so that they will settle within the chamber 16, while the lighter particles are carried by the air upwardly through the conduit 21.

The means for delivering a sheet or stream of materials to the lower end of the suction pipe 14 may be variously constructed and in the construction shown this is accomplished by supporting a screen surface 25 at a substantial inclination below the nozzle 15 of the suction pipe, so that the materials delivered to the inclined screen surface will flow by gravity over this surface, and as they pass under the nozzle 15 air is drawn upwardly through the screen surface and materials thereupon to pick up the lighter particles. The materials being treated should pass over the screen surface 25 in substantially a uniform sheet and the construction of the means for supplying the materials to the screen surface is therefore important.

In the construction shown, a hopper 26, which may be supported by the lower ring 13 is provided, and the rate at which the materials escape from the hopper may be controlled by adjusting the sliding gate 27. The materials are conveyed from the hopper 26 to the screen surface by an inclined chute 28 having the spaced side walls 29. It is necessary to impart a substantial slope to the chute 28 so that the materials will travel along the chute under the influence of gravity, but if these materials are permitted to slide upon the floor of the chute the floor soon becomes highly polished with the result that the materials slide down the same at a high velocity. This is not desirable, as it causes the materials to pass too rapidly below the suction end of the pipe 14, and in order to retard the speed at which the materials flow down the chute 28, it is desirable to construct the chute so that the materials adjacent the floor of the chute are arrested to form a layer over which other

materials slide to the screen surface. In this manner a smoother and more uniform flow of materials is obtained than is possible when the materials are permitted to slide along the highly polished floor of the chute. Various means may be employed for causing a layer of materials to lodge upon the floor of the chute 28 over which other materials will flow, and in the construction shown the screen surface 25 is supported above the floor of the chute 28 so that a pocket is formed adjacent the upper edge of the screen surface in which the materials may accumulate. In the construction shown, a block of wood or the like 30 is placed in the pocket just mentioned partly to fill up the same.

It may be desirable to adjust the screen surface 25 towards and from the lower end of the suction pipe 14, and also to vary the inclination at which the screen surface is supported. Means is therefore shown for adjustably supporting the screen surface 25 and to this end spaced side arms 31 are provided which are rigidly secured at their upper ends to the chute 28 or other supporting means. Between the spaced arms 31 is adjustably mounted the screen supporting frame consisting of spaced side bars 32 which are rigidly secured to the transversely extending rods 33. These rods have projecting ends that extend into elongated slots 34 formed in projections 35 provided upon each arm 31. The projecting ends of the bars 33 rest upon adjusting screws 36 carried by the arms 31 and the arrangement is such that the screen supporting frame may be raised or lowered, or the inclination at which the same is supported may be varied, by adjusting the screws 36. The opposite ends of the spaced bars 32 may be connected by angle irons 37, to which the upper and lower edge of the screen surface may be secured, and plates 38 extending upwardly from the side bars 32 may be provided to prevent the materials from escaping over the opposite ends of the screen surface.

It is desirable that the air which enters the lower end of the suction pipe 14 pass upwardly through the screen surface and materials thereupon, and that air, as far as practicable, be prevented from entering this pipe between the lower end of the same and the upper face of the screen surface. The lower end of the suction pipe is therefore shown as provided with side plates 39 which are adjustably secured to the pipe 14 by wing nuts 40 and these side plates may be adjusted downwardly beyond the lower end of the pipe 14 to close the space between the pipe and the screen surface. The entrance of air into the suction pipe above the screen surface may be further prevented by providing the lower end of the pipe 14 with

aprons 41, which project outwardly from the lower end of the pipe towards the screen surface.

The capacity of the classifier of the present invention may be varied as desired by increasing the width of the screen surface 25 so that a wide sheet of materials may pass over this surface. The lower end of the suction pipe 14 should have approximately the same width as the screen surface 25, so that the entire sheet of materials passing over the screen surface will be subjected to the rising air currents, and to this end the nozzle or lower end of the suction pipe 14 is made long and narrow. In other words, the width of the nozzle 15 in the direction in which the materials flow under the same is relatively narrow, while the length of this nozzle may be as great as required to reach entirely across the screen surface. From the foregoing description it will be seen that a classifier constructed in accordance with the present invention will separate materials rapidly and efficiently, since a relatively wide sheet of materials is caused to flow continuously under the lower end of the suction pipe 14, and the lighter materials are completely removed by the rising air currents so that the materials are separated or classified as rapidly as they slide over the screen surface. The area of the screen surface 25 may be much smaller than that required by the ordinary screening machine having the capacity of the present classifier, and, since the screening surface 25 is not vibrated as in the ordinary screening machine, the wear and strain upon the same is very slight and it may therefore be formed of lighter material than may the ordinary screening surface of a vibratory screen. Furthermore, since the air drawn upwardly through the screen and materials thereupon tends to lift the sheet of materials passing over the screen surface, the weight of these materials upon this surface is relieved and this further reduces the strain to which the screen surface is subjected.

In some cases it may be desirable to provide means for forcing a blast of air upwardly through the screen surface and materials, in addition to the suction action of the pipe 14, and to this end a blast pipe 42 is provided having an upwardly flaring end 43 for delivering air under pressure to the under side of the screen surface.

