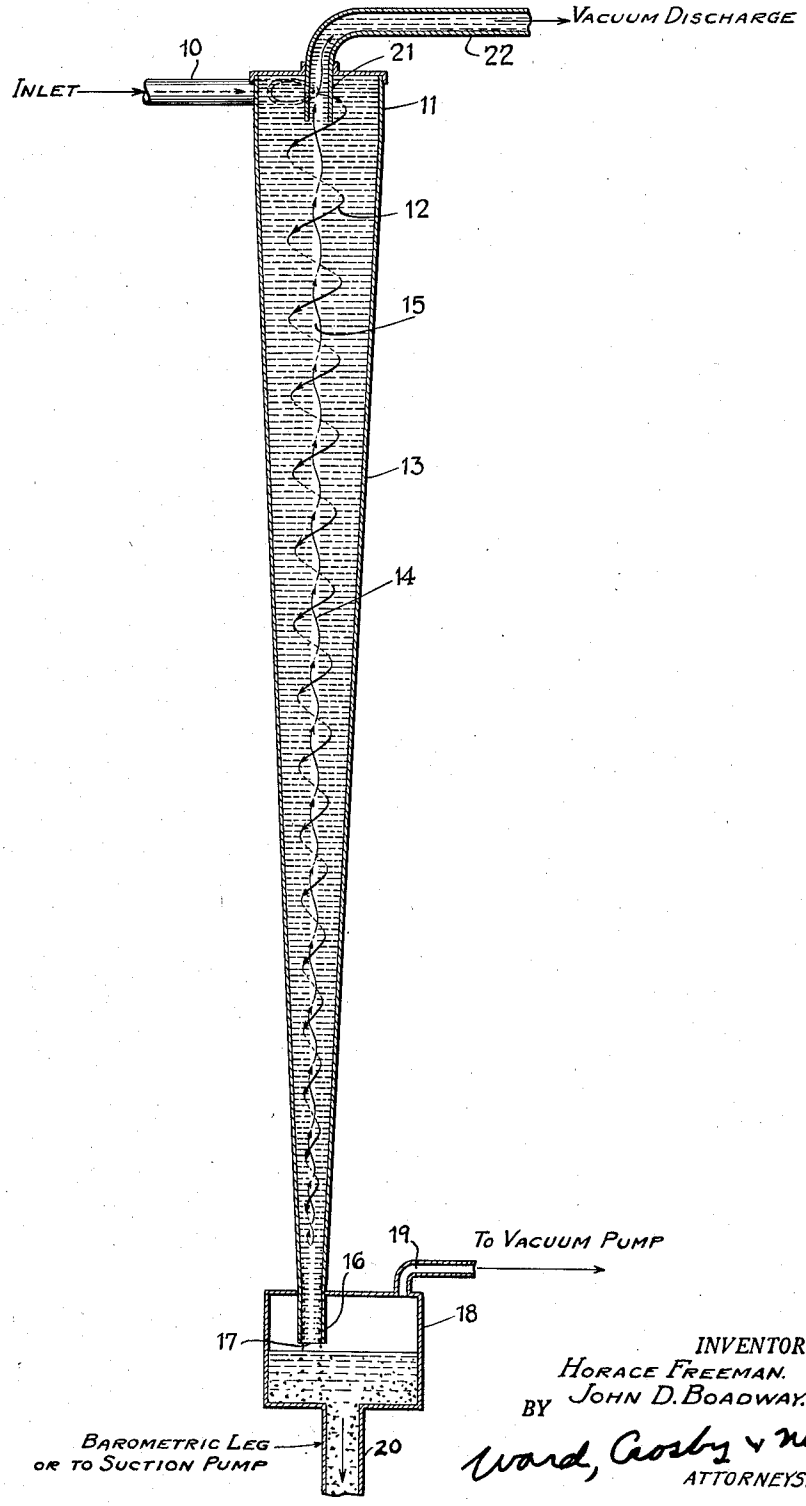
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APPARATUS FOR SEPARATING AND DEAERATING PULP SUSPENSION

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APPARATUS FOR SEPARATING AND DEAERATING PULP SUSPENSION

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1 Claim. (Cl. 209—211)

This invention relates to methods and apparatus for separating gases, vapor and solid particles such as dirt from liquids and liquid suspensions, the invention among various other possible uses being adapted for the treatment of paper pulp suspensions.

