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METHODS FOR DISCHARGING ROTATING STREAMS OF FLUIDS CONTAINING CONTAMINANTS

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Fig. 1.

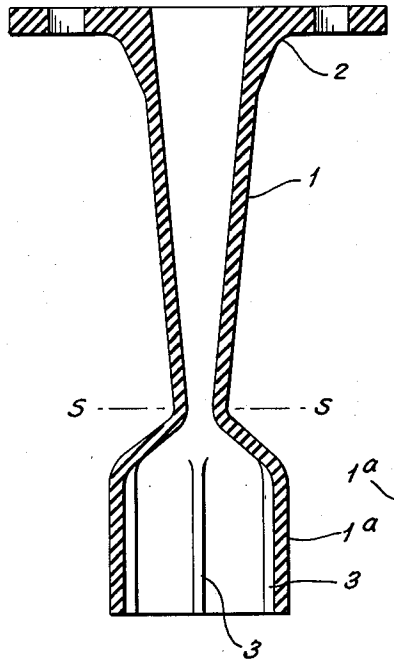
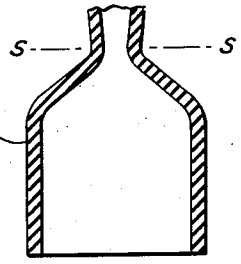


Fig. 2.



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METHODS FOR DISCHARGING ROTATING STREAMS OF FLUIDS CONTAINING CONTAMINANTS

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6 Claims. (Cl. 239—11)

This invention relates to the discharging of a rotating stream of fluid containing solids and to methods for effecting such discharging and is particularly concerned with methods for discharging rotating streams of fluid containing comparatively heavy contaminants from the bottom of a cyclone chamber while purified fluid is conducted to another outlet from the cyclone chamber.

This application is a continuation in part of my application Serial No. 862,886 filed December 30, 1959 entitled Arrangement in Resilient Discharge Nozzles.

The usual practice in the discharge of rotating fluids containing contaminants is to discharge the same through a passage of increasing area so that the narrowest cross section will be at the orifice of the nozzle. The use of resilient material has been resorted to for the nozzle with the purpose in view that if contaminants get stuck in the narrowest section of such a nozzle and resulted in the increase in pressure in the nozzle, automatic expansion of the nozzle will result, so that the contaminants will loosen and be released.

However, the effects of following such prior practice has generally not lived up to the expectations of a trouble-free functioning. It has not been possible to reliably eliminate permanent cloggings, which have still required external cleansing measures. Moreover, changes in pressure arising in the nozzle and cyclone chamber on clogging tendencies before the automatic cleansing become effective have often become too large to match the requirement which must be made as to stable pressure conditions and thus also stable flow conditions in the cyclone chamber. Of course this is due to the fact that the contaminants too easily get so strongly stuck in the narrowest section that too great an increase of the pressure is required to sufficiently widen the nozzle and eject the contaminants.

It has been discovered, however, that the drawbacks of the prior art practices may be eliminated by revisions in the discharge action which may be readily effected through simple, though heretofore unappreciated nozzle revisions. Thus the invention is primarily characterized by the feature that after the stream being discharged has been reduced to its narowest section, it is expanded into a path which has a cross sectional area many times larger than a cross sectional area of that of the narrowest section.

In the accompanying drawing FIG. 1 is a vertical section of an illustrative apparatus for carrying out the method of the invention, such apparatus being equipped with vanes; and

FIG. 2 is a fragmentary view similar to FIG. 1 with the vanes omitted.

The nozzle 1 as illustrated in FIG. 1 consists entirely of resilient material, of which rubber is an example. The upper end of the nozzle as viewed in the drawing is flanged outwardly at 2 to provide for connection of the same to the bottom outlet of a cyclone chamber, of a type well known in the art but not shown in the accompanying drawing. From the top down to the section S—S, the nozzle is shaped and contracts in known manner but below the section S—S as seen in the drawing, the path through the nozzle expands out into an extending orifice portion 1*a* which produces the surprising improved discharge effects of the method of the invention. The cause of this effect would seem to be substantially the following:

As the nozzle constitutes an outlet from a cyclone chamber forming a direct continuation of the same, the discharge products will also pass through the nozzle, including its extension and orifice portion, in the form of a vortex. The frictional force of the swirling discharge products against the wall of the nozzle causes the latter to be distorted from the flanged end 2 downwards. There will be a great difference in the torque between that at the narowest or throat section of the nozzle and that in the wide orifice portion. This results in distortion becoming comparatively large in the throat. From this it follows that even very small variations in the intensity of the turbulent motion, for instance, such variations which occur as a result of relatively small clogging tendencies cause comparatively great variations in the distortion at the throat. On account of this, the wall material at the throat is maintained and acts "alive" in a manner to considerably reduce the possibility of particles getting stuck in the throat. The same effect may arise from breaking movements in the throat caused by the forces effective in the orifice portion.