The type of classifier shown in Figs. 1 to 5 inclusive is a good practical construction, but where the sheet of materials being treated is relatively wide, it may be desirable to employ the modified construction shown in Figs. 6 and 7, wherein a relatively long hopper 44 is provided in which is mounted a rotating worm 45 which serves to discharge the materials from the hopper to the inclined chute 46. This chute prefer-

ably has a pocket formed at 47 in which materials may lodge to form a layer over which the other materials will slide, thereby to retard the speed at which the materials travel towards the screen surface 48, and also so cause the materials to flow in a more uniform stream to the screen surface. In the construction shown in Figs. 6 and 7, a long, narrow suction pipe 49 is provided for drawing air upwardly through the screen surface 48 and materials thereupon, and this suction pipe may lead into a settling chamber 50 preferably provided with a baffle plate 51, arranged to promote settling of the heavier materials within the settling chamber. Air may be removed from the upper end of the chamber 50 through a suction pipe 52, and a relatively narrow throat 53 is preferably provided between the chamber 50 and pipe 52 which throat should have approximately the same cross-sectional area as the suction pipes 49. The materials that settle within the chamber 50 may escape therefrom through the trap door 54. If desired a blast pipe 55 may be provided to force air upwardly through the screen surface 48, and this surface may be adjusted towards or from the lower end of the suction pipe 49 by securing the screen supporting frame 56 to the slotted supporting arm 57 in different positions of adjustment.

In some cases it may be desirable to subject the materials to the action of more than one suction pipe, and to this end, in Fig. 8 a construction is shown in which the materials within the hopper 58 slide down the chute 59 and are delivered to the inclined screen surface 60, above which are provided three suction pipes 61, 62 and 63, each of which may lead into a settling chamber 64 having the baffle plates 65. In this construction, any light materials which are not sucked up by the air entering the suction pipe 61 are subjected to a second treatment as these materials pass under the lower end of the pipe 62, and may be subjected to still a third treatment as they pass under the suction end of the pipe 63. The screen surface 60 may be provided with apertures throughout its entire surface, or may have apertures directly below the suction pipes and unapertured portion between the adjacent suction pipes, as shown.

The screen surface 25 is shown as formed of woven wire, and while this constitutes a good practical material supporting surface, other means may be employed which will cause the materials to pass below the mouth of the suction pipe and will permit air to pass upwardly through the supporting surface and materials thereupon. The operation of the classifier may be varied as desired by changing the strength of the air employed, by adjusting the screen supporting surface towards and from the lower end

of the suction pipe, by changing the inclination at which the screen surface is supported, and by varying the rate of feed of materials to the screen surface.

5 The classifier of the present invention is extremely simple in construction and is free from operating parts, so that no driving mechanism is required to vibrate the screen surface or other parts, and, although the  
10 screen may be adjusted relatively to the suction pipe, it has been defined in some of the claims as stationary to point out that the same is not vibrated.

What is claimed is:—

15 1. A classifier, comprising in combination, a stationary screen supported at a steep inclination so that the materials to be treated will flow by gravity over its surface, a suction pipe having an open lower end  
20 in the form of an elongated slot that extends transversely across the screen to draw air upwardly thru the screen and materials thereupon, and means for feeding the materials by gravity to the screen in a substantially uniform stream without imparting vibratory movement to the materials,  
25 including a feed hopper, a steeply inclined feed chute for conducting the materials from the hopper to the screen and along which the materials tend to slide rapidly,  
30 and a raised surface near the discharge end of the chute positioned to cause the materials to pile up in the chute in the form of a sloping bank over which a sheet of materials flow by gravity and is retarded and  
35 rendered uniform by said bank.

2. A classifier, comprising in combination, a stationary screen supported at a steep inclination so that the materials to be treated  
40 will flow by gravity over its surface without the screen being vibrated, a suction pipe having an open lower end extending transversely across the screen to draw air upwardly thru the screen and materials thereupon, a steeply  
45 inclined feed chute for delivering the materials to the upper side of the screen, a hopper for supplying materials to the chute, and a plurality of independently adjustable

means for adjusting the screen angularly and bodily relative to the lower end of the suction pipe to vary the inclination of the screen and also its distance from the lower end of the pipe.

3. A classifier, comprising in combination, a stationary screen supported at a steep inclination so that the materials to be treated  
55 will flow by gravity over its surface, a suction pipe having an open lower end extending transversely across the screen to draw air upwardly thru the screen the materials thereupon, means for feeding the materials by gravity to the screen in a substantially uniform stream without imparting vibratory movement to the materials, including a feed  
60 hopper, a steeply inclined feed chute for conducting the materials from the hopper to the screen and along which the materials tend to slide rapidly, a raised surface near the discharge end of the chute positioned to cause the materials to pile up in the chute  
65 in the form of a sloping bank over which a sheet of materials flow by gravity and is retarded by the bank, and guard plates adjustably secured to the lower end portion of said pipe and constructed to prevent  
70 air from entering the pipe between its lower end and the upper face of the screen.

4. A classifier, comprising in combination, a stationary screen supported at a steep inclination so that the materials to be treated  
80 will flow by gravity over its surface, a feed chute for delivering materials to the screen, a suction pipe having a nozzle at its lower end extending transversely across the screen to draw air upwardly through the screen  
85 and materials, and guard plates adjustably secured to the lower end portion of said pipe at the opposite sides of the screen and having wide flaring lower ends constructed and arranged to prevent air from entering  
90 the pipe between its lower end and the upper face of the screen.

In testimony whereof, I have signed my name to this specification.

ALBERT H. STEBBINS.