Vortex type separator devices for separating dirt from paper pulp suspensions have heretofore been used of a construction comprising an elongated very gradually tapered conical chamber into which the suspension is forced tangentially at the larger end so as to form a vortex of gradually decreasing diameter extending toward the smaller or apex end of the chamber, portions of the vortex reversing and running back to form an inner vortex from which the treated stock is withdrawn axially from within the larger end, while a small portion of the stock together with the dirt particles is discharged from the other and quite small apex end.

The present invention involves certain modifications in the construction of and method of operating apparatus of the general type above referred to and which will adapt the same for use for effectively separating from the liquid or suspension dissolved and occluded gases, bubbles and froth as well as the dirt particles.

As heretofore proposed, separators of the type above referred to were not adapted for removing gases or vapors in any of these various forms. In such devices as heretofore operated a small hollow gas core would normally exist at the center of the vortexes, but if the apex or dirt outlet was placed in free communication with the atmosphere then such hollow core would be maintained at atmospheric pressure and thus there would be no effect in the vortexes such as required to liberate the dissolved or occluded gases from the liquid of the vortexes, and such bubbles and froth as might accumulate along within the hollow core would be largely carried out in the outgoing stream of treated stock and thus not separated therefrom. On the other hand, if the apex or dirt outlet of such separators were immersed in a body of liquid, while there might be a tendency for a slightly sub-atmospheric pressure to occur within the hollow core due to the removal of air bubbles along with and in the stream of treated stock, yet any dissolved or occluded gas which might tend to come into such hollow core by reason of any such sub-atmospheric pressure would be all carried out along with and still in admixture with the stream of treated stock or with the small stream of rejected dirt-containing stock passing out through the apex opening, thus still leaving no chance for separation of gases from the suspension, and in fact as a result of the agitation of the suspension the froth and bubbles therein would tend to increase.

Another proposal has been to withdraw both the treated stock stream and the rejected dirt-containing stream from this type of device and to pump such streams to secondary cleaners and thence to the paper machines, but here again the outgoing streams would embody all of the gas originally contained in the suspension.

With the present invention on the other hand the

greater part of the gases and vapors in their various forms in the suspension may readily be removed without interfering with the dirt-separating functions of such apparatus.

Various further and more specific objects, features and advantages of the invention will appear from the detailed description given below taken in connection with the accompanying drawing which forms a part of this specification and illustrates merely by way of example, one form of apparatus for the practice of the invention. The invention consists in such novel features, arrangements and combinations of parts and method steps as may be shown and described herein.

In the drawings, the single figure is a vertical sectional view of the apparatus of the invention.

The suspension or liquid mixture to be treated is admitted under pressure through inlet **10** tangentially into a cylindrical upper end portion **11** of the separating chamber whereby a helical flow, as an outer downward vortex as indicated at **12**, is established within an elongated slightly tapered conical chamber portion **13**. This helical flow, as indicated, is of gradually diminishing diameter and gradually portions of it are reversed to form an upward inner helical flow as indicated at **14** surrounding a small gas core **15**. Down near the apex or lower outlet end **16** of the conical chamber portion, the heavier particles such as dirt will have become forced centrifugally outwardly of the vortex and travel along down to the outlet **17** where with a small amount of the stock, same will be discharged into an enclosed chamber **18**.

This chamber or enclosure **18** as indicated, is brought into communication by a pipe **19** with a suitable vacuum pump and such enclosure is so designed and arranged that it will normally be partially filled, as indicated, with the discharged dirt-containing suspension. The under side of the chamber **18** is connected by a pipe **20** either to a barometric leg or to a suitable suction pump such as will insure discharge of the rejected stock from the chamber at about the same rate as the discharge of such stock from the conical chamber above.