In order to attain the effect aimed at the throat portion of the nozzle at least it should be relatively thin-walled—an appropriate wall thickness is maximum about half the passage diameter—and soft; the hardness should suitably not exceed essentially about 50° Shore. As regards other parts of the nozzle these requirements may be taken more lightly. Thus the attachment and orifice portion proper need not, at least at its termina, be particularly thin-walled or soft-walled and may consist of a separately attached part of a completely different material from that of the rest of the nozzle. However, from the point of manufacture and expense it would seem to be advantageous to make the nozzle homogeneous.

The internal profile of the attachment and orifice portion may be modified in many ways while still being capable of carrying out the method of the invention. For instance, they may be given a purely conical shape. The shape illustrated, however, having a comparatively long cylindrical orifice portion, has turned out to be especially adaptable as it not only provides for effective discharge in accordance with the invention but it also serves as a very efficient shield against lateral splashes from the discharged reject.

In the example given in FIG. 1 the attachment or extending orifice portion is provided internally with longitudinal vanes 3, which may be replaced by flutes or the like, in order to magnify the distortion effect of the vortex in said portion, but the method of the invention achieves quite satisfactory results without any such devices as indicated by the showing in FIG. 2.

In accordance with the method of the invention it is also possible to make the nozzle converge towards the narrowest section at a larger angle than previously ventured upon. The fact is that an increased converging angle by itself increases the tendency towards clogging. Hence, the invention also offers a possibility to shorten the nozzle while retaining a considerably greater safety against clogging disturbances during operation.

I claim:

1. A method which comprises, rotating a body of fluid containing rejects at the bottom of the vortex chamber of a vortex type separator, discharging a stream of said fluid through an outlet at the bottom of said vortex chamber forming a direct continuation of the chamber, rotating said stream by torque imparted thereto by the rotating body of fluid from which it is discharged, substantially contracting the flow of said rotating stream

from said outlet in an elongated path of circular cross section to a throat area of smallest cross section, confining said flow at said throat area in a highly resilient readily yieldable manner, quickly expanding said flow beyond said throat area into a path of cross section many times greater than that of said throat area, thereby causing said throat area to expand and contract in response to the vibrating torsional deflections resulting from said flow to increase the cross sectional area at said throat as may be needed to prevent blocking of the same.

2. The method as in claim 1 and including expanding said flow beyond said throat area into a cylindrical path.

3. The method as in claim 1 and including expanding said flow beyond said throat area into a path formed with spaced longitudinal obstructions to the rotation of said fluid.

4. A method which comprises, rotating a body of fluid containing rejects at the bottom of the vortex chamber of a vortex type separator, discharging a rotating stream of said fluid through an outlet at the bottom of said vortex chamber forming a direct continuation of the chamber, said stream being rotated by torque imparted thereto by the rotating body of fluid from which it is discharged, substantially contracting the flow from said outlet in an elongated path by causing it to flow through an elongated contraction-expansion nozzle of circular inner cross section having, in the direction of the flow direction, an inlet end portion, a relatively thin-walled throat portion of highly resilient wall material confining the narrowest inner cross section of the nozzle and an

outlet end portion of an inner cross section many times larger than that of the throat portion, said nozzle being attached at its inlet end to said votex chamber so as there to communicate with the bottom outlet thereof, while the throat portion and the outlet end portion of the nozzle are left free from any outer supporting structure, and passing the rotating stream of fluid containing rejects from said bottom outlet through said nozzle thereby causing torsional and bending deflections of the throat portion thereof under influence of torsional and bending forces from that stream acting in the outlet end portion of the nozzle.

5. A method as claimed in claim 4, in which the rotating stream is caused to act in a cylindrical bore part of the outlet portion of the nozzle.

6. A method as claimed in claim 4, in which the rotating stream is brought to act against longitudinal obstructions to the rotating motion thereof in the outlet portion of the nozzle.

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