Thus it will be seen that the small elongated hollow core **15** in the vortexes may, by means of the evacuated chamber **18** be maintained constantly under a low sub-atmospheric pressure preferably a pressure about equal to the normal vapor pressure of the suspension being treated in chamber portion **13**, or for example from 4 to 8 cms. Hg absolute.

Hence dissolved and occluded gases within the vortexes in the conical chamber portion **13** will tend strongly to be liberated from within the liquid nearest the hollow core **15** because of such sub-atmospheric pressure, and such liberated gases as well as vapor present in the hollow core and the gas contained in any bubbles or froth which will be forced into the hollow core will be constantly evacuated downwardly through the hollow core to the enclosure **18** and out to the vacuum pump.

Meanwhile the treated stock embodied in the upward return vortex **14** will pass out through the central outlet **21** at the upper end and may be withdrawn therethrough by applying to the outlet connection **22** any suitable evacuating device such as a barometric leg or suction pump.

While because of the evacuated condition maintained in the core **15** and the constant rapid withdrawal of gases therefrom into the enclosure **18** will insure that most of the gas in the suspension will be evacuated through the connnection **19** to a vacuum pump, yet some bubbles may be carried out along with the treated stock through the connection **22**, and if desired same, if sufficient in quantity to be objectionable, may be separated by running the stock through a supplemental froth-separating chamber in the manner disclosed in our co-pending ap-

plications, Serial No. 314,248, filed October 11, 1952, entitled "Method and Apparatus for Separating Undesired Particles and Gases from Paper Pulp Suspensions and Other Fluids," and now abandoned in favor of Serial No. 324,561, filed December 6, 1952, issued as Patent No. 2,849,930 on September 2, 1958, entitled "Method and Apparatus for Treating Pulp Suspensions and Other Fluids for Removal of Undesired Particles and Gases," reference to which is hereby made, for a more detailed explanation of various aspects of the invention. In said application certain phases of the invention as well as alternative embodiments are broadly claimed and other alternative embodiments are disclosed and claimed in our co-pending application, Serial No. 425,942, filed April 27, 1954, issued as Patent No. 2,757,582, on August 7, 1956.

Although one embodiment of the invention is herein disclosed for purposes of explanation, various modifications thereof, after study of this specification, will be apparent to those skilled in the art to which the invention pertains. Reference should accordingly be had to the appended claim in determining the scope of the invention.

What is claimed and desired to be secured by Letters Patent is:

Apparatus for separating gas, dirt particles and the like from liquid pulp suspensions which comprises: an elongated chamber of circular internal cross-section; a liquid inlet connection positioned to discharge the suspension tangentially into one end of said chamber for maintaining a helical flow about the inside walls of the chamber and surrounding a gas core extending throughout the length of the chamber, portions at least of said chamber which are adjacent the end thereof opposite from said inlet connection being of gradually restricted diameter terminating in a relatively small outlet, thereby to cause the larger part of such helical flow to reverse and to extend back toward the inlet end of the chamber as an inner vortex also surrounding the gas core; an outlet conduit for the desired treated suspension communicating with the central portion of the inlet end of said chamber and concentric with said small outlet; a second chamber closed to the atmosphere and into which said small outlet freely communicates to discharge into such second chamber the outer portion of the helical flow surrounding the gas core and containing said dirt particles; means for withdrawing the dirt containing liquid from said second chamber to maintain the liquid level therein below said small outlet; and vacuum pump means connected to said second chamber at a point above said liquid level for separately evacuating gas from above the level of said liquid received in said second chamber and acting to maintain said second chamber under low subatmospheric pressure and also continuously to evacuate the contents of said gas core through the middle of said small outlet and to discharge such gas from the second chamber, thus maintaining said gas core also under low subatmospheric pressure.

References Cited in the file of this patent

UNITED STATES PATENTS

2,102,525	Freeman	Dec. 14, 1937
2,377,524	Samson	June 5, 1945
2,571,219	De Cew	Oct. 16, 1951
2,614,656	Clark	Oct. 21, 1952
2,642,950	Clark	June 23, 1953
2,685,937	Clark	Aug. 10, 1954
2,878,934	Tomlinson	Mar. 24, 